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Future Scenarios for the Quantity Surveying Profession: Adaptation to Socio-Technical Change

By

Josephine Llale

A thesis submitted for the degree

DOCTOR OF PHILOSOPHY

In the School of Construction Economics and Management

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DECLARATION

I, Josephine Llale, declare that the content of this thesis is my own unaided work, except where specific and acknowledged reference is made to the published work of others. This thesis has not submitted in any previous application for a higher degree in any university.

Signature of candidate:……..…… Date: …….……

ABSTRACT

The role of the professions is currently being influenced by revolutionary changes in the socio-technical systems in which the professions operate. Social changes and technological advancement, are making certain tasks of these professions redundant. There are, thus, claims that these professions, including the quantity surveying profession, may not exist in the future.

This analysis uses the quantity surveying profession in South Africa as a case study to investigate the validity of this claim. Geels' Multi-Level Perspective (MLP), augmented by the 5Ps model, is used as both a theoretical framework and heuristic device to understand change and to provide future scenarios for the quantity surveying profession. Before generating future scenarios for the sustainability of the quantity surveying profession, the following was conducted: data was collected from 23 semi-structured interviews, with experts from the quantity surveying profession and the construction sector; a workshop was held with 39 attendees from a quantity surveying conference, and a focus group was brought together, with 11 built-environment professionals, are all analysed, using a combination of grounded theory, narrative and thematic data analysis techniques.

Findings from the interviews reveal divergent views regarding the future of the quantity surveying profession, with some experts holding a positive view and others a negative one. While there is consensus that technology will replace various professional tasks, technology is not regarded as a major threat to the profession. The workshop and focus group findings reveal that corruption and intense competition are the two critical factors influencing the profession's outlook.

Scenario planning is used to construct four possible futures for the quantity surveying profession in South Africa, based on the data from the interviewees, workshop and focus group. The scenarios are useful in guiding the quantity profession, as well as others, in considering their future. A further contribution made by the study is in demonstrating that the MLP framework can be used to predict future changes in a socio-technical system.

Keywords: change, profession, quantity surveying, socio-technical system, technological advancement.

DEDICATION

This thesis is dedicated to my Lord and Saviour, Jesus Christ. In Him, I live, move and have my being.

ABBREVIATIONS AND ACRONYMS

3D	Three Dimensional
4D	Fourth Dimensional
4IR	Fourth Industrial Revolution
5D	Fifth Dimensional
6D	Sixth Dimensional
7D	Seventh Dimensional
AAQS	African Association of Quantity Surveyors
ABM	Agent-Based Modelling
AEC	Architectural Engineering and Construction
AI	Artificial Intelligence
AIM	Asset Information Model
AIQS	Australian Institute of Quantity Surveyors
ANC	African National Congress
APC	Assessment of Professional Competence
AR	Augmented Reality
ASAQS	Association of South African Quantity Surveyors
ASCE	American Society of Civil Engineers
BAU	Business as Usual
B-BBEE	Broad Based Black Economic Empowerment
BE	Built Environment
BEAM	Building Environmental Assessment Method
BIM	Building Information Model
BIPC	Building Industry President Council
BRE	Building Research Establishment
BREEAM	Building Research Establishment Environment Assessment Method
BRIC	Brazil, Russia, India and China
BRICS	Brazil, Russia, India, China and South Africa
CAD	Computer Aided Design
CAR	Construction Automation and Robotics
CBE	Council for the Built Environment
CCTV	Closed-Circuit Television
CDE	Centre for Development and Enterprise
CETA	Construction Education and Training Authority
CIA	Central Intelligence Agency
CIC	Construction Industry Council
CIDB	Construction Industry Development Board
CIG	Cardiotocographs
CIMP	Construction Industry Master Plan
CIOB	Chartered Institute of Building
CIRC	Construction Industry Review Committee
CITB	Construction Industry Training Board
CLA	Causal Layered Analysis
CPD	Continuous Professional Development
CPM	Construction Project Manager

CPUT	Cape Peninsula University of Technology
DfMA	Design for Manufacture and Assembly
DHA	Department of Home Affaris
ECSA	Engineering Council of South Africa
EPWP	Expanded Public Works Programme
FAR	Field Anomaly Relaxation
FIFA	Federation Intertionale de Football Association
FM	Facilities Management
GBCA	The Green Building Council of Australia
GDP	Gross Domestic Product
GFA	Gross Floor Area
GFC	Global Financial Crisis
GIA	Gauteng Institute of Architects
GIFA	Gauteng Infrastructure Financing Agency
HKCIC	Hong Kong Construction Industry Council
HKGCS	Hong Kong Green Building Council
HKHA	Hong Kong Housing Authority
HKIBIM	Hong Kong Institute of Building Information Modelling
HKIS	Hong Kong Institute of Surveyors
HM	Her Majesty
HR	Human Resources
HSE	Health, Safety and Environment
HTA	Honeytreat Academy
IoT	Internet of Things
IBS	Industrialised Building Systems
ICE	Institute of Civil Engineers
ICEC	International Cost Engineering Council
ICT	Information and Communications Technology
ICW	International Construction Week
IDMS	Integrated Database Management System
ILO	International Labour Organization
IT	Information Technology
IUSS	Infrastructure Unit Systems Support
JBCC	Joint Building Committee Contract
JCT	Joint Contracts Tribunal
KPIs	Key Performance Indicators
LCC	Whole life cycle costing
MFMA	Municipal Finance Management Act
MLP	Multi-Level Perspectives
MTR	Mass Transit Railway
NBER	National Bureau of Economic Research
NBS	National Building Standards
NDP	National Development Plan
NEC	New Engineering Contract
NHBRC	The National Home Builders Registration
NMU	Nelson Mandela University

OHS	Occupational Health and Safety
PABX	Private Automatic Branch Exchange
PAQS	Pacific Association of Quantity Surveyors
PAR	Participatory Research
PESTEL	Political, Economic, Social, Technological and Legal
PFI	Public Finance Initiatives
PFMA	Public Finance Management Act
PG	Postgraduate
PPP	Public-Private Partnership
QS	Quantity Surveyor
R&D	Research and Development
RAS	Robotics and Autonomous Systems
RDM	Robust Decision-Making
RICS	The Royal Institute of Chartered Surveyors
RISM	Royal Institution of Surveyors Malaysia
SABC	South African Broadcasting Corporation
SACAP	South African Council for the Architectural Profession
SACLAP	The South African Council for the Landscape Architectural Profession
SACPCMP	The South African Council for the Project and Construction Management Profession
SACPVP	The South African Council for the Property Valuers Profession
SACQSP	South African Council for the Quantity Surveying Profession
SADC	Southern African Development Community
SAFMA	South African Facilities Management Association
SAIA	South African Institute of Architects
SAFSEC	The South African Forum of Civil Engineering Contractors
SAICE	South African Institute of Civil Engineers
SAPOA	South African Property Owners' Association
SAQA	South African Qualifications Authority
SMMEs	Small, Medium and Micro Enterprises
SMS	Safety Management System
SOE	State-Owned Entity
SOFI	State of the Future Index
SPV	Special Purpose Vehicle
SSM	Standard System of Measuring Building Work
StatsSA	Statistics South Africa
STITC	Standing Committee on Infrastructure Transport and Cities
STS	Socio-Technical System
SWOT	Strengths, Weaknesses, Opportunities and Threats
TIA	Trend Impact Analysis
TSA	Technology Sequence Analysis
UAV	Umanned Aerial Vehicle
UCT	University of Cape Town
UG	Undergraduate
UK	United Kingdom
UNEP	UN Environment Programme
UP	University of Pretoria

USAF	Universities South Africa
USP	Unique Selling Point
VM	Value Management
WEF	World Economic Forum

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GLORY BE TO GOD.

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Chapter 1: Introduction and Background

1.1 Introduction

The main purpose of this chapter is to provide the study's purpose, rationale and background. The preliminary literature review revealed claims that certain current professions may not exist in future. Given the notable role the professions currently play in society, it was necessary to investigate this claim. This claim is investigated using the South African quantity surveying profession as a case study, to determine how the professions may evolve in future, in order to endure. From the preliminary literature study, the problem statement, the aim and objectives were developed. The chapter begins by providing the background and the rationale for the study. It concludes by providing a the layout of the thesis.

1.2 Background

Current socio-technical changes that are affecting the professions and wider society present both opportunities and threats to the professions. Social trends and associated technological developments have the potential to create new opportunities for the professions and to render some of the traditional tasks of the professions redundant. There is, however, more compelling evidence that suggests that socio-technical changes in society are more likely to pose a threat to the current professions, than present an opportunity (Brynjolfsson and McAfee, 2014; Susskind and Susskind, 2017).

The accounting and quantity surveying professions have been cited as the professions likely to become obsolete before the year 2030. Intelligent software is able to process large and complex data much faster and accurately than quantity surveyors. It is predicted that as a result of this phenomenon, the need for quantity surveyors will be reduced. Quantity surveyors will be relegated to maintaining software and systems that perform the tasks they traditionally carried out (Luksha et al., 2015).

The Building Information Model (BIM) is regarded as one of the greatest potential threats to the current quantity surveying profession. The National Building Standards (NBS) (2011) define BIM as a, "…*rich information model, consisting of potentially multiple data sources, elements of which can be shared across all stakeholders and be maintained across the life of the building from inception to recycle*," (NBS, 2011). BIM is able to perform traditional quantity surveying tasks, such as cost estimation, cost planning, and the preparation of bills of quantities much faster and accurately than quantity surveyors (Kulasekara et al., 2013).

Even though current socio-technological changes are a threat to the current professions, there are claims that they may present new opportunities to the professions. Technology, for instance, may enhance the performance of the professions rather than substituting the role of the professions in society (Beukes,

2014; Brynjolfsson and McAfee, 2014; Matipa et al., 2010; P. F. Wong et al., 2014; Wu et al., 2014). According to the proponents of technology, technology will enable the professions to perform their duties faster and to a higher standard.

Given these conflicting views about the future of the professions, how will the current professions evolve? Will they become obsolete or will they advance? This study uses the quantity surveying profession as a case study to determine how the professions may evolve. The study provides scenarios for future quantity surveying professions. It should be noted that current literature does not provide alternative futures for the professions.

The majority of the literature predicts the extinction of the professions, and not their survival. This prediction has caused some consternation within the professions in question. By providing scenarios based on scientific investigation, these professions will perceive how they might evolve in future. Hence the need for this study.

In the next sections, as further substantiation for the need, the rationale and the background for the study is provided. Since the current professions are arguably the product of the First Industrial Revolution, the discussion will extend from the period of the First Industrial Revolution to current times. The discussion on the professions will first focus on the professions from a general point of view, before narrowing the focus to the quantity surveying profession specifically.

1.2.1 The First Industrial Revolution

The First Industrial Revolution (1750–1850), which began in Britain, brought fundamental change to society (Berg and Hudson, 1992; Brynjolfsson and McAfee, 2014; Yirmibesoglu and Dincer, 2018). The steam engine not only transformed society from agrarian to industrial, but it also ushered in the modern age (or the first machine age) (Berg and Hudson, 1992; Brynjolfsson and McAfee, 2014). Machines carried out work that was previously carried out by animals and humans (Brynjolfsson and McAfee, 2014; Yirmibesoglu and Dincer, 2018). Work moved from the home to the factories (Britannica, 2018). New work skills sets, such as machine operation skills instead of the use of hand tools, had to be acquired (Ibid). There was rapid urbanisation that led to the development of cities (Ibid). Many professions, including the quantity surveying profession, emerged during this period, directly as a result of the professionalisation and rationalisation of work that took place during this period (Abbott, 1988; Susskind and Susskind, 2017; Root, 2001). The First Industrial Revolution brought radical transformation to society and workplaces (Berg and Hudson, 1992; Brynjolfsson and McAfee, 2014).

1.2.2 The Second and Third Industrial Revolutions

The Second Industrial Revolution (1860 and 1900) was characterised by rapid inventions of new technologies, including electricity (Atkeson and Kehoe, 2001). However, there was little change in

productivity levels in society, largely because of the manufacturers' affinity for and fidelity to old technologies (Ibid). The Third Industrial Revolution, which began in the 1970s, was characterised by digitally automated production, through electronics and information technology (Bloem et al., 2014). The changes brought by the Second and Third Industrial Revolutions were evolutionary and did not disrupt the status quo's underlying socio-technical processes. Society and the professions were able to adapt to the demands made upon them by these changes (Brynjolfsson and McAfee, 2014; Schwab, 2017). The Fourth Industrial Revolution (4IR), however, has the potential to bring meaningful transformational change, to society and the professions, the magnitude of which has not been experienced since the First Industrial Revolution. Figure 1.1 provides a graphic representation of the four industrial revolutions.

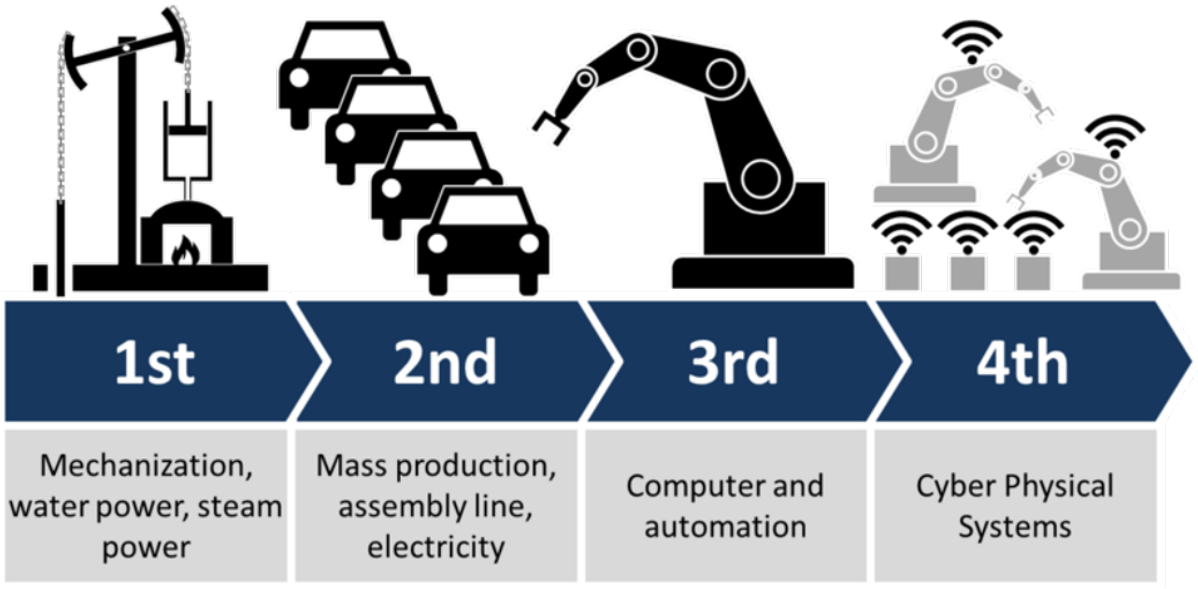


Figure 1. 1 Four industrial revolutions (Source: Roser, 2015)

1.2.3 The Fourth Industrial Revolution

What makes the Fourth Industrial Revolution materially different from the Second and Third Industrial Revolutions? Why is there the perception that it will fundamentally change how work is carried out in the future? (Brynjolfsson and McAfee, 2014; Hirschi, 2018; Susskind and Susskind, 2017). Schwab (2017) claims that 1) heightened velocity, 2) acute breadth and depth, and 3) systemic impact are what makes the Fourth Industrial Revolution vastly different from the previous two. He claims that the greater velocity is the result of today's world of interconnectedness (Schwab, 2017). In an interconnected world, new technology begets another (Ibid). Unlike the previous two revolutions, the Fourth Industrial Revolution's range and scope is multidimensional and multifaceted (Ibid); "*It is not only changing the 'what' and the 'how' of doing things but also 'who' we are,*" (Schwab, 2017: 3). As a result, it demands systemic changes across professions and society as a whole (Ibid). The main claim made by some authors on the Fourth Industrial Revolution is that it will both transform how work is done and

substantively alter the social fabric of society (Brynjolfsson and McAfee, 2014; Schwab, 2017; Susskind and Susskind, 2017).

1.2.4 The legitimacy of professions

In addition to the Fourth Industrial Revolution, changing societal norms and values are also challenging how the professions are currently instituted. The legitimacy of professions in society can arguably be attributed to two main factors: 1) the professions' congruence to societal norms and values (Abbott, 1988; Burlea-Schiopoiu and Popa, 2013; Susskind and Susskind, 2017) and 2) exclusive rights to specialist knowledge and tasks (Abbott, 1988; Susskind and Susskind, 2017).

Many professions, as currently instituted, emerged during the First Industrial Revolution (1750–1850) which started in Britain (Abbott, 1988; Susskind and Susskind, 2017) and within certain norms and values. What are the implications of changed societal norms on the current professions? Societal norms and values evolve with time (Deegan, 2002). An organisation's legitimacy and ultimately its existence in society is determined, to some extent, by societal norms and values (Abbott, 1988; Hughes, 1963; Susskind and Susskind, 2017; Tilling, 2004). It has been over 200 years since the invention of the first steam engine. Are the societal values and norms that facilitated the emergence and continued existence of the professions still hold legitimacy today? What is the influence of current societal values and norms on the professions? Without answers to such questions, the professions face an uncertain future.

1.2.5 Legitimacy from the social contract

The legitimacy theory purports that there exists a 'social contract' between society and organisations (Allan D. Shocker and S. Prakash Sethi, 1973; Archel et al., 2009; Deegan, 2002; John Dowling and Jeffrey Pfeffer, 1975). The contract legitimatises the organisations' continuous operation in society (Ibid). Susskind and Susskind (2017) claim that a similar contract exists between society and the professions. They refer to the contract as the 'grand bargain' (Susskind and Susskind, 2017). The grand bargain, therefore, legitimises the continued existence of the professions (Ibid). Without this contract, the legitimacy of professions in society would be questionable. Since society and the professions entered the 'social contract' during the First Industrial Revolution, is the contract still valid in today's society? (Susskind and Susskind, 2017). If the conditions under which the contract was entered into have changed, is the contract still valid? Will the contract be valid in future? Questions such as these have necessitated calls to review the grand bargain contract (Susskind and Susskind, 2017). The study claims that the continued existence of the professions in society is dependent upon their legitimacy.

1.2.6 Legitimacy from specialist knowledge and professional tasks

Besides obtaining legitimacy from the social contract with society, the professions' legitimacy is confirmed by their specialist knowledge and professional tasks (Abbott, 1988; Susskind and Susskind,

2017). The Fourth Industrial Revolution threatens the professions in two main forms. First, it is allowing knowledge previously the purview of the professions alone more accessible to society, through widespread use of the Internet (Susskind and Susskind, 2017). Second, some professional tasks can undoubtedly be automated and replaced by technology (Brynjolfsson and McAfee, 2014; Susskind and Susskind, 2017).

The professions are often regarded as exclusive holders of specialist knowledge (Abbott, 1988; Hugman, 1996; Susskind and Susskind, 2017).The diffusion of specialist knowledge through the Internet potentially disempowers the professions and inversely empowers society. Society is able solve its 'problems' without or with a limited need for the professions. The professions' custodianship of specialist knowledge affords them a privileged position in society, which allows them to charge the fees they do. The loss of this privilege position therefore has the potential to adversely affect the professions' income and is consequently an undesirable outcome (Susskind and Susskind, 2017).

1.2.7 The automation of professional tasks

Claims that professional tasks are likely to be automated in future also threaten the legitimacy of the current professions in society (Acemoglu and Autor, 2011; Brynjolfsson and McAfee, 2014; Jaimovich and Siu, 2012; Susskind and Susskind, 2017). Brynjolfsson and McAfee (2014) and Susskind and Susskind (2017) regard technology as a superior substitute for the professions. They claim that technology outperforms humans in (amongst others), accuracy, speed and reliability (Brynjolfsson and McAfee, 2014; Susskind and Susskind, 2017). The loss of professional tasks often means loss of jurisdictional rights over that task (Abbott, 1988). The services professionals offer to society risk being reduced because of technology (Susskind and Susskind, 2017).

From the literature review, there seems to be consensus amongst authors that technology is likely to change how work is carried out in society in future (Brynjolfsson and McAfee, 2014; Hirschi, 2018; Susskind and Susskind, 2017). There are, however, divergent views on the extent and nature of the influence of the Fourth Industrial Revolution on the professions.

1.2.8 Divergent views on the influence of technology on the professions

The Fourth Industrial Revolution is regarded by some as a substitute for the professions (Susskind and Susskind, 2017), while some regard it as an enhancer to professional work (Beukes, 2014; Brynjolfsson and McAfee, 2014; Matipa et al., 2010; P. F. Wong et al., 2014; Wu et al., 2014). Abbott (1988) claims that a profession can increase its jurisdiction in society through acquiring a new jurisdiction.

One of the ways in which a profession can increase its jurisdiction is by offering new services that no other profession currently offers to society (Abbott, 1988). How the professions will respond to societal changes, and the automation and substitution of professional tasks, is unclear. This is specifically with

regard to whether societal changes will create further jurisdictions for the professions. What is not yet clear is whether the professions will use the Fourth Industrial Revolution to gain a greater jurisdiction in society or if the Fourth Industrial Revolution will essentially 'murder' the professions? (Gardner, 2016). What will provide clarity is to understand the extent to which the Fourth Industrial Revolution is a threat or an opportunity to the professions. These questions warrant an investigation. Hence, it is imperative to investigate the influence of socio-technical changes on the professions.

There are claims that current technological changes will create new professions (Brynjolfsson and McAfee, 2014; Luksha et al., 2015; Susskind and Susskind, 2017). Others claim that these changes will in fact cause the demise of some professions in the future (Acemoglu and Autor, 2011; Jaimovich and Siu, 2012; Susskind and Susskind, 2017). Some professions may lose their professional status (Abbott, 1988; Davis, 2009). Since not all occupations are professions, and therefore the distinction possesses a certain status (Abbott, 1988; Bernard Barber, 1963; Davis, 2009; Montgomery et al., 2018; Susskind and Susskind, 2017), the loss of this professional status is undesirable. Acquiring professional status is usually esteemed in society (Montgomery et al., 2018; Susskind and Susskind, 2017).

Society accords more respect to professionalised occupations than those without professionalisation (Barber, 1963; Hughes, 1963; Susskind and Susskind, 2017). There are also hierarchies in levels of professional status (Armstrong, 1985; Hugman, 1996; Jeff Hearn, 1982; Makwana, 2017; Susskind and Susskind, 2017; Tudor et al., 2018; Williams, 2014). The highly ranked professions command greater respect and income than those ranked lower (Barber, 1963; Glazer, 1974). Lower ranked professions include teaching, nursing, social work and similar (Glazer, 1974; Makwana, 2017; Torres and Weiner, 2018; Williams, 2014). Highly ranked professions include medicine, law and university professorship (Makwana, 2017; Susskind and Susskind, 2017; Williams, 2014).

Relegation to a lower status is, therefore, also undesirable for any profession. It is thus imperative for a profession to retain or increase its professional status to guarantee its privilege and a potentially higher income. The study assumes therefore that the quantity surveying profession in South Africa will wish to retain its professional status.

The next section provides justification for the selection of the quantity surveying profession as a case study for other professions aiming to retain their status, and looks at the construction sector's changing socio-technical system and the potential influence these changes have on the quantity surveying profession. This is because in this study, the quantity surveying profession is analysed as a system within a system (the construction sector). Socio-technical factors and the macro-environment factors influencing the construction sector therefore have an influence on the quantity surveying profession.

According to the systems theory, an organisation is a complex system within the larger external environment with which it interacts (Biech, 2007). The external environment constantly exerts pressure

on the boundaries of the system (Ibid). Any change in the system will influence change in the entire system (Ibid). The precept of any system is equilibrium. The systems theory assumes that the external environment is stable but continually changing (Ibid). Thus in this study, the quantity surveying profession is a complex system that has its boundary and its own internal structures, but operates within the system of the construction sector, which is also influenced by its external environment. Refer to Figure 1.2. The construction sector is described as a socio-technical system. A socio-technical system (STS) comprises the interactions of both the social system and the technical system in an open environment (Appelbaum, 1997).

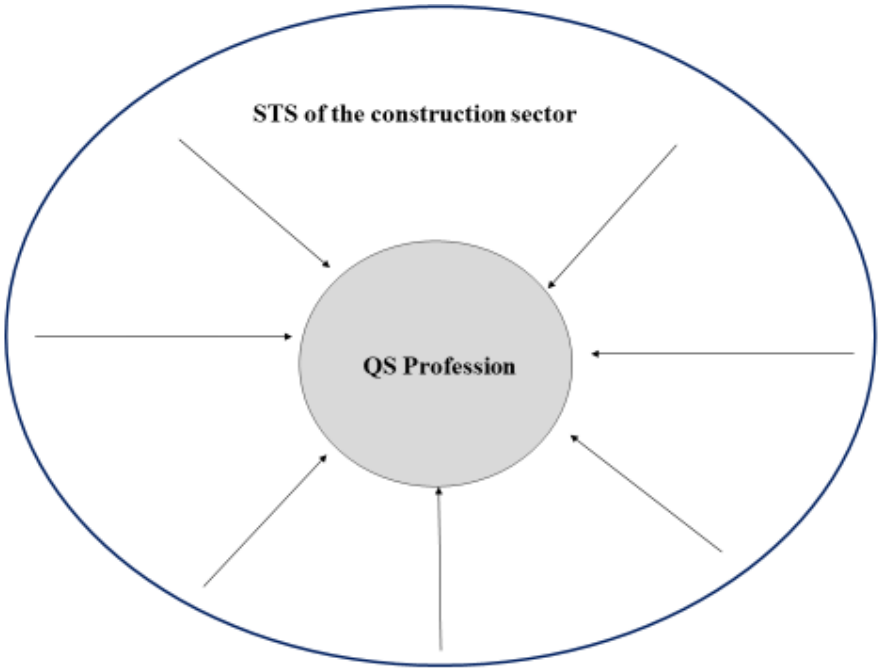


Figure 1. 2 The quantity surveying profession: a system within a system

1.2.9 The construction sector's socio-technical system and the quantity surveying profession

1.2.9.1 A brief overview of the construction sector's socio-technical system

Figure 1.3 shows a typical STS. The social system refers to the interaction of human elements, such as people, user practices, markets, cultural meaning, societal groups and so on (Geels, 2005a). On the other hand, the technical system consists of technology, such as machinery, computers, software, hardware, tools, equipment, information and communications technology (ICT) infrastructure and suchlike (Lyytinen and Newman, 2008). Within the construction sector, the built environment professionals, contractors, clients, users, suppliers and other stakeholders interact with technology to produce infrastructure. The interaction between the social system and technology is often regulated by standard practices, norms and standards.

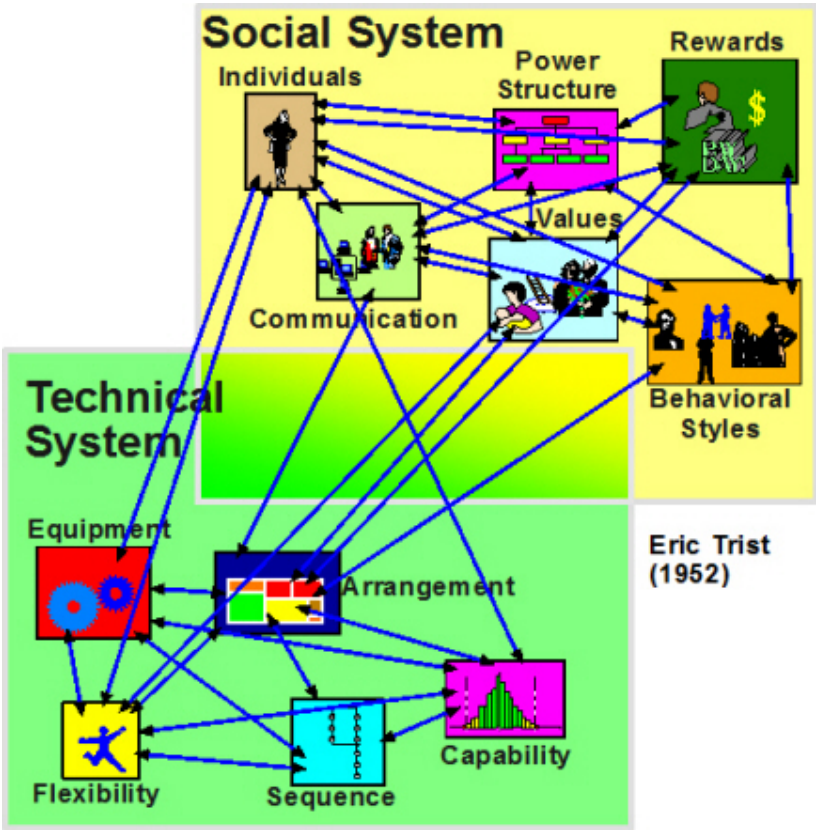


Figure 1. 3 Socio-technical system (Source: Trist, 1952 in Strategos, n.d)

A typical example of how the interaction between the two systems occurs within the construction sector's socio-technical system is when a client will approach an architect, with the need to construct a building. The architect will prepare the initial sketches and ask the quantity surveyor to estimate the cost of the designs. Upon the client's acceptance of the estimated cost, the architect's designs are developed further. From the architect's developed designs, the quantity surveyor usually prepares a tender document called bills of quantities, for tendering purposes. A suitable contactor is selected based on the lowest tendered price (Ashworth et al., 2013; Winch, 2000). The architect, engineers, and quantity surveyors are often regarded as the design team; the contractor, material supplier and manufacturers are called the construction team (Refer to Figure 1.4).

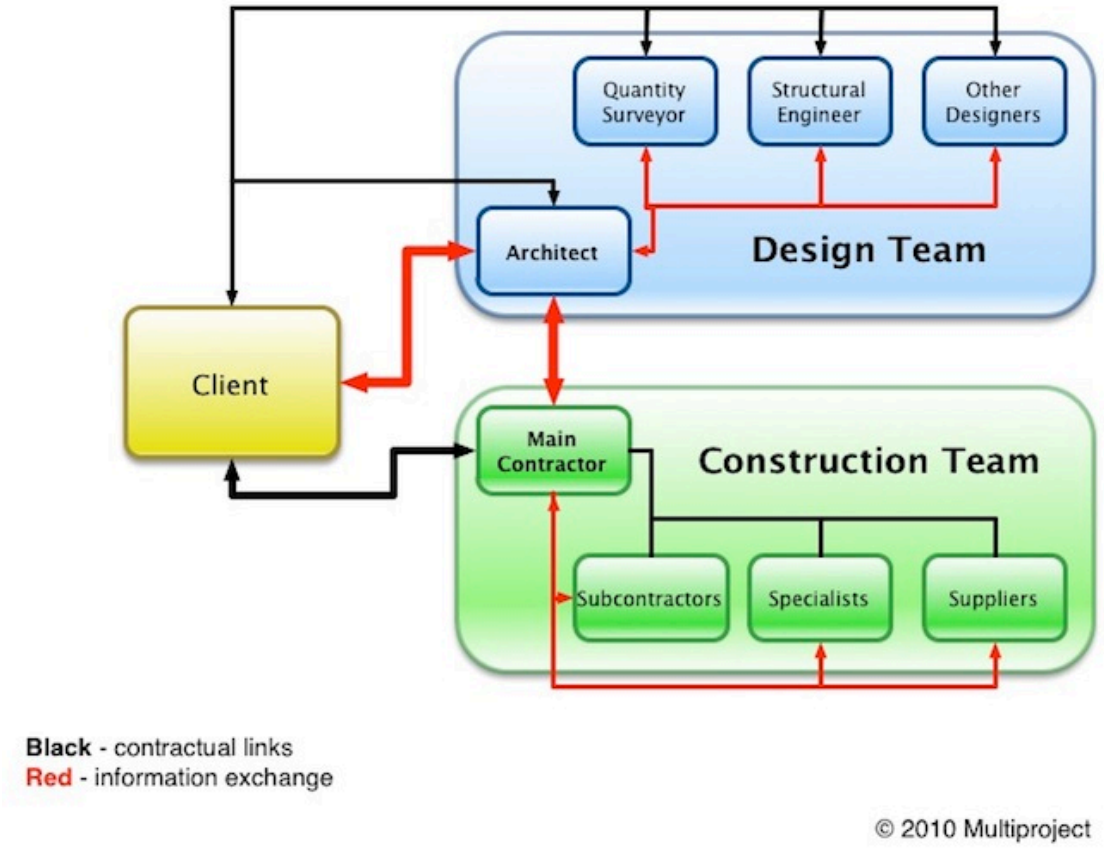


Figure 1. 4 Traditional procurement method (Source: Multiproject, 2010 in Lee et al., 2016)

The contactor will construct the building in accordance with the architect's designs, using the required materials, technology and equipment, within the agreed tendered price and stipulated period. During the construction period, the contractor is paid in monthly instalements based on the onsite progress. Once the work is complete, the building is handed over to the client, the quantity surveyor prepares the final account of the works, and the contractor is paid his final amount based on the quantity surveyor's final account (Ashworth et al., 2013). This method of procuring the building is usually called the 'traditional method' because it has existed for a long time (Mathonsi and Thwala, 2012; Walker and Lloyd-Walker, 2012). Winch (2000) refers to it as the 'professional system'. In South Africa, the professional system is widely used. Figure 1.4 shows a typical traditional method. The main purpose of the professional system is for the client to get the best value for money (Winch, 2000). This objective is, however, seldom realised as the system is fraught with challenges.

The three main objectives of any construction project are based on the project management primer, namely cost, quality and the timeous completion of the project (Kumar, 2014; Oshungade and Kruger, 2015; Walker and Lloyd-Walker, 2012). In the professional system, however, cost overruns, an extended construction programme and low quality are common (World Economic Forum, 2016). Cost

overruns and an extended construction programme are often encountered because of multiple factors, including poor project planning (Ibid).

Because of the construction sector's fragmentation, the contractor is usually not involved in the design phase; they only become involved in the value chain during the construction period (Ashworth et al., 2013; Walker and Lloyd-Walker, 2012). At this stage, the design is usually fully developed and the contractor is only required to build based on the designs of the design team, with no input from him. The fragmentation between the design team and the contractor often leads to misunderstandings (Ashworth et al., 2013). Some details are misinterpreted by contractors. If the designs have to be altered as a result of the misunderstandings or misinterpretations, this often leads to delays. The sequential order of design and construction in the professional system is what often leads to higher construction costs and a prolonged construction programme (El Agha , 2013). Alternative practices, such as alternative procurements methods, contracts and data sharing platforms provide an alternative to the traditional procurement method.

1.2.9.2 Changes within the construction sector's socio-technical system: alternative practices

1.2.9.2.1 Alternative procurement methods

The construction sector has begun to embrace collaborative practices and information sharing technology, in an effort to reduce the challenges and risks brought about by the aforementioned fragmentation(Oshungade and Kruger, 2015; Walker and Lloyd-Walker, 2012). Collaborative practices include procurement systems, information-sharing ICT platforms, and building contracts that promote collaborative practices between the design team and the construction team (Harty et al., 2007; Walker and Lloyd-Walker, 2012; Winch, 2000).

Procurement systems define the contractual relationships between parties in construction projects (El Agha, 2013). Clients, or the client's representatives, are usually responsible for selecting an appropriate procurement system for construction projects (Ibid). There are three types of non-traditional procurement systems, namely 1) the integrated procurement system, 2) management oriented procurement system, and 3) the collaborative / discretionary procurement system (Mathonsi and Thwala, 2012).

The integrated system is a procurement system, where an organisation or the contractor is responsible for both the design and the construction of a project (Mathonsi and Thwala, 2012). A design and build procurement system combines both design and construction under one contract (Oshungade and Kruger, 2015). The risks associated with a fragmented structure, such as miscommunication between the design and construction teams, are greatly reduced. In comparison to other places such as Europe and North America, the design and build procurement methods are not widely used in South Africa (Mfongeh,

2010). The professional system is widely used in comparison to the other procurement methods in South Africa (Oshungade and Kruger, 2015).

In a management oriented procurement system, an organisation together with the designers and other consultants manage the construction of a project. The managing organisation will usually manage a number of subcontractors (Oshungade and Kruger, 2015). All contacting parties become involved from an early stage. Contractors usually select trusted subcontractors with whom they already have an existing relationship. This existing relationship between the contractor and the sub-contractor reduces disputes, which are another reason costs overrun and periods of construction are extended (Mostafa, 2016). However, the management contracting procurement method, if not properly managed, can lead to disputes, as design and construction responsibilities are distributed amongst various stakeholders (El Agha, 2013).

The construction management procurement method is commonly used in complex and large construction projects (Mostafa, 2016; El Agha, 2013). Like the design-and-build procurement method and the management procurement method, the construction management procurement method also allows for the early involvement of contracting parties (Dakhil, 2017). Overall project costs are usually lower than in the professional system (Lam and Chan, 1994).

Given the current challenges in the South African construction sector (poor quality, delays and cost overruns), alternative procurement methods might be a potential solution. The question is, however, how will the independent role of the professional quantity surveyor be affected within these alternative procurement methods? A change in the current status quo is likely to affect the status of the quantity surveying profession. What influence will a change in the procurement methods have on the quantity surveying profession? It is therefore important to look at how change in the procurement methods will potentially influence the quantity surveying profession.

The South African Government is also considering procuring certain infrastructure using Public-Private Partnerships (PPPs). The Government recognises that resources alone will not meet the country's infrastructure demand, and therefore it seeks partnerships with private parties to meet this demand. A PPP is defined as, "…*an agreement where the public sector enters into a long-term contractual agreement with private sector entities for the construction or management of public sector infrastructure facilities by the private sector entity…*" (Grimsey and Lewis, 2002: 108).

The private party in a PPP is referred to as the special purpose vehicle (SPV). The SPV procures the contractor to construct the public infrastructure . Once the infrastructure is built, the SPV maintains the infrastructure on behalf of the public entity, until the infrastructure is handed over to the public sector at the end of the agreed period. In this type of contract, the contractor usually employs the design team

The contractor is also responsible for both design and construction (SA National Treasury PPP Unit, 2004).

1.2.9.2.2 Alternative procurement contracts

Besides collaborative practices, the South African construction sector has also introduced contractual documents that promote collaboration between contracting parties. The widely used form of contract in building projects in South Africa is the Joint Building Committee Contract (JBCC). Unfortunately, it is regarded as adversarial in nature (Richards et al., 2005).The JBCC contracts promotes arm's length type of relationship between the design team and the construction team (Ibid). Disputes between contracting parties are, thus, common.

New forms of contract, such as the New Engineering Contract (NEC), were introduced in the UK in the 1990s, with the aim of engendering teamwork between the various parties involved in construction. The NEC's use of simple and clear language removes the ambiguity associated with the language often used in traditional contracts. There are no specific dispute clauses in the NEC, as the collaborative management designed in the contract is aimed at dispute avoidance (Barnes, 2013). The gap between design and construction is drastically reduced through this integrated contractual arrangement, thereby, reducing claims.

1.2.9.2.3 Alternative data sharing platforms

The construction sector is also starting to embrace information-sharing technologies. Building Information Modelling (BIM) is a " *rich information model, consisting of potentially multiple data sources, elements of which can be shared across all stakeholders and be maintained across the life of the building from inception to recycle*," (NBS, 2011). BIM provides an information-sharing platform for stakeholders involved in the construction process (NBS, 2011). Contracts, designers specifications, quantities, cost, space and geometry can be shared on a common platform (Ibid). BIM, however, has the potential to blur professional boundaries of the design team (Kulasekara et al., 2013).

1.2.9.2.4 The implications of alternative practices on the quantity surveying profession

This study argues that the structure, composition and arrangement of the construction sector's current socio-technical system legitimises the existence of the current construction sector's professions. Current changes in the construction sector's socio-technical system are thus threatening the legitimacy of the built environment's professions generally, and the quantity surveying profession specifically.

In South Africa, the law regulates the design team or the built environment professionals. The Council for Built Environment (CBE) regulates all the built environment professionals through their various councils (CBE, 2018). Together with the various councils, the CBE determines professional boundaries between the various professions.

The South African Council for the Quantity Surveying Profession (SACQSP) identifies work that is to be performed by quantity surveyors in South Africa in its document entitled, "Identification of Work to be Performed by Persons Registered in terms of the Quantity Surveying Profession Act 2000 (Act No. 49 of 2000)," (SACQSP, 2011). Through similar measures other professional councils, such as the South African Council for the Architectural Profession (SACAP) and Engineering Council of South Africa (ECSA) also set their own boundaries (Ave, 2013).

The various acts of the built environment professionals do not allow for encroachments. Societal and technological changes are putting pressure on the professional system to transform. Transformation may present new challenges and threats to the professions, as currently instituted in South Africa.

Collaborative practices, for instance, have the potential to make professional boundaries and the law that governs the professions redundant. If that happens, what implications will this phenomenon have on the built environment professions in South Africa?

This study further argues that of all the built environment professionals, the quantity surveying profession is the most dependent on retaining the 'professional system' for survival. A move towards collaboration has the potential to remove the need for a quantity surveyor. In the UK, for instance, four quantity surveying jobs were removed from the BAA Pavement Team by using a cost reimbursable contract instead of a target cost contract, and the number of quantity surveyors working at Heathrow Express was halved by using a single collaborated team (Winch, 2000).

although collaborative practices are not used widely in South Africa, there is evidence that the South African construction sector in South Africa will follow its international counterparts (CIDB, 2015). These trends in the South African construction sector's socio-technical system warrants a need for the built environment professions to reconsider their position in society. Since the quantity surveying profession is the profession most likely to be adversely affected by the changes in the socio-technical system, the study advocates for an investigation into the potential influence that socio-technical changes are likely to have on the quantity surveying profession in South Africa.

1.2.9.2.5 Changing professional tasks

In addition to alternative practices threatening the current position of the quantity surveyor, changing professional tasks are a potential threat to the quantity surveying profession. The World Economic Forum (WEF, 2016) claims that the urban population is growing by 200 000 people per day. This urban growth requires additional accommodation and infrastructure (Oke et al., 2017; WEF, 2016).

The acute demand for infrastructure calls for a reconsideration of the construction process (Cottle, 2015). The rapid urban population growth has also increased discussions on the use of automation and robotics to improve efficiency, speed and safety (Oke et al., 2019; Struková and Líška, 2013). Other

measures to meet demand and improve efficiency in the construction sector include standardised and off-site construction, the use of 3D technology such as 3D printing, drones, smart and new construction materials, etc. (Harty et al., 2007).

For instance, off-site construction and the use of automation and robotics on site, will affect the job functions of the built environment professionals, including the quantity surveyor. BE professionals usually go to site to perform some of their professional tasks. However, technology is rendering this function redundant. In manufacturing, for instance, processing plants can be managed off site using a computerised system (Chaudhari, 2017). Are the built environment professionals' functions on site likely to disappear because of technology?

Studies claim that the accounting and quantity surveying professions are some of the most at risk of extinction (Acemoglu and Autor, 2011; Adendorff, 2018; Luksha et al., 2015). Tasks that accountants and quantity surveyors carry out such as, "*adding a column of numbers,*" can be codified in computer software and executed by a machine (Acemoglu and Autor, 2011: 20).

The probability of the accounting profession disappearing in the next two decades currently sits at 92% (Adendorff, 2018). Lushka et al. (2015) place quantity surveying second as the profession most at most of extinction. Quantity surveying tasks are being taken by intelligent software (Luksha et al., 2015). Kulasekara et al. (2013) claim BIM is capable of replacing traditional quantity surveying tasks. The production of bills of quantities for procuring contractors is one of the traditional functions of quantity surveyors (Ashworth et al., 2013; Kulasekara et al., 2013). By using BIM, there is the widespread belief that the production of bills of quantities can be reduced by 80% (Ashworth et al., 2013).

In South Africa, the implications of BIM on bill production are enormous. The Amendment of Guideline Tariff of Professional Fees Quantity Surveying Profession Act, 2000 (Act 49 of 2000) accords a substantial amount of fees to bill production (SACQSP, 2015). According to the latest guidelines, dated August 2015, about thirty five per cent (35%) of fees are apportioned to bill production and procurement (Ibid). If BIM takes over the bill production task and other quantity surveying tasks, then claims about the extinction of quantity surveying cannot be ignored, given that a profession's claim to legitimacy is also provided by jurisdiction over certain professional tasks (Abbott, 1988). The loss of jurisdiction over the bill production to BIM has the potential to weaken the quantity surveyor's standing position, both in society and in the construction sector's socio-technical system.

The effects of the changes in the construction process and the tasks on the quantity surveying profession are just two examples of the socio-technical factors that have the potential to substantially influence the evolution of the quantity surveying profession. The study identifies other factors that are likely to bring

transformation to the quantity surveying profession in South Africa in the future. Knowledge of the factors likely to have a major influence on the quantity surveying profession will enable the profession to consider and prepare for its future.

If the quantity surveying profession's legitimacy in society as well as within the construction sector also stems from the structure, composition and arrangement of the construction sector's socio-technical system, then any change in the construction process is likely to have an effect on its role in society.

1.2.10 Summary of the background

Current socio-technological changes are causing seismic changes for the profession. Work in future will be carried out differently. What is not certain is the future appearance of the professions. Therefore, the need for scenario planning is imperative, especially as a means of assisting the professions to think about their future, using the quantity surveying profession as a case study.

1.3 The rationale for the study

The purpose of the study is to provide future scenarios for the quantity surveying profession in South Africa given current socio-technical changes. How will the changing societal norms and values, the diffusion of specialist knowledge through technology and the automation of professional tasks influence the evolution of the quantity surveying profession? The study highlights opportunities and threats the current socio-technical changes pose to the quantity surveying profession in South Africa.

Even though the quantity surveying profession is used as a case study to investigate the implications of socio-technical changes on the quantity surveying profession, this phenomenon is also evident in other professions. Insights gained from this study can be applied to other professions.

Scenarios are useful in thinking about the future where; 1) the level of uncertainty is high and unpredictable and 2) the anticipated change is significant (Schoemaker, 1991). A scenario is a "… *method for thinking about potential futures and the challenges and opportunities they bring"*(Harty et al., 2007). In a socio-technical system, change is complex, emergent, non-deterministic and path dependent (Agar, 2004; Van de Ven and Huber, 1990; Lyytinen and Newman, 2008; Mohr, 1982; Ven et al., 2008). Therefore, the same qualities can be ascribed to the current changes within the construction sector, within which the quantity surveyor operates. Scenarios are thus an appropriate method for providing the quantity surveying profession with direction for its future, which is currently absent in contemporary literature.

Most of the current studies on the future of professions are diagnostic in their analysis and do not provide the professions with direction for the future, hence the choice to use scenarios to assist the quantity surveying profession.

1.4 Statement of the problem

According to Creswell (2014), research problems must possess a 'narrative hook' and explicitly identify the research problem. The main problem of the study involves investigating the influence of the current socio-technological changes on the role of the quantity surveying profession in South Africa. The background (section 2) and the literature review provide some evidence of factors likely to cause fundamental changes in the role of the quantity surveying profession in South Africa. The problem statement of the study is stated as follows.

"Current changes in the socio-technical system of the construction sector are influencing the role of the quantity surveying profession in society and in the construction sector. Some of these changes pose a threat to the existence of the quantity surveying profession. Failure by the profession and other stakeholders to respond adequately to these changes may lead to the extinction of the profession or to the profession losing its professional status."

1.5 Aim of the study

The aim of the study is to identify possible futures for the quantity surveying profession in South Africa given the socio-technical changes currently taking place in the construction sector.

1.6 The research objectives

Research objectives provide purpose and direction for the study (Saunders et al., 2016). In order to investigate the influence of socio-technical changes on the quantity surveying profession successfully, the following objectives are proposed for the study (refer to Table 1.1);

Table 1. 1 Research questions and objectives

Empirical Research Questions	Literature Objective	Empirical Objectives
What is the current state of the quantity surveying profession?	Determine from literature the current state of the quantity surveying profession.	Determine from experts the current state of the quantity surveying profession.
What are the socio-technological factors that are likely to influence the current quantity surveying profession?	Identify from literature the socio-technological factors likely to influence the quantity surveying profession.	Identify from experts and focus groups the socio-technological factors likely to influence the quantity surveying profession.
How are the socio-technological factors likely to influence the current role of the quantity surveyor?	Determine from literature how the socio-technological factors are influencing the current role	Determine from experts how the socio-technological factors are influencing the

	of the quantity surveying profession.	current role of the quantity surveying profession.
What are the tasks of the quantity surveying profession that are at risk?	Identify from literature the quantity-surveying tasks at risk.	Identify from experts the quantity-surveying tasks at risk.
What are the likely future scenarios for the quantity surveying profession in South Africa?	From literature, identify possible futures for the future quantity surveying profession.	From the interviews and focus groups, provide scenarios for the future of the quantity surveying profession.

1.7 The research questions

Clough and Nutbrown (2002) warn against research questions that are "too big", "too small" or "too hot". Research questions should be "just right," that is, they must be able to be investigated within the researcher's setting at the current time.

The current changes and future changes in the construction sector's socio-technical system in South Africa are likely to cause changes in the roles of the built environment professionals. Thus, the main research question for the envisaged study is:

"*What is the future of the quantity surveying profession given the socio-technical changes in the construction sector in South Africa?*"

According to Earl Jones (in Brier, 2005), future studies can divided into five categories:

- "*…Near-term future: up to a year from now;*
- *Short-range future: 1–5 years from now;*
- *Middle-range future: 5–20 years from now;*
- *Long-range future: 20–50 years from now;*
- *Far future: 50+ years from now."*

The study is a middle-range future study, as the effects of trends and factors are likely to occur within the period of five to 20 years. It aims to identify and the predict the future of the quantity surveying profession within the next twenty years. The following are thus the study's sub-questions:

- What is the current state of the quantity surveying profession?
- What are the socio-technological factors likely to influence the current quantity surveying profession?

- How are the socio-technological factors likely to influence the current role of the quantity surveyor?
- What are the tasks of the quantity surveying profession that are at risk?
- What are the likely future scenarios for the quantity surveying profession in South Africa?

1.8 Research Assumptions

Suresh (2014: 93) defines assumptions as, "*principles that are accepted as being true based on logic or reasons, but without proof or verification.*" Given that achieving professional status is esteemed by all occupations, this study assumes that the quantity surveying profession desires not only to exist in the future, but also to retain its professional status (Abbott, 1988; Bernard Barber, 1963; Davis, 2009; Montgomery et al., 2018; Susskind and Susskind, 2017).

Another assumption this study makes is that factors driving change in the built environment socio-technical system and the quantity surveying profession elsewhere in the world will also affect the South African built environment socio-technical system and the quantity surveying profession in South Africa.

1.9 Research Design

Given the complexity of the factors facing the professions, this exploratory study adopts an interpretivist's research philosophy. An interpretivist philosophy allows the 'why' and 'how' questions to be addressed. A case study of the quantity surveying profession is used to investigate the possible futures of the profession. Exploratory future scenarios are generated from analysed data collected through 23 face-to-face interviews with experts, a workshop and a focus group. The collection of data follows grounded theory techniques. A combination of grounded theory, narrative and thematic data analysis is used to interrogate the data that is subsequently used to generate future scenarios for the quantity surveying profession.

1.10 Delineation

In South Africa, the quantity surveying profession is a statutory defined profession and subject to extensive regulation. The proposed study is thus limited to the investigation of the influence of socio-technical system changes on the quantity surveying profession in the construction sector in South Africa. However, the lessons learnt from the study are relevant to other professions, as the quantity surveying profession is in other jurisdictions.

1.11 Limitations

One of the limitations of the study is that only experts based in the Gauteng Province of South Africa were interviewed as this is where the researcher is based. Another reason why the Gauteng Province

was preferred over other provinces is that the Gauteng Province is the most affluent and most populous province in South Africa (StatsSA, 2018b; StatsSA, 2018c). The perspective given by Gauteng experts are likely to be different to those given by experts in a province, such as Northern Cape, where the province is mainly rural and the economic activity is lower in comparison to Gauteng.

Another limitation of the study is that face-to-face interviews were used to collect data. Interviews usually introduce two types of bias, participants' bias and researcher bias (Saunders et al., 2016). Participants' bias may occur when the participant does not disclose all the relevant information (Ibid). Bias from the researcher arises in the way questions are posed, framed and interpreted (Saunders et al., 2016; Kumar, 2014).

The use of a focus group to collect data also provided another limitation. Focus groups are self-selecting by nature, and thus the views expressed are non-representative of non-participants. In addition, only dominant views may be expressed, as other participant may feel intimidated to express their views (Saunders et al., 2016).

1.12 Outcomes and significance of the study

The study demonstrates that the multilevel perspective (MLP), which is often used to analyse historical change, can also be used as a theoretical framework and heuristic device for predicting future transitions (Geels, 2005a, 2005b; Geels, 2006, 2004, 2002; Geels, 2005c; Trist, 1981). In addition, the study highlights:

- changes in the quantity surveying profession;
- the factors likely to influence changes;
- threats and opportunities;
- possible futures for the quantity surveying profession; and
- recommendations that will assist the quantity surveying profession to prepare for the future.

Relevant stakeholders at the micro level (niches), the macro level (regimes), and even the specific macro level within the quantity surveying profession, will be able to use the findings to make strategic decisions concerning the future of the quantity surveying profession.

1.13 Ethical issues

Ethical issues in a research design refer, generally, to questions and situations that may place research participants under, "… *embarrassment, harm or any other material disadvantage,*" (Saunders et al., 2009: 160).

Before the data was collected, ethical clearance was obtained from the University of the Witwatersrand's Ethical Committee. The ethics clearance certificate is included in the Appendix section of the study. All participants of the interviews, workshop and focus group were informed about the aim of the study and were requested to sign the consent forms before they could participate in the interviews, the workshop and the focus group. Furthermore, identities of all participants are undisclosed.

1.14 Chapter Outline

The following is the chapter outline of the study;

Chapter 2: The Professions and the Quantity Surveying Profession

One of the purposes of the literature review chapter is to identify gaps that exist in the body of knowledge, which the study attempts to fill. First, this chapter introduces the concept of the professions and the theories that are used to conceptualise them. The quantity surveying profession is then discussed broadly before narrowing the discussion to the South African quantity surveying profession.

Chapter 3: The Factors Influencing the Quantity Surveying Profession

This chapter discusses the factors influencing the quantity surveying profession and their implications of the quantity surveying profession in six Commonwealth countries, including South Africa. Literature predictions about the future of the professions are also discussed.

Chapter 4: The Theoretical Framework: MultiLevel Perspective (MLP)

Chapter 4 discusses the MLP and 5Ps model. The MLP is the main theoretical framework and the heuristic device the study uses to analyse change and to forecast the future of the quantity surveying profession. Shortcomings of the MLP are provided and the reasons why the 5Ps model is used to augment the MLP are provided.

Chapter 5: Design and Methods of the Research

In Chapter 5, the research paradigm chosen for this study is discussed. The rationale and justification for the chosen research design is provided. Since the study is a futures study, the choice to use scenario planning in forecasting possible futures for the quantity surveying profession is defended. Data collection and data analysis techniques and procedures adopted for the study are explained.

Chapter 6: Findings and Discussions

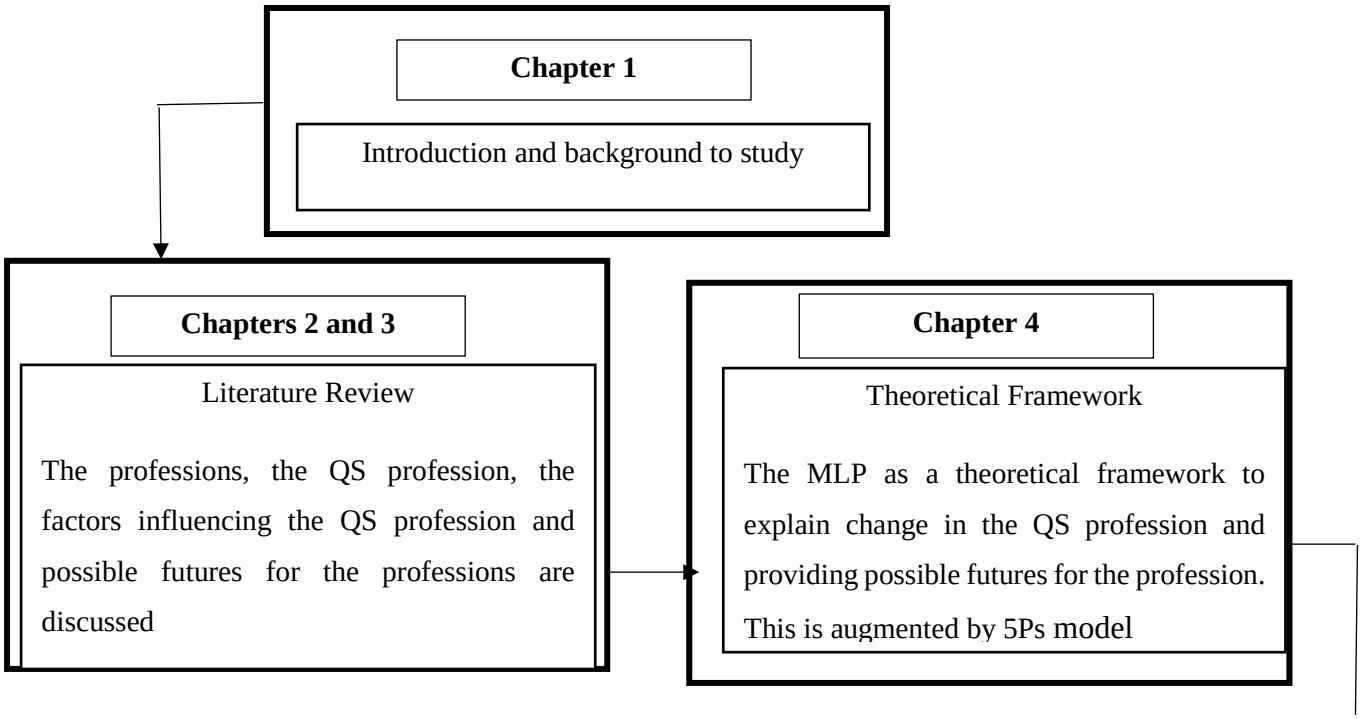
This chapter presents the findings of the interviews with experts, the workshop and the focus group. The findings are presented according to the research questions and objectives, and are analysed using the MLP framework.

Chapter 7: Scenario Generation

Based on the analysis of the data presented in Chapter 6, possible futures for the South African quantity surveying profession are presented using the MLP as a framework.

Chapter 8: Conclusion and Recommendations

An effective conclusion chapter must 1) demonstrate how the findings are connected to the main arguments of the paper, 2) show the applicability of the findings, 3) demonstrate relevance and value of the study, 4) identify gaps and uncertainties that might require further study, and 5) make recommendations for future studies (Mouton, 2001; The Writing Center, 2012). Thus, Chapter 5 covers the five afore-mentioned points. Given that the study is qualitative, the discussion of the meaning of the results in line with the research questions, the aim and objectives are also provided. Figure 1.5 shows the thesis' layout.



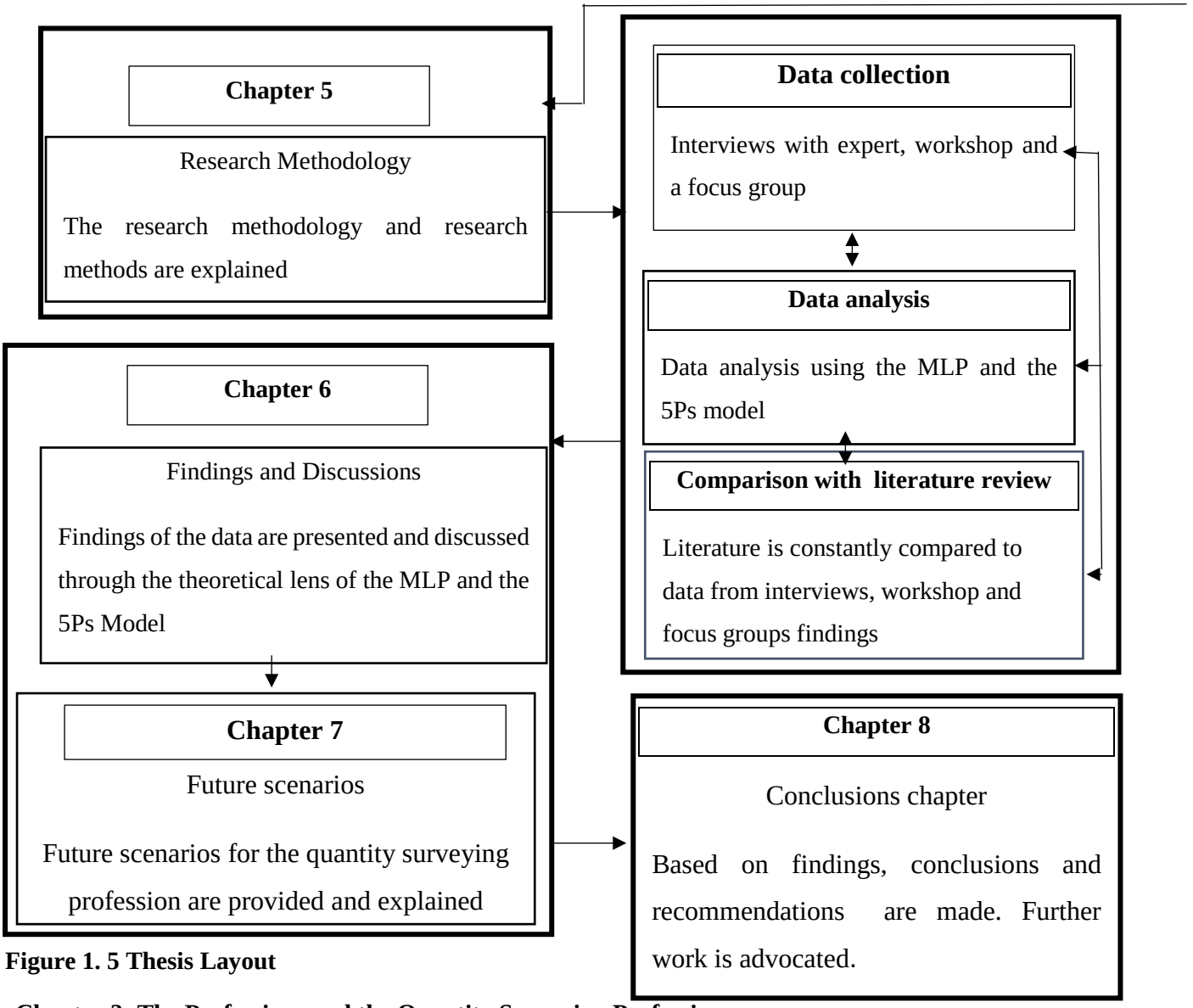


Figure 1. 5 Thesis Layout

Chapter 2: The Professions and the Quantity Surveying Profession

2.1 Introduction

The aim of a literature review includes 1) finding out what has been written about the phenomenon under investigation and the limitations of previous studies, 2) identifying available research instruments and 3) also demonstrating how the current study fits in the body of knowledge (Mouton, 2001; Saunders et al., 2016). In Chapter 1, the following literature objectives were identified:

1. Determining the current state of the quantity surveying profession
2. Identifying socio-technological factors that are likely to influence the quantity surveying profession

3. Determining how the socio-technological factors are influencing the current role of the quantity surveying profession
4. Identifying from literature the quantity-surveying tasks at risk; and
5. Identifying possible futures for the quantity surveying profession

In the next section, the importance of these literature objectives are explained.

2.1.1. Literature objectives

2.1.1.1 Determining the current state of the quantity surveying profession

The current state of the quantity surveying profession refers to its current *condition*. Thus, the current state of quantity surveying includes how the quantity surveying profession is defined and instituted, the role of the quantity surveying profession, the tasks of the quantity surveying profession and similar. It is important to understand the current state of the quantity surveying profession to determine how it is likely to respond to pressure applied to it. Just like compressive tests carried out on concrete determine its ability to withstand pressure applied to it, this study argues that the current state of the quantity surveying profession will determine how it responds or reacts to pressure applied to it.

2.1.1.2 Identifying the socio-technological factors that are likely to influence the quantity surveying profession is important

As stated in Chapter 1, there are claims that current socio-technical factors are influencing the professions, including the quantity surveying profession. Although there are factors that are likely to influence the professions in general, there are factors that are likely to influence the quantity surveying profession in particular, hence the need to identify these factors to determine their ability and likelihood to do so. This will determine whether claims that the quantity surveying profession will become obsolete in future have merit.

2.1.1.3 Determining how the socio-technological factors are influencing the current role of the quantity surveying profession

After identifying the factors influencing the quantity surveying profession, it is important to determine the manner in which the profession will be influenced, given the current state of the profession. Questions such as what is likely to change about the profession, whether these change are significant enough to obliterate the profession, to cause a complete change in the profession, or if the profession is resilient enough to withstand the change, will be answered by determining how the socio-technological factors are influencing the current role of the quantity surveying profession.

2.1.1.4 Identify, from literature, which quantity-surveying tasks are at risk

If some of the tasks of the professions are going to become redundant, due to technology and other factors, it is then important to identify which of these tasks are at risk, and if these tasks can be regarded as core tasks of the profession. By core tasks, these are the tasks that uphold the profession. What would likely happen to the profession if these tasks are replaced? If these tasks are at the core of a profession, and the foundation that upholds it, then there is merit in claims that technology or other factors are likely to render the professions redundant. If there are other factors that make and uphold the profession aside from these core tasks, then claims that professions will be made redundant in future are false. Hence it is important to determine tasks that are at risk of extinction to determine if their extinction will also mean the extinction of the profession as a whole.

2.1.1.5 Identification of possible futures for the quantity surveying profession

One of the contributions of this study is to provide the quantity surveying profession with future scenarios. Literature provides future scenarios for the professions including the quantity surveying profession. It is important to review these scenarios, not only to see what literature says about the future of the profession, but also to determine how these scenarios were developed. Understanding how literature has developed future scenarios for the profession will form the basis for developing future scenarios for the quantity surveying profession in South Africa, which this study seeks to provide.

The literature review was divided into two chapters for clarity. This chapter deals mainly with Literature Objective 1 and Literature Objective 4. Chapter 3 looks at Literature Objectives 2, 3 and 5 There are, however, overlaps in both Chapters 2 and 3 of the discussion of the literature objectives. The overlap is partly because the literature review was initially written as one chapter. Another reason for the overlap is to avoid an incoherent discussion. In the next section, the literature review methodology used for this chapter and Chapter 3, are explained.

2.1.2 Literature review methodology

There are two main types of literature review methodology, namely the systematic review and the narrative or the non-systematic review (Ferrari, 2015). A systematic review follows a "*detailed, rigorous and explicit,*" (Green et al., 2006: 102) method in search of the relevant literature to include in the literature review. Unlike the systematic reviews, narrative literature reviews do not follow both a rigorous and a thorough method (Saunders et al., 2016).

In a systematic review, the search for literature is based upon clear aims and objectives. The search methods are usually pre-planned. A comprehensive search for articles is undertaken. The selection criteria for which articles to include is provided. The literature is synthesised based on an explicit framework. The findings of the reviewed articles are presented in a thorough and impartial manner. The

main limitation of the systematic review, however, is that the literature search is confined to the boundaries set by the aim and objectives of the search. (Ferrari, 2015; Green et al., 2006; Saunders et al., 2016).

Systematic reviews can be divided into qualitative systematic review and quantitative review (or meta-analysis). The main difference between these two systematic reviews is that, in a meta-analysis, literature is appraised and the results are statistically combined, whereas in qualitative systematic reviews, results are not statistically combined (Green et al., 2006).

There are no clear guidelines for searching for literature in a narrative review (Ferrari, 2015; Green et al., 2006). The search methods followed and the selection criteria for the literature reviewed is usually not provided. The main objective of a narrative literature review is to describe and appraise published literature on a topic and to reach a conclusion based on the evidence provided by the literature. Since, narrative reviews lack the rigour and thoroughness associated with systemic reviews, they are sometimes not regarded as true scientific research (Ferrari, 2015; Green et al., 2006; Saunders et al., 2016).

The literature review for this study follows a narrative review method. The major reason for choosing the narrative review over the systematic review was to allow the key phenomenon under study to be investigated without narrowing the search too much. Some of the principles of the systematic review were followed, such as defining the aims and objectives of the study prior to undertaking the search. Throughout the literature review process, the aims and objectives of the study were, however, continuously refined based on the findings of the literature.

Google Scholar and the University of the Witwatersrand's library website were the main search engines used to find relevant articles for the study. Keywords used to select articles include, 'profession', 'quantity surveying profession', 'Fourth Industrial Revolution', 'multilevel perspective', and 'socio-technical'. The search for articles was based on the current year of search going backward. Although articles published within the past five years were preferred, older publications were also included on the basis of their relevance to the study and the fact that some articles are regarded as classical (Mouton, 2001).

Besides electronic sources, textbooks, theses and dissertations are some of the sources used to obtain insight through literature. Only articles that met the aims and objectives of the study are included in the literature review.

2.1.3 Structure of the literature review

The literature review can be organised according to 1) date of study, 2) school of thought, theory, definition, 3) theme or construct, 4) hypothesis, 5) case study and 6) method (Mouton, 2001). In this study, literature is organised according to the central themes of the study. The main themes of the study are the current state of the quantity surveying profession, socio-technical factors likely to influence the quantity surveying profession, quantity surveying tasks that are at risk, and the future of the professions, including the quantity profession. Where appropriate, the themes are first discussed from a global perspective, before narrowing the discussion to the South African context. This is because the South African quantity surveyor is used as case study for other professions.

Chapter 2 of the literature review begins by providing a conceptual framework for the study. Concepts and words that are frequently used in the study, such as the profession, system and socio-technical system are defined. Definitions provided in the conceptual framework are the definitions adopted for this study. The broad themes of the study are 1) the professions, 2) the quantity surveying profession, 3) the factors influencing the quantity surveying profession and their possible implications on the quantity surveying profession, 4) the future of the professions and 5) past future scenarios of the South African quantity surveying profession. Themes 1 to 3 cover all the literature objectives with the exception of Objective 5, that is, the identification of possible futures for the quantity surveying profession. A summary of the main findings from the literature review are provided in both this chapter and Chapter 3.

2.2 Conceptual framework

A conceptual framework is useful in bringing clarity to the meaning of words used in the study (Mouton, 2001). This section provides the meaning of the main concepts that the study adopts.

Functionalism – is a sociological paradigm that, "*sees society as a structure with interrelated parts designed to meet the biological and social needs of individuals who make up that society,*" (OpenStax College, 2015).

Legitimacy – "*Legitimacy is a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions,"*(Suchman, 1995: 574).

Profession (s) – no universal definition exists for professions. The study adopts a functionalist perspective of professions and the four features provided by Susskind and Susskind (2017) to describe professions. Susskind and Susskind (2017:15), provide the following four features of a profession: "…

(1) ...specialist knowledge (2) their admission depends on credentials (3) their activities are regulated (4) they are bound by a common set of values."

RICS – The Royal Institute of Chartered Surveyors is an internationally recognised professional body responsible for maintaining professional standards across the built and natural environment, which protect consumers and businesses alike. The RICS is also responsible for the certification of candidate quantity surveyors for professional registration (RICS, 2020c).

Socio-technical system (STS) – is conceptualised in this study from Geels' functionalist perspective. A socio-technical system is "*the linkages between elements necessary to fulfil societal functions (e.g. transport, communication, nutrition),"* (Geels, 2004: 900). Furthermore, a socio-technical system "*consist[s] of technology, regulation, user practices and markets, cultural meaning, infrastructure, maintenance networks, supply networks,"* (Geels, 2005b: 446).

System – the study adopts the same approach as Harary and Batell (1981: 30). A system includes a set of units and their interrelations within a nested hierarchical structure (Harary and Batell, 1981).

System theory – "*is an area of inquiry through which one attempts to understand the wholeness of scientific and social problems* (Bridgen, 2017: 10). Systems theory is used to explain problems holistically.

The Fourth Industrial Revolution – "*is the confluence of emerging technology breakthroughs, covering wide-ranging fields, such as artificial intelligence (AI), robotics, the Internet of Things (IoT), autonomous vehicles, 3D printing, nanotechnology, biotechnology, materials science, energy storage and quantum computing…"* (Swhwab, 2017: 1). In addition, big data is also included amongst the newer technologies of the Fourth Industrial Revolution.

There are some terms that are used interchangeably in the study. These include the following; built-environment and the construction sector, the professional system and the traditional procurement method.

2.3 The professions

2.3.1 The professions and professionalisation

There is no consensus on a universal definition of a profession (Glazer, 1974; Susskind and Susskind, 2017). Conceptualisation of the professions is also contested (Forsyth and Danisiewicz, 1985). The word profession is originally from the word 'profess' (Hughes, 1963). A profession is an, "… *occupation which one professes to be skilled in and to follow*…" (Hughes, 1963:656). Due to a lack of

consensus on the definition for professions, they are instead, described according to the common features they share.

Ashworth et al. (2013) include the following in describing professional status, 1) "*systematic knowledge*", which is used in problem solving, 2) selflessness , 3) membership to a professional body that regulates behaviour through a code of conduct, and 4) high income and elitism. According to Anteby et al. (2016) professions can simply be understood through the lenses of "*becoming*", "*doing*", and "*relating*". The distinct features of a profession, according to Susskind and Susskind (2017: 5) are, "*… (1) they have specialist knowledge, (2) their admission depends on credentials, (3) their activities are regulated, (4) [and] they are bound by a common set of values.*" The professions in this study are 'defined' using the features as described by (Susskind and Susskind, 2017).

The concept of professionalisation refers to the process of becoming a professional (Abbott, 1988). Abbott (1988: xii) describes professionalisation as, "*…a form of institutionalizing expert knowledge.*" Society and the law usually gives professional bodies the right to 'professionalise' individuals. Professionalisation typically involves training, licencing and professional examinations (Abbott, 1988; Susskind and Susskind, 2017).

Many individuals do not go through the process of professionalisation but are regarded as professionals. They include carpenters and sports persons (Susskind and Susskind, 2017). It is also important to note that some occupations may be accepted as a profession in one country and not in another (Davis, 2009). A professional in this study refers to individuals who have gone through the process of professionalisation, as described by Abbott (1988) and Susskind and Susskind (2017).

Professions hold different types of classifications. Medicine and law are regarded as the true, or classic, professions (Forsyth and Danisiewicz, 1985). Nursing, social work, librarianship and education are called the semi-professions (Ibid). Engineering and business administration are called the private enterprise professions (Ibid). From the classification provided by Forsyth and Danisiewicz (1985), the built environment professions, including the quantity surveying profession, fall under the private enterprise profession classification. As an enterprise, the professions are involved in business that is motivated by profits (Reiff, 1974). The services of private enterprise professions can be withheld or provided for a fee (Ibid).

Glazer (1974) distinguishes between two classes of professions, the major professions and the minor professions. Medicine and law are the major professions and every other profession is a minor profession (Glazer, 1974). Williams (2014) regards medicine and college professorship as the alpha professions. Schoolteachers and registered nurses belong to the beta professions (Williams, 2014).

The built environment professions are arguably in the mid-range of the professions' scale. For instance, chartered surveyors in the UK are in the lower ranks on the profession scale, as compared to surgeons (Susskind and Susskind, 2017), but they are not ranked low, with professions such as nursing and social work. In addition, levels of status, prestige and income also vary depending on classification (Bernard Barber, 1963; Gardner, 2016; Glazer, 1974; Iarskaia-Smirnova and Lyons, 2018; Reed, 2018; Susskind and Susskind, 2017; Torres and Weiner, 2018; Zufiaurre and De Villarreal, 2018). The highly ranked professions usually command more prestige and a higher income than the low-ranked professions (Unal, Tarhan and Koksal, 2018; Torres et al., 2018; Glazer, 1974, Barber, 1963, Zufiaurre et al., 2018).

Furthermore, professions dominated by females tend to command less respect than those that are not (Iarskaia-Smirnova and Lyons, 2018; Makwana, 2017; Roberts and Coutts, 1992; Zufiaurre and De Villarreal, 2018). The built environment professionals are predominantly male (Aboagye-Nimo et al., 2018; Morello et al., 2018), and as a result, they command far greater respect and higher salaries in comparison to the female-dominated professions.

In the United Kingdom (UK) and the United States of America (USA), there are discussions within the construction sector to increase participation from women, as a means to bolster the decreasing labour force (Aboagye-Nimo et al., 2018; Morello et al., 2018). But, due to the construction sector's hazardous nature, poor on-site sanitation, gender bias towards males, and a poor work-life balance, the sector has to date failed to attract large numbers of females (Ibid). The status quo however, is likely to change in future. New technologies, such as off-site construction, automation, and the use of robotics, are all likely to eliminate the majority of the unpleasant features of the sector, making it more attractive to women. Unless society's attitude towards women's role in society changes, the increase in their participation in the sector may have an adverse effect on the professional status of the built environment professions (Pekkola et al., 2018; Roberts and Coutts, 1992).

Low professional status negatively affects the profession's income. Within the built-environment professions, relegation to a lower status will negatively affect the service fees the professions can charge their clients. Attracting new entrants to the profession might prove difficult, as earning a high income is one of the factors that attracts new entrants to a profession. The next section discusses the history of the professions.

2.3.2 The history of the professions

The origin of the professions is contested (Susskind and Susskind, 2017). There are claims that the professions "…*have existed from time immemorial*," (Marshall, 1939). Gardner (2016) and Noordegraaf (2007) trace the origin of the professions to the Middle Ages, with the guilds as forerunners to the concept of professions. While Abbott (1988) perceives that the professions have their roots in ancient

and medieval times, he argues that professions, as instituted currently, are mainly a product of the First Industrial Revolution (1750–1850).

Cicero, the 1st century Roman lawyer, and Hippocrates, the 5th century ancient Greek physician, are some of those people cited, who support claims that professions existed in ancient times (Susskind and Susskind, 2017). Within, the quantity surveying profession, a Biblical quotation of Jesus Christ is often used as a basis for claiming the long history of the profession (Ashworth et al., 2013; Bowles and Le Roux, 1992). In Luke 14:28, Jesus asks, "*Suppose one of you wants to build a tower. Will he not first sit down and estimate the cost, to see if he has money to complete it?*" (Zondervan, 2009).

Some argue that professions can be traced to the guilds (Susskind and Susskind, 2017). Guilds were associations that practised technical and artistic crafts during the medieval and post-medieval eras, mainly in Europe and the UK (Desmet et al., 2020; Gardner, 2016; Susskind and Susskind, 2017). The two most dominant types of guilds were the merchant guilds and the craft guilds (Desmet et al., 2019). The merchant guilds were organisations of traders whose interest revolved around the exchange of goods, and the craft guilds were organisations with craftsmen of similar trades or professions (Ibid). Like current professional organisations, the merchant guilds looked after the interests of their members, by determining standards and controlling competition (Desmet et al., 2019; Susskind and Susskind, 2017).

The craft guilds were social institutions where members with the same expertise helped each other and participated in religious activities (Desmet et al., 2019). Guilds were secretive and exclusive (Gardner, 2016), characteristics that, according to Susskind and Susskind (2017), are common in the current professions.

In England, the decline of craft guilds began in the 19th century due to pressure from the economic environment (Desmet et al., 2019). Guilds resisted any new technology that weakened their position in society and welcomed only technology that improved their skills and income (Epstein, 2008). Labour-saving technology was often resisted through legal appeals, industrial action, and violence (Randall, 1991). The law usually protected guilds from competition (Letwin, 1954). By the 19th century, labour-saving technology increased (Desmet et al., 2019), and the law began to favour technology and entrepreneurs (Mokyr, 1990). In spite of the guilds resorting to violence and vandalism, it was the end of the guilds (Desmet et al., 2019).The Municipal Corporations Act, in 1835, officially abolished the craft guilds in England (Ibid).

How the current professions within the built environment in South Africa are instituted bears some resemblance to how the guilds were also instituted. Just like the guilds, legislation protects the

professions from competition. Legislation prohibits anyone who is not registered, in terms of its requirements, from practising as a professional. The Fourth Industrial Revolution, however, is now in competition with the professions, in the same way technology was with the guilds. How will the professions respond to technological advancement encroaching on their jurisdiction? Will history repeat itself?

Notwithstanding the different opinions on the origins of the professions, there is enough evidence to support Abbott's (1988) claim that the professions (as they currently instituted), are a product of the First Industrial Revolution (Susskind and Susskind, 2017). Besides the question of the time at which the professions emerged, the reasons for their emergence is also important. What is the role and purpose of the professions in society? Theories on the professions attempt to provide answers to these questions.

2.3.3 Theories of the professions

Various theorists attempt to provide reasons for the professions and professionalisation in society. The theories of professions are also referred to as the 'sociology of professions' (Pekkola et al., 2018). Theorists divide the theories of professions into various categories. Traulsen and Bissel (2004)) divide the major theories of professions into three groups: 1) the functional system of expertise, 2) the power approach and 3) the proletarianisation and deprofessionalisation. King et al. (2018) categorise the theories of professions into seven groups: 1) taxonomic (trait and functionalist) approach, 2) Marxian approach, 3) Bourdieu's social world, 4) capital and habitus, 5) symbolic capital and symbolic power struggles, 6) Foucault's power knowledge concept, and 7) Neo-Weberian (social closure) theories. Abbott (1988) classifies professions' theory into four groups: 1) functionalism, 2) structural, 3) monopolistic, and 4) culturalism. Susskind and Susskind (2017) also divide professions into 1) functionalism, 2) traits, 3) conspiracy theory (which also includes the monopolistic), and 4) the Marxist. The above classifications are just but a few classification on the professions. This study, however, adopts a combination of Pekkola et al. (2018) and Saks' (2016) classification of the theories of professions. Classification by Pekkola et al. (2018) and Saks (2016) are relatively comprehensive and include contemporary theories, which the other classifications lack.

Pekkola et al. (2018) take a historical perspective in their classification of the professions. The theory of professions is classified according to their historical developments. According to Pekkola et al. (2018), there are only two broad categories on the theories of professions, foundations and contemporary. The foundations theories include the trait approach, the functionalist, the interactionalist, the neo-Weberian and Faucauldian. Systemic, organisational, hybridity, and beyond hybridity are classified as contemporary theories. The theories are further classified according to their development; 1. Functional (1940–1960), 2. Interactional (1960–1980), 3. Systemic (1980–1990), 4. Organisational

and hybridisation (of professional and managerial principles) (1990–2010), and 5. Beyond hybridity (2010–date) Pekkola et al. (2018).

Saks (2016) categorises the theories into four broad categories: 1) the differential approach, which includes the trait and the functionalist approach, 2) the critical theories, which includes the interactionist, Marxist, Foucaldianism and discourse analysis, 3) the Neo-Weberian Perspective, and 4) the neo-Institutional.

While the development of the theories of professions can be traced from the 19th and 20th centuries (Abbott, 1988; Pekkola et al., 2018; Susskind and Susskind, 2017) as a unique field of study, theories of the professions started to develop in the second half of the 20th century (Pekkola et al., 2018). The study focuses only on theories of professions as developed in the second half of the 20th century. Using a combination of Pekkola et al. (2018) and Saks' (2016) classification of the theories makes it possible for many of the theories on the professions to be categorised under the two broad categories: foundation and contemporary. Obviously, not all theories on the professions will fit neatly into this classification; however, the classification by Pekkola et al. (2018) simplifies the classification, whilst Saks' (2016) classification makes it possible to categorise theories into the two broad categories identified by Pekkola et al. (2018). Although the combination of Pekkola et al. (2018) and Saks' (2016) classification is not all comprehensive, it covers many theories on the professions; it simplifies analysis, as theories are classified according to the period of development and common features, assumptions or ideologies (refer to Table 2.1).

Table 2. 1 Classification of the theories of professions (Pekkola et al., 2018; Saks, 2016)

Foundational	Contemporary
1. Functionalism 2. Structuralism 3. Trait approach	A. Systems
Critical theories Interactionism Marxism Foucauldianism Discourse analysis Neo-Weberian	B. Organisational
	C. Neo-Institutionalism
	D. Hybridisation

	E. Beyond Hybridisation

2.3.3.1 Foundations theories

2.3.3.1.1 Functionalism

The proponents of the functional theory include Parsons (1939, 1964, 1968, 1951), Goode, (1957), Millerson (1964), Carr-Saunders and Wilson (1933), Marshall, (1964, 1939) (Abbott, 1988; Pekkola et al., 2018; Susskind and Susskind, 2017). Functionalists view society as a stable, orderly and continuous structure made of different parts (OpenStax College, 2015; Welcome, n.d.).

The main assumption in the functionalist perspective is that the society is a system that is orderly and stable (Welcome, n.d.). In this perspective, society is characterised by a common set of beliefs, values and behaviour (Ibid). The different parts of society are referred to as institutions and these institutions work together to maintain a state of dynamic equilibrium (OpenStax College, 2015). Thus, the functionalist perspective is based on stability and consensus (Welcome, n.d.). Functionalists (Carr-Saunders and Wilson 1933, Marshall 1939 , Durkheim 1997, Parsons 1964), structuralists (Millerson 1964, Willensky 1964 and Caplow 1954) and traitists claim that professions are required for society to function properly (Abbott, 1988; Pekkola et al., 2018; Susskind and Susskind, 2017). The professions deal with knowledge asymmetry that exists in society (Abbott, 1988; Traulsen and Bissel, 2004). Society's relation with the professions is based on trust and the perception that the professions' motivation is altruism (King et al., 2018; Pekkola et al., 2018; Saks, 2016). The functionalist theory is helpful in understanding the social role of the professions; however, it is criticised for being idealistic (King et al., 2018; Traulsen and Bissel, 2004). Functionalists are criticised for exalting positive aspects of the professions such as altruism without providing evidence to such claims (Saks, 2016).

2.3.3.1.2 Structuralism

Functionalism, sometimes referred to as structural functionalism, is concerned with how the occupational groups organise themselves into associations, with the aim of regulating the profession through education, licensure, codes of ethics, etc. suchlike (Abbott, 1988). From a functionalist point of view, the organisation of the professions into associations is beneficial to society as it ensures that only qualified or licenced individuals carry out certain tasks (Abbott, 1988). Society is thus protected from unscrupulous work carried out by unlicenced individuals. The professional associations are often given the authority to determine jurisdictional boundaries by the state (Ibid). The associations can, however, behave like monopolies and gatekeepers in terms of knowledge and expertise (Abbott, 1988; Brandon et al., 1990; Susskind and Susskind, 2017). The structuralism approach views the professions as ameans of controlling occupations; it ignores the relationship between the professional and the client (Abbott, 1988). The content of the work by professionals is also not taken into account (Ibid).

2.3.3.1.3 Trait approach

The trait approach has similar features as the functionalist approach, except that to distinguish the professions from other occupational groups, traitists identify certain characteristics that professions supposedly possess, which other occupational groups do not possess (Pekkola et al., 2018; Saks, 2016). The list includes specialist knowledge, expertise, formal training, rationality, self-regulation and an altruistic bent towards their work (King et al., 2018; Saks, 2016). The biggest criticism of the trait approach is from this perspective, the authorities have not agreed on the basic traits of professions (Saks, 2016; Traulsen and Bissel, 2004).

2.3.3.2 Critical theories

2.3.3.2.1 Interactionism

The interactional theories include symbolic interactionism, the power and monopoly approaches (Pekkola et al., 2018; Saks, 2016). Leading writers of the interactional theory include Johnson (1972), Freidson (1988) and Larson (2013) (Abbott, 1988; Pekkola et al., 2018; Susskind and Susskind, 2017). The power and monopolistic perspective has its roots in the writings of Marx and Fowkes (1976) and Krause (1999) (Ibid). Interactionalists are interested in the everyday interactions between individuals (Welcome, n.d.).

The monopolists, for instance, are interested at who benefits or suffers, and at whose expense or benefit (Welcome, n.d.). Monopolists (Weber 1947, 1978; Larson 2013; Freidson 1988, 2001; Johnson 1972) view the professions and professionalisation as a tool for exclusivity, elitism and profit-making (Susskind and Susskind, 2017). Since interactionism focuses on the micro-level – the relationship between the professional and client – the meso and macro levels are not taken into account (Saks, 2016).

2.3.3.2.2 Marxism

Marx and Krause are the proponents of Marxism (Susskind and Susskind, 2017). The Marxists divide society into three classes, the bourgeois, the middle class and the proletariat (or the working class) (King et al., 2018). From this perspective, the classes struggle for the control of limited resources (OpenStax College, 2015; Welcome, n.d.). There are divergent views on the Marxist perspective regarding the professions (King et al., 2018; Saks, 2016). However, the common features in all divergent views, are the perpetuation of the societal class system and capitalism through professionalisation (Ibid). Professions are regarded as part of the, "*state machinery, representing the capitalist regime and socialising citizens,*" (Pekkola et al., 2018: 124).

Proletarianisation is one of the offshoots of the Marxist perspective. In this view, the professions' motivation is mainly capital (Susskind and Susskind, 2017). Other occupational groups are reduced to 'lower' levels in order for other groups (the professions), to gain a monopoly over expertise and to

maximise their profits (Traulsen and Bissel, 2004). Proletarianisation can also occur within the professions, where other professions' work is routinised in the same manner as manual labour, so that other professions can dominate them (King et al., 2018; Saks, 2016). A classic example is the manner in which the nursing profession serves medicine (Abbott, 1988; Saks, 2016).

Another school of thought within the Marxist perspective is that the mid-classified professions, such as engineering and accountancy, serve the bourgeoisie class, such as medicine, through surveillance (King et al., 2018; Saks, 2016). Other Marxists claim that the mid-classified professions are a hybrid of the bourgeoisie and the working class, with both characteristics present (King et al., 2018). The Marxist perspective is useful in understanding structural issues responsible for the inequality in society (OpenStax College, 2015). What the Marxist perspective lacks, however, is empirical evidence to support its claims (King et al., 2018). Societal stability, that is, equilibrium is also ignored (OpenStax College, 2015).

2.3.3.2.3 Foucauldianism

The father of foucauldianism is Michel Foucault (Goldstein, 1984). Foucault was not interested in why power was used but in *how* it was used and its effects (McKinlay and Pezet, 2018). Foucauldianism is concerned with the influence of the state on the professions, referred to as "*governmentality*" (Cooper and Robson, 2006; Saks, 2016; Walker, 2016). The state's influence is usually through institutionalising expertise (Saks, 2016). The two main schools of thought in Foucauldism are the archaeological and the genealogical approaches (Høvring et al., 2018).

The archaeological approach or the archaeology of knowledge is concerned with how professional power and knowledge is used to make populations governable (Saks, 2016). Genealogical approach focuses on the history of practices (Bastalich, 2009). Foucauldianism is useful in analysing how professions exert power, because on disciplinary or profession -pecific knowledge (King et al., 2018). Similar to Marxism, the Foucauldian perspective lacks sufficient evidence to base its claims and is too abstract (Saks, 2016).

2.3.3.2.4 Discourse analysis

Certain writers on discourse analysis include Gubrium and Holstein (2003) (Saks 2016). Discourse analysis looks at how occupational groups, such as managers and supervisors, use verbal and written communication in workplaces (Kärreman and Levay, 2017; Saks, 2016). It is concerned with how professionalism and professional vocabulary is used in discourse by managers and supervisors (Saks, 2016). Noordegraaf (2007: 765) defines professionalism as the application of, "*…general, scientific knowledge to specific cases in rigorous and therefore routinized or institutionalized ways.*" The

discourse analysis is useful in understanding professional culture (Saks, 2016). One of its disadvantages, however, is its treatment of workplaces and professionalism as a symbol (Ibid).

2.3.3.2.5 Neo-Weberian

The neo-Weberian perspective is based on the original writing of Weber (1968). This perspective on the professions is concerned with the idea of social closure through the professions' regulating the,"… *market conditions in their favour, despite competition.*" (Saks, 2016: 7). Professionals are viewed as gatekeepers of their profession. The aim of professions is to enhance their status in the market through social closure, which is often sanctioned by the state. Professional associations are often given autonomy by the state to draw professional boundaries that give professionals autonomy over areas of expertise. The professions derive their status, power and high income from this type of social closure (Pekkola et al., 2018; Saks, 2016). Although the neo-Weberian perspective allows the process of professionalisation to be analysed from structural and historical aspects; its claims are unsupported and somewhat denigrating towards professions (Saks, 2016).

2.3.3.3 Contemporary theories

2.3.3.3.1 Systematic

The leading author of the systems of professions is Abbott (1988) (Pekkola et al., 2018). Abbott views the social world as an ecology made up of inter-connected ecologies (Abbott, 2005; Pekkola et al., 2018). Abbott (1988) looks at professions as a system within a system. The ideology of the systemic approach is based on the systems theory (Abbott, 1988; Pekkola et al., 2018). According to the systemic approach, professionals cannot be analysed apart from other organisations and professional groups (Abbott, 1988; Pekkola et al., 2018). Abbott (2005) further describes professions as linked ecologies, where each ecology acts as encircling the other. In the systemic approach, professional expertise are regarded as jurisdictions that professions perpetually seek to strengthen in order to legitimise their position in society (Abbott, 1988, 2005; Pekkola et al., 2018).

The systematic perspective is useful in analysing professions and their jurisdictions (Pekkola et al., 2018). However, the use of the systemic perspective is criticised for using animal and plant behaviour analogies to explain human behaviour instead of using the analogy of politics and power to explain human behaviour (Saks, 2016).

2.3.3.3.2 Organisational and hybridisation

Organisational theorists or managerial theorists include Brint (1996), Evetts (2009), Adams (2015), Brock and Saks (2015), and Saks (2016) (Pekkola et al., 2018). The organisational perspective is concerned with the influence of the markets and organisations in the context of the changing social

world (Ibid). From an organisational perspective, professions are described as a type of an organisation and as a type of status category (Brint, 1996). Professions are interested in "… *rational-legal forms of authority, hierarchical structures and managerialism,*" (Pekkola et al., 2018: 126). There are four perspective in organisational theory: 1) occupational, 2) structuring, 3) culture and control, and 4) power and conflict (Kaissi, 2005), This perspective is influenced by neo-Weberianism and neo-institutionalism (Pekkola et al., 2018).

Organisational theory is only useful in analysing the professions working within organisations (Pekkola et al., 2018). Hybridisation is the combination of professionalism and managerialism (Ibid). Noordegraaf (2015, 2007) is one such theorist amongst the theorists of the hybrid perspective (Blomgren and Waks, 2015). Hybridism refers to the combination of professional principles and managerial principles to describe the professions (Pekkola et al., 2018). The hybridisation perspective emerged to overcome the conflict between professional and managerial institutional logics (Pekkola et al., 2018; Saks, 2016). Institutional logics are defined as "*overarching principles, values, beliefs and assumptions that prescribe what is legitimate and meaningful within different realms of social and economic life,*" (Thornton and Ocasio, 1999 in Ramus et al., 2017: 1 255). Institutional logics guide behaviour and provide the rules of action for decision-makers in organisations (Thornton and Ocasio, 1999). Hybrid professionals are professionals who, as a result of exogenous factors and in order to cope, have beyond their own area of expertise, developed other expertise, such as management or public policy (Noordegraaf, 2007). Hybridisation is only concerned with the influence of the state, organisations, corporations and profit on professions (Ibid).

2.3.3.3.3 Neo-institutionalism

The neo-institutional perspective is concerned with the professions' expanding location in the business sector, the public sector, and within the professional firms themselves (Saks, 2016). The professional groups are regarded as "…*one institution among others fighting for survival in an ecology of institutional forms,"* (Suddaby and Muzio, 2015 in Saks, 2016: 11).

Neo-institutional perspective is ideal for analysing the competing institutional logics between professional principles and managerial principles; however, the neo-institutional perspective, like the systematic perspective's use of animal and plant behaviour analogies, to explain human behaviour instead of politics and power is limiting (Saks, 2016).

2.3.3.3.4 Beyond hybridism

Amongst the leading theorists on the beyond hybridism perspective is Noordegraaf (2007; 2015) (Blomgren and Waks, 2015; Pekkola et al., 2018). While hybridism is more concerned with how professions handle the conflict between professional and managerial principles (Pekkola et al., 2018),

in beyond hybridisation, "*organizing becomes part of professional work and repertoires*," (Noordegraaf, 2015: 198). Managerial principles and values are incorporated in professional work. Beyond hybridisation is only concerned with how professions incorporate managerial principles in their work. Table 2.2 shows a brief summation of the theories of the professions.

Table 2. 2 Theories of the professions (Adopted from Pekkola et al., 2018 and Saks, 2016)

Theories of professions	**Research Objectives**	**Society**	**Main time period**
Functionalism Structuralism Trait approach	Professions function in society The traits of professions	Asymmetry of knowledge and expertise in society	1940s–1960s
Interactionism	Power of professions Client-professional relationship	Micro level analysis of professions	1960s–1980s
Marxism	Class based organization of professions	Social control through capitalism	1970s–
Foucauldianism	State's influence on the professions	Professions' societal control through the concept of 'governmentality'.	1970s–
Neo-Weberianism	Conflict between professions and organisations	Social closure enforced through the control of the market	1970s–
Systems	Jurisdictional boundaries of professions and the concept of professionalisation	Professions are system within a larger social system	1980s–1990s
Discourse analysis	How discourse is used to enforce professional culture	Micro and meso level perspective	1990s–
Organisational Hybridisation	Conflict between professional and managerial principles	Micro and macro level perspective	1990–2010
Neo-Institutionalism	Professional service firms in the context of other organisations	Professions compete with other institutions in a global ecology	2000s–
Beyond Hybridisation	Changes in Western societies, the role of knowledge, its production, and the erosion of	How exogenous societal factors, (such as the state, organisations, globalisation,	2010–

	professionalism by managerialism	corporatisation and profit) influence professions	

2.3.4 Discussion on the theories of professions

The previous section on the theories of professions is not all comprehensive, but merely provides a synopsis of some of the theories of the professions. Theories in qualitative research can be used in a number of ways. First, theory may be used to explain practice and perspectives. Second, qualitative researchers use theory as a theoretical lens through which a certain phenomenon is studied. Third, qualitative researchers build their own theory from the data. Finally, in some qualitative studies, no explicit theory is used (Creswell and Creswell, 2018).

The main research question this study wants to answer is: "*What is the future of the quantity surveying profession given the socio-technical changes in the construction sector in South Africa?*" Given claims that there is a possibility that the quantity profession might not exist in future; the study aims to investigate the validity of this claim using theory. The foundational theories (functionalism, structuralism and the trait approach) address the question of why the professions exist in society (Pekkola et al., 2018). As the study claims, the professions' legitimacy is what upholds their continued existence in society, and this legitimacy is conferred to the professions by society, partly because of the asymmetry of knowledge and expertise in society (Abbott, 1988; Traulsen and Bissel, 2004), how will the professions then respond to the socio-technical changes in society that threaten their legitimacy?

In comparison to other theories of the professions, the foundational theories are the most appropriate theoretical lens through which to analyse the influence of the socio-technical changes on the professions, as they address the question of why the professions exist. It is mainly for this reason that this study adopts a foundational perspective to investigate the claim that the quantity surveying professions may not exist in future.

Since there are also claims that the changes in society might lead to certain professions losing their professional status in future (Abbott, 1988), critical theories will be used to analyse the implications of the possible loss of professional status. How will the loss of professional status affect professions' position in society? As professional status accords the professions their elite positions and high income in society (Susskind and Susskind, 2017), how will the professions be affected by socio-technical changes in society? Critical theories, because of their focus on the professions' power, elitism and status, are an appropriate lens to analyse the possible relegation or loss of professional status of the quantity surveying profession because of societal changes.

Claims that socio-technical changes in society might create threats and opportunities for professions will be tested through systemic and neo-institutional theories. How will the professions increase their jurisdiction by taking advantage of opportunities created by socio-technical changes in society? Because systemic and neo-institutional theories are concerned with how professions compete with each other and other institutions and organisations in society for jurisdictional control, they are appropriate for looking at threats and opportunities presented by socio-technical changes.

In this study, the quantity surveying profession is conceptualised as a system within a broader socio-technical system of the construction sector. The socio-technical system of the quantity surveying profession is embedded within the construction sector's socio-technical system. The profession is therefore a subset of the construction sector's socio-technical system. This is another reason why the systemic and neo-institutional theories are used to analyse the profession.

As the quantity surveying profession is used as a case study to analyse the possible implications of the socio-technical changes on the professions, the next section looks at various aspects of the quantity surveying profession, such as its definition, its history and its role in society.

2.4 The quantity surveying profession

2.4.1 The history of the quantity surveying profession

As in the case of the professions, there is no consensus on the origins of the quantity surveying profession. There are claims that the quantity surveying profession has been in existence since biblical times (Ashworth et al., 2013; Bowles and Le Roux, 1992). Others claim that the profession evolved after the Great Fire of London in 1666 (Ashworth et al., 2013). As currently instituted, the quantity surveying profession seems to have originated in the UK (Maritz and Siglé, 2016) during the First Industrial Revolution (1750–1850) (Abbott, 1988). The profession has, currently, spread to many other Commonwealth countries such as Nigeria, Australia, Malaysia and South Africa (Dada and Jagboro, 2012; Maritz and Siglé, 2016).

In most Commonwealth countries, the profession is analogous to its British counterpart (Boon and Prigg, 2012; Dada and Jagboro, 2012; Maritz and Siglé, 2016). UK quantity surveying seems to continue to lead and provide direction for the profession worldwide. For instance, the RICS, an organisation responsible for setting and maintaining quantity surveying standards, amongst others, was formed in London, UK, in 1792 (RICS, 2019b). It was known then as 'The Surveyors Club' (Ibid). Its headquarters are still based in London (Ibid). Currently, the RICS has members and offices in many countries of the world (Ibid).

Other evidence demonstrating that quantity surveying in the UK is leading the profession is in the adoption of BIM. Many Commonwealth countries are using the UK as a benchmark in adopting BIM in their own countries (Akintola et al., 2017a; Boon and Prigg, 2012). Hence, the UK quantity surveying profession is also used as a comparison for the quantity surveying profession in general.

2.4.2 The history of the quantity surveying profession in South Africa

The South African quantity surveyor evolved from the British quantity surveyor. Quantity surveying was introduced to South Africa through British architects during the Second Industrial Revolution as a result of the discovery of diamonds (1870) and gold (1886). The economic developments associated with these mining activities attracted British architects to South Africa (Ibid) (Maritz and Sigle, 2016; ASAQS, 2008).

In the beginning, British architects used to measure and issue quantities to contractors. There were shortcomings with their quantities, however, which eventually led to the arrival of British quantity surveyors, in 1896. The Anglo-Boer War (1899–1902) had a negative effect on the country, and on the construction sector, including the quantity surveying profession. In 1906, a voluntary quantity surveying organisation, called the Transvaal Society of Quantity Surveyors, was formed to facilitate the development of the profession. Some of the achievements of the Transvaal Society of Quantity Surveyors include issuing the Standard System of Measurement of Builder's Work and the Billing of Quantities in 1906 (Maritz and Sigle, 2016).

By 1908, the Transvaal Society of Quantity Surveyors had evolved from a regional organisation to a national organisation, called the South African Institute of Quantity Surveyors. In 1925, the Institute gained its affiliation with the Chartered Surveyors Institution of Great Britain (Maritz and Sigle, 2016).

After, the Anglo-Boer War and the establishment of the Union of South Africa in 1910, the South African Government begun a programme of reconstruction, with a public works department being formed. Incorporated within the public works department were the architectural and the quantity surveying divisions. Quantity surveyors received permission from the Government to adopt the London system of measurement (Maritz and Sigle, 2016).

In 1927, the Architects' and Quantity Surveyors' Private Act (No. 18 of 1927) was passed (ASAQS, 2008). Amongst other things, the Act provided for the registration of professional quantity surveyors. Quantity surveying functions were, however, not protected by the Act. A fee scale, similar to the Royal Institute, was introduced. Quantity surveyors charged 2.5% of the contract value for the preparation of bills of quantities and extra percentages for the settlement of the final account. Other quantity services were also included in the fee scale.

The World War II also had an influence of the development of the quantity surveying profession in South Africa. The Transvaal Provincial Administration gave preference to quantity surveyors who were on the active service roster by giving them projects. Students' registration at the University of Pretoria and the University of the Witwatersrand also increased from 59 in 1945 to 151 in 1946. Eighty-eight of the new students were ex-servicemen (ASAQS, 2008).

In 1970, the Quantity Surveyors' Act (No. 36 of 1970) superseded the previous Act of 1927. The Act of 1970 gave birth to the South African Council for Quantity Surveyors, a juristic person with the authority to regulate the quantity surveying profession in South Africa. The Council also retained the voluntary associations. At that period, the Institute of Quantity Surveyors was called the Board of the Association of South African Quantity Surveyors. Following recommendations from the Commission of Enquiry into Remuneration of the Professions, the sliding fee scale replaced the 2.5% fee (ASAQS, 2008).

In the year 2000, the Quantity Surveying Profession Act (No. 49 of 2000) replaced the Quantity Surveyors' Act (No. 36 of 1970). One of the significant changes the Act brought was compulsory registration for anyone who wished to practise as a professional quantity surveyor in South Africa. Registration involves, amongst other things, going through an Assessment of Professional Competence (APC). Only registered persons in terms of the Act are permitted to use the title 'professional quantity surveyor' or 'PrQS'. It is therefore illegal for anyone who is not registered as a 'PrQS' to represent themselves as such (Maritz and Sigle, 2016).

The South African Council for the Quantity Surveying Profession (SACQSP) is the juristic person mandated to administer the Act on behalf of the Minister of Public Works. Some of the duties of the SACQSP includes identifying work that is reserved for quantity surveyors and to recommend fees for quantity surveyors. Through the Council for the Built Environment Act (No. 43 of 2000), the Council for the Built Environment (CBE) regulates the SACQSP and five other built-environment councils in South Africa (Maritz and Sigle, 2016).

From the discussion regarding the history of the quantity surveying profession in South Africa, it is apparent that the profession is highly legislated and that its roots originate in the UK. The practice and procedures of the quantity surveying profession in South Africa are, therefore, analogous to the British quantity surveying profession. The next section provides definitions for the quantity surveying profession.

2.4.3 The definition of quantity surveying

Ashworth et al. (2013) describe quantity surveyors as the "*construction accountants*" of the construction sector. The Association of South African Quantity Surveyors (ASAQS) (n.d. c) defines a quantity surveyor as, "*…a financial consultant of the construction industry, whose training and experience qualifies him to advise on cost and contractual arrangements, and to prepare contract documents.*" Both these definitions describe what a quantity surveyor is, but not what quantity surveying entails.

The RICS (2017) defines quantity surveying as being, "*… concerned with controlling and managing the costs of construction projects.*" The SACQSP describes quantity surveying as "**…** *the provision of expert, professional services and advice on construction procurement, contracting and costs. Quantity surveyors are trained, experienced specialists who have acquired comprehensive knowledge of construction procurement and contracting methods, finance and economics. They advise, collaborate and co-operate with members of other Built Environment Professions,*" (SACQSP, 2011).

There are some common words or phrases that obliquely refer to the same thing in all the definitions of quantity surveying provided. Words such as 'finance', 'cost' and 'contract'. Knowledge of cost or finances and contracts is therefore essential in quantity surveying. Both contractual knowledge and knowledge of cost can, thus, be regarded as the purview of the quantity surveying profession. From Forsyth and Danisiewicz's (1985) definition of a profession, quantity surveyors claim that construction contracts and construction financial management are skills in which they profess to be experts.

Although the quantity surveying profession is predominantly found in the United Kingdom and other Commonwealth countries (Ashworth et al., 2013), such as Australia, Malaysia, Nigeria and South Africa, occupations that carry out tasks similar to quantity surveyors are recognised under different titles in other countries. In some European countries, for instance, 'quantity surveyors' are referred to as construction economists or value engineers (in Finland) or cost engineers in the USA (Drake, 1994; Wao and Flood, 2016). Other countries use different titles, and quantity surveying is not regarded as a profession in these countries, but merely as an occupation (Ashworth et al., 2013). In spite of differences in the name and classification, what role does the quantity surveying profession play in society?

2.4.4 The traditional role of the quantity surveying profession

What has become known as the traditional role of the quantity surveying profession can be traced to the First Industrial Revolution (1750–1850) in the UK. Before current independent quantity surveyor emerged, quantity surveyors used to work for master tradesmen and builders. Initially, quantity surveyors used to measure and cost the work after completion. The final cost was then submitted to the client for payment. Over time, clients grew dissatisfied with only knowing the cost at the end of the project and wanted to know the cost before construction began (Maritz and Siglé, 2016).

The new system required quantity surveyors to provide an estimate of construction costs before commencement of work, based on the architect's drawings. With buildings and construction becoming increasingly complicated, the preparation of estimates became time consuming and costly. For unsuccessful tenderers, the cost incurred in preparing estimates was irrecoverable. Thus, builders decided to hire one quantity surveyor to prepare estimates. The cost of the quantity surveyor was either shared between the builders or paid by the successful tenderer. Since clients were ultimately paying for quantity surveyors, they decided that quantity surveyors should rather work for them directly (Maritz and Siglé, 2016).

The first quantity surveying firm established in the UK in 1785 was called Henry Cooper and Sons of Reading (ASAQS, n.d b.). It was only in 1859 that the term 'quantity surveyor' was first recorded. Prior to that, quantity surveyors were known by various titles, such as 'measurers', 'custom surveyors' or 'surveyors' (Ibid).

The document used by quantity surveyors to cost construction projects, procure contractors, cost plan, budget, make cash flow projections, value interim payments and settle final accounts is known as the bills of quantities (Rashid, Mustapa and Wahid, 2006). It was during the First Industrial Revolution that the bills of quantities, the first, aforementioned quantity-surveying firm was established, and the quantity surveyor's traditional role within the "professional system" first emerged (ASAQS, n.d b; Winch, 2000).

The traditional role of the quantity surveyor includes, "*single rate approximate estimates, cost planning, procurement advice, measurement and quantification, document preparation especially bills of quantities, cost control during construction, interim valuations and payments, financial statements, final account preparation and agreement, and the settlement of contractual claims,*" (RICS in Ashworth et al., 2013: 9).

The Second and Third Industrial Revolutions did not see any major changes in the quantity surveying profession; rather adapting and changing in minor ways (Ashworth et al., 2013). This claim appears to be supported by the similarity between quantity surveyors at the time and the role they currently fulfil. The next section looks at the current role of quantity surveyors.

2.4.5 The current role of the quantity surveying profession

There has been a minor evolution in the role of the quantity surveyor over the years. Table 2.3 compares the traditional role to the current role of the quantity surveyor in the UK. By comparing the two, it is clear that the quantity surveying profession has extended beyond its traditional role.

These additional roles include whole-life cycle costing (LCC), value management (VM) and facilities management (FM), which were previously not within the traditional quantity surveying role.

Table 2. 3 Traditional role versus current role of the quantity surveyor in the UK (RICS in Ashworth et al., 2013)

Traditional Quantity Surveying Roles in the UK (RICS circa 1960 in Ashworth et al., 2013)	**Current Quantity Surveyor Role in the UK (RICS circa 2006 in Ashworth et al., 2013)**
• *Single rate approximate estimates;* • *Cost planning;* • *Procurement advice;* • *Measurement and quantification;* • *Document preparation, especially bills of quantities;* • *Cost control during construction;* • *Interim valuations and payments;* • *Financial statements;* • *Final account preparation and agreement; and the* • *Settlement of contractual claims.*	• *Investment appraisal;* • *Advice on cost limits;* • *Whole-life costing;* • *Value management;* • *Risk analysis;* • *Insolvency services;* • *Cost-engineering services;* • *Subcontract administration;* • *Environmental service measurement and costing;* • *Technical auditing;* • *Planning and supervision;* • *Valuation for insurance purposes;* • *Project management;* • *Facilities management;* • *Administering maintenance programmes;* • *Advice on contractual disputes;* • *Planning supervisor;* • *Employers' agent;* • *Programme management;* • *Cost modelling; and* • *Sustainability Advisor.*

The RICS document of quantity surveyors services, the *England and Wales: Quantity Surveyor Services 2018 Edition* classifies the work of quantity surveyors according to the following broad classifications: construction services-all contracts, construction phase services supplementary, non-construction services, financial support services, BIM and bespoke additional services. The classifications and services have changed when compared to a 2008 version of the same RICS document.

In 2008, the classification only had two broad headings, core services and supplementary services. Core services include work done by a quantity surveyor under a traditional procurement project, prime cost contract/management, contracts/construction management contracts, and lastly design and build contract. Under supplementary services, the classification is general, financial, and contractual and project specific services. What is starkly different between the 2008 and 2018 quantity surveying

service classifications, is the inclusion of BIM and non-construction services as one of the services quantity surveyors provide (refer to Table 2.4).

Table 2. 4 Quantity surveyor services (Adopted from RICS, 2008 and RICS, 2018)

Quantity Surveyor Services 2008 Edition	Quantity Surveyor Services 2018 Edition
• Core services • Supplementary services	• Construction services – all contracts • Construction phase services supplementary • Non-construction services • Financial support services • BIM • Bespoke additional services

Construction services include services related to health and safety, tendering and procurement, as well as the construction phase. Services provided in the construction services include cost planning, cash flows, site visits and the preparation of interim valuations for payments. The non-construction services quantity surveyors provide include services related to the relocation of client's offices to new premises, monitoring key performance indicators, insurance claims, facilitation of workshops for lessons learned, acting as a client partnering advisor and setting up a document management website, and setting up and maintaining an e-tendering portal for the client (RICS, 2018).

As the South African quantity surveyor evolved from the UK quantity surveyor, there are similarities in the traditional role of the quantity surveyor (see Table 2.5). The common features include preparation of contract document such as bills of quantities, cost control during construction and preparation of final accounts. Notable differences are in the current role of the quantity surveyor. Whole life costing, value management and facilities management are not part of the current role of quantity surveyors in South Africa.

Table 2. 5 Traditional role versus current role of the quantity surveyor in South Africa (ASAQS, n.d.a)

Traditional role	Current role
• *Preparing feasibility studies and budgets for proposed projects;*	• *Estimating and cost advice;* • *Cost planning;* • *Property development advice;*

• *Preparing bills of quantities and other tender documentation to acquire fair and equitable tenders for projects;* • *Negotiating building contracts;* • *Drafting contract documents;* • *Monitoring costs and reporting to clients during the design and construction of projects; and* • *Determining the final costs of projects.*	• *Advice on tendering procedures and contractual arrangements;* • *Negotiated, lump-sum, managed and cost-plus contracts, package deals, turnkey offers, etc.;* • *Financial control over contracts;* • *Valuation of work in progress;* • *Cash-flow budgets;* • *Final account in respect of the contract;* • *Act in disputes, etc.;* • *Material list and values;* • *Quantity surveying services in respect of civil, mechanical, and electrical work;* • *Property economics;* • *Project management; and* • *Fast-track construction*

In spite of the differences between the current roles of the quantity surveyor in the UK and South Africa, quantity surveyors in both countries have expanded their traditional roles, which once again supports the assertion that quantity surveyors are able to adapt and evolve with changes placed upon them. The question is, what has enabled the quantity surveying profession to survive the First, Second and Third Industrial Revolutions? The skills, competencies and knowledge of quantity surveyors have been cited as the main reasons for the profession's survival (Ashworth et al., 2013; Prokesch, 1997). Then the question turns to the specific knowledge, skills and competencies that eabled this survival.

2.4.6 Knowledge, skills and competences of quantity surveyors

It is important to define what knowledge, skills and competencies are. There is no universal definition for 'knowledge', 'skills' or 'competencies'. According to RICS (2017:3) a, "… *competency is the knowledge, skills, abilities and behaviours needed for a particular role or task.*" The *Oxford Learner's Dictionary* (n.d.) defines knowledge as "… *the information, understanding, and skills that you gain through education or experience*." A skill is, "… *a proficiency or ability acquired or developed through training or experience*," (Dada and Jagboro, 2012: 78). Perera and Hemajith, (2007) defines a skill as the ability to perform a task. Competency encompasses skills and knowledge.

The RICS (1998 in Ashworth et al., 2013) identified the following as the knowledge base for quantity surveyors:

- Construction technology;
- Measurement rules and conventions;
- Construction economics;
- Financial management;
- Business administration; and
- Construction law.

The competencies of a quantity surveyor are divided into three categories, that is, mandatory or basic competencies, core competencies and optional competencies (RICS, 1998) (Refer to Table 2.6).

Table 2. 6 Competencies of a quantity surveyor in 1998 (RICS, 1998 in Nkado)

Mandatory Competencies	Core Competencies	Optional Competencies
• Personal and Interpersonal Skills • Business Skills • Data Information and Technology • Professional Practice • Law • Measurement • Mapping (Nkado)	• Construction • Contract Practice • Construction Technology and Environmental Services • Economics of Construction • Procurement and Financial Management	• Arbitration and other dispute resolution procedures • Development Appraisal • Facilities Management • Insolvency • Insurance • Project Management • Property Investment Funding • Research Methodologies and Techniques • Taxation, Allowances and Grants • Valuation

The RICS' "*Associate Assessment: Quantity Surveying and Construction, February 2017*" classification of competencies differs from its 1998 requirement. Competencies are divided into mandatory and technical competencies (refer to Table 2.7).

Table 2. 7 Competencies of a quantity surveyor in 2017 (RICS, 2017)

Mandatory Competencies	Technical Competencies
• Client care • Communication and negotiation • Conduct rules, ethics and professional practice • Conflict avoidance, management and dispute resolution procedures • Data management • Health and safety • Sustainability • Team working	• Construction technology and environmental services • Contract practice • Procurement and tendering • Project financial control and reporting • Quantification and costing of construction works **And** one of the following: • Building information modelling (BIM) management • Commercial management of construction (recommended for quantity surveyors working in a contracting environment) **or** • Design economics and cost planning (recommended for those working in a consulting environment).

Some of the new mandatory competencies required for a quantity surveyor include health and safety, sustainability and BIM. The inclusion of these new competencies demonstrates that the profession recognises the societal changes taking place currently. The South African Council for the Quantity Surveying Profession (SACQSP) does not specify the competence quantity surveyors require, except to state that a quantity surveyor should possess adequate knowledge and experience of quantity surveying in the construction sector (SACQSP, 2015b).

The skills required by quantity surveyors include (RICS, 1998 in Ashworth et al., 2013):

- Management;
- Documentation;
- Analysis;
- Appraisal;
- Quantification;
- Synthesis; and
- Communication.

One of the ways in which quantity surveyors acquire knowledge is through tertiary education. There are approximately 85 universities in the world that offer quantity surveying as a qualification (Hotcoursesabroad, 2020a). Forty-four universities in the UK offer quantity surveying

(Hotcoursesabroad, 2020b). Most of these universities offer courses that focus on "…*measurement, estimating, documentation, commercial aspects, costing, management, contract administration, contract law, economics and financial aspects*." (Estimation QS, 2020).

The course offering by UK universities are on a par with the requirements of the quantity surveying profession, as the emphasis is on cost or finance and also on contract. What is substandard however, relates to the technical courses offered. Not all 44 universities offer construction, engineering and design courses (Estimation QS, 2020). An understanding of both the commercial and the technical aspects will develop a well-rounded quantity surveyor (Ibid). One possibility for the exclusion of technical courses could be that knowledge of quantity surveying can be applied outside the context of building and engineering, which are the fields which technical courses emphasize.

There are 26 public universities in South Africa (USAF, n.d.). Only five universities in South Africa have fully accredited quantity surveying courses (SACQSP, n.d.a). By comparing the course content of three of these universities' undergraduate and postgraduate courses, the common thread of cost or finance and contract knowledge is apparent. Unlike some British universities, the South African universities offer courses related to construction, engineering and design (refer to Table 2.8).

Table 2. 8 Quantity surveying curriculum from three fully accredited universities in South Africa (NMU 2018a, 2018b; UCT 2020a, 2020a; UP 2020a, 2020b)

	University of Pretoria	**University of Cape Town**	**Nelson Mandela University**
Year 1 (UG)	• Academic Information Management 101 (AIM 101) • Building Organisation 121 (BGG 121) • Academic Literacy for Construction Economics 122 (ALL 122) • Building Organisation 121 (BGG 121) • Building Drawings 121 (BOU 121)	• Evidence-based Management • Building Science I • Construction Tecnology • Practical Training • Construction Technology I • Microeconomics 1 • Macroeconomics 1 • Engineering Drawing 1 • Mathematics 1	• Quantities • Quantity Surveying I • Building Science (Environment and Services) 1A • Building Science (Environment and Services) 1B • Building Science (Materials and Methods) 1A • Building Science (Materials and Methods) 1A

	• Building Science 110 (BWT 110) • Building Science 120 • Economics 110 • Economics 120 Building Services 112 • Building Services 122 • Quantities 101 • History of the Environment 122 • Introduction to Structures 110 • Structures 120 • Pre-calculus 133		• Computing Fundamentals 1.1 • Computing Fundamentals 1.1 • Introduction to Micro-economics – Special • Introduction to Macro-economics – Special • Commercial Law 1 • Commercial Law (Building Disciplines) 1
Year 2 (UG)	• Building Science 210 • Building Science 220 • Financial Management 110 • Financial Management 120 • Quatities 200 • History of the Environment 224 • Reinforced Concrete Structure 210 • Civil Engineering Services • Statistics 110 • Statistics 161 • Site Surveying 213 • Building Services 221	• Financial Accounting 1 • Elementary Surveying • Business Law I • Labour Law I • Professional Communication Studies • Construction Technology II • Practical Training • Construction Management I • Measurement & Design Appraisal I	• Quantities 2 • Quantity Surveying 2 • Building Services (Environment and Services) 2A • Building Services (Environment and Services) 2B • Building Science (Materials and Methods) 2A • Building Science (Materials and Methods) 2B • Accounting (Special) 101 • Accounting (Special) 102 • Business Management 101

			• Business Management 102 • Mathematics for Accounting
Year 3 (UG)	• Business Law 310 • Housing 320 • Quantity Surveying Practice 300 • Building Science 310 • Building 320 • Introduction to Property Law 320 • Quantities 300 • Community-based project 300 • Property Finance Mathematics 320 • Business Science 311 • Sustainable Construction 320 • Research Methodology	• Construction Technology III • Practical Training • Construction Costing • Measurement & Design Appraisal II • Applied Contract Law I • Property Studies I • Construction Management II • Cost Engineering under Uncertainty	• Quantities 3 • Quantity Surveying 3 • Building Economics 3 • Building Science (Environment and Services) 3A • Building Science (Environment and Services) 3B • Building Science (Materials and Methoda) 3A • Building Science (Materials and Methoda) 3B • Marketing Management 2 • Business Management: Financial Management 301
Year 4 (PG)	• Building Cost and Estimation 700 • Quantity Surveying Practice 700 • Research Report 785 • Management Practice 700	• Management Accounting I • Property Studies II • Measurement & Design Appraisal II • Applied Contract Law II • Professional Practice	• Quantities 4 • Quantity Surveying 4 • Building Economics 4 • Property Economics 4 • Professional Practice • Business Management:

	• Quantities 700 • Construction Management 710 • Construction Contract Law 730 • Construction Contract Law 740 • Construction Project Management 730 • Feasibility Studies 710 • Feasibility Studies 720 • Practical Development Feasibility 700	• Practical Training • Treatise • Civil Engineering Measurement • Statistics 1000 • Globalisation & the Built Environment • Advanced Construction Management • Integrated Management Project • Housing Development & Management • Treatise	General and Strategic Management • Treatise 4

The education and training of quantity surveyors provides the competency needed to perform their duties. Both the RICS and the SACQSP require quantity surveying candidates to gain practical work experience in the field, under the supervision of a qualified quantity surveyor, before they receive full accreditation as professional quantity surveyors. The practical experience is usually completed within three to five years (RICS, 2020d; SACQSP, 2015b). The accreditation enables candidates to perform certain quantity surveying professional tasks without supervision.

2.4.7 The tasks of quantity surveyors at risk of being lost to technology

From the RICS' (2017) definition of competency, it can be deduced that quantity surveyors' competence allows them to perform certain tasks in order to fulfil their role. Acemoglu and Autor (2011: 1 045) define a "*task [as] a unit of work activity that produces output (goods and services)*." They further describe a skill as, "*…a worker's endowment of capabilities for performing various tasks*," (Acemoglu and Autor, 2011: 1 045). From these definitions, an inference can be drawn that quantity surveyors apply their skill endowments to perform certain tasks to provide certain services in exchange for a fee (Acemoglu and Autor, 2011). As quantity surveyors are a construction cost and contractual experts, the main services that quantity surveyors produce are related to cost and contractual advise.

The tasks that quantity surveyors perform in exchange for a fee are varied; numerous authors and professional bodies claim a wide range of tasks are performed by quantity surveyors. However, this section only looks at the traditional tasks at risk of being lost to technology. Kulasekara et al. (2013)

and Nigam and Dixit (2016) identified the following as the traditional tasks of quantity surveyors at risk of being substituted by BIM:

- Quantities take-off;
- Bills of quantities preparation;
- Cost estimation;
- Cost planning;
- Cost reporting;
- Cost control;
- Material procurement;
- Payment application;
- Value management; and
- Life - cycle costing.

Value management and life cycle costing are not traditional quantity surveying tasks; however, they have been included with the traditional tasks as they are becoming more relevant to the modern quantity surveyor (Kulasekara et al., 2013). In the next section, each task is described.

2.4.7.1 Quantities take-off

Quantities take-off is described as a process whereby quantities are measured from the designer's drawings and converted into quantities with descriptions (Kulasekara et al., 2013; Maritz and Siglé, 2016). The measurements are expressed in linear metres or square metres, by volume or another unit of measurement such as number, tonnage, percentage and suchlike (ASAQS, 2017). To ensure uniformity in measuring, there are rules for measurement that quantity surveyors need to follow in the process of take-off quantities (Ibid). The rules of measurement are outlined in the Standard System of Measuring Building Work (SSM) (Ibid).

The take-off process was traditionally carried out manually, using scale rulers and a calculator. Quantity surveyors measured quantities that could be priced by contractors or used for estimating purposes, from printed 2D architectural or engineering drawings. With the advancement of technology, however, there is software that is able to aid quantity surveyors in take-off quantities from drawings. Drawings are also provided in an electronic format. The quantities taken off from drawings are usually compiled in a document called the bills of quantities (ASAQS, 2017; Ashworth et al., 2013; Klein and Dalgeish, 2007).

2.4.7.2 Bills of quantities preparation

Bills of quantities is a document that contains all the information regarding the work that must be carried out in a construction project (Maritz and Siglé, 2016). Quantities that are taken off are usually arranged according to different trades, such as earthworks, masonry, waterproofing and similar. Bills of quantities form a basis for estimating and tendering in a traditional procurement method (Ashworth et al., 2013; Maritz and Siglé, 2016).

Bills of quantities involve the description of measured items and the calculation of the quantities. In the past bills of quantities were prepared manually using dimension paper. The process involved in the preparation of the bills of quantities includes, taking-off, squaring, abstracting, billing, writing item descriptions and compiling bills of quantities. Measurements that are taken off from drawings are multiplied, added and subtracted in the squaring process, to arrive at a quantity. In the abstracting process, identical measured items are grouped in their respective trades. Billing means writing out full descriptions of items in accordance with Standard System of Measuring Building Work (SSM). The last process in the preparation of the bills of quantities is the compilation of all the items into bills of different trades. A senior quantity surveyor usually carries final checking of the document before the bills of quantities are issued for tendering (Maritz and Siglé, 2016).

In the past, the preparation of bills of quantity surveyors was not only error-prone but also tedious and cumbersome. There are currently many software applications available to assist the quantity surveyor in the preparation of more accurate bills of quantities. Bills of quantities were once regarded as the main selling points of the quantity surveying profession in many countries. Currently, the effectiveness of bills of quantities is heavily debated (Ashworth et al., 2013; Kulasekara et al., 2013; Maritz and Siglé, 2016; Nigam and Dixit, 2016).

Once a suitable contractor is selected for a construction project, quantity surveyors usually prepare contract documents that will form the basis for the contractual relationship between the contractor and the client (Ashworth et al., 2013). The contractual document will usually include bills of quantities, a form of agreement, contract drawings and other relevant documents (Ibid). The contractual knowledge of quantity surveyors, thus, become useful in the preparation of contract documents.

2.4.7.3 Cost estimation

Cost estimation is a means of determining probable cost of a construction project (Maritz and Siglé, 2016). Quantity surveyors usually take off quantities from drawings and price them to arrive at an estimated cost (Hergunsel, 2011). Prices are usually obtained from their cost data (Kulasekara et al., 2013; Maritz and Siglé, 2016). The source of quantity surveyors' cost data is usually previous projects

and experience. Where items to be priced are new, quantity surveyors may use their construction cost knowledge and expertise to determine the price of the item (Maritz and Siglé, 2016).

To be able to price items accurately, quantity surveyors must possess some knowledge of the materials and their method of installation on construction sites (Kulasekara et al., 2013). The ability to determine cost of construction by breaking down components of buildings into items that can be priced is arguably one of the ways that has cemented quantity surveyors' position in industry. Their legitimacy in society is therefore somewhat dependent on their continual ability to provide cost estimations.

2.4.7.4 Cost planning

Cost planning is a pre-tender method of estimating the methods of controlling costs during the design stage (Ashworth et al., 2013). In cost planning, quantity surveyors inform the designers about the implications of the designs (Ibid). There are two types of cost planning: 1) elemental cost planning or "*designing to a cost*," and 2) elemental and comparative cost planning or, "*costing a design*" (Ashworth, 2010: 248).

In an elemental cost planning method, a cost limit, which designers must not exceed in their designs, is fixed for the construction project (Ashworth and Perera, 2010). Elemental and comparative cost planning involves an evaluation of different design solutions including associated costs by the client, designers and the quantity surveyor (Ibid). The most appropriate solution is then chosen based on all relevant factors (Ibid). In an elemental and comparative cost planning method, price is not fixed and it does not necessarily determine the design (Ibid).

There are three processes to cost planning. First, the determination of a preliminary estimate. Second, a plan of how costs from the estimate should be spent on different elements of the project. Third, it involves checking whether design elements can be constructed within the provided cost plan (Ashworth and Perera, 2010).

Cost planning was first introduced in the UK after World War II (Ashworth and Perera, 2010). Following wide variations of construction costs for schools, the Ministry of Education, in an effort to monitor and control cost, introduced a system where construction costs could be cost-planned (Ibid). In South Africa, the Government usually provides cost norms for social infrastructure, such as public schools and public health facilities (Department of Education, 2009; IUSS, 2018).

2.4.7.5 Cost reporting

Cost reporting involves providing regular updates on the likely final cost of a project (Kulasekara et al., 2013). Quantity surveyors continually estimate and report cost changes to clients on a regular basis (Ibid). The reports prepared by quantity surveyors are called 'cost financial control reports' (SACQSP,

2015). Changes in the construction design or specifications or scope of work are called ‘variations’ (Maritz and Siglé, 2016). A monthly cost report usually consists of the preliminary estimate or budget estimate, the variations to the contract including anticipated variations, and an estimated final account amount (Seeley, 1997).

2.4.7.6 Cost control

Quantity surveyors use various activities to control costs of a project (Ashworth et al., 2013). Cost control may include cost planning, cost monitoring and reporting (Maritz and Siglé, 2016). The process of cost controlling usually begins at the inception stage of a project and lasts until the project is complete, and the final account is concluded (Ashworth et al., 2013; Maritz and Siglé, 2016).

Ashworth et al. (2013) provides three main reasons cost reporting is important. First, cost reports provides a cost limit for the client’s expenditure. Second, cost control is important in achieving balanced design expenditure between different elements of the building. Third, cost control provides the client with value for money (Ashworth et al., 2013).

2.4.7.7 Material procurement

Quantity surveyors were once regarded as brick counters (Klein and Dalgeish, 2007), a title that denotes their ability to quantify materials required in a construction project. Currently, quantity surveyors only provide material cost lists and material values to their clients when specifically required to do so (ASAQS, n.d. a).

2.4.7.8 Payment application

Payment application (more commonly known as payment valuations) are regularly prepared by the quantity surveyor for the contractor (Kulasekara et al., 2013). Construction projects usually involve a substantial amount of money. Most construction contracts allow contractors to be paid for progress on regular intervals, usually in monthly intervals (Ashworth et al., 2013).

To prepare monthly interim payment valuations, quantity surveyors usually visit the construction site to measure physical progress. Quantity surveyors usually use tools such as measuring tapes to measure linear measurements of building elements on construction sites. With the advancement of technology, there are currently new laser measuring devices that quantity surveyors’ use to measure on site (EstimationQS, 2017). The measurements obtained are then priced against the contractor’s rates to obtain an amount that will be paid to the contractor, including an amount for the contractor’s overheads (Ashworth et al., 2013).

2.4.7.9 Value management

Value management (VM) is a management style that aims at creating a common understanding of the project or design objectives or design problem(s) and their solutions (Bowen et al., 2010; Kelly, 2014). Kelly and Poynter-Brown (1990: 54) define VM as a, "*philosophy concerned with providing the product desired by a customer at the required quality and the optimum cost.*" It is usually carried out at the inception stage of the project, but it can be applied throughout the entire procurement process (Ibid). Value management involves a seven-phase methodology called a job plan (Ashworth, 2010). The seven steps are orientation, information, speculation, analysis and evaluation, development, selection and conclusion (Ibid).

The orientation phase involves determining the client's needs. The information phase requires that a ream of information, pertaining to the project, to be gathered. At the speculation phase, the value management team, made up of all relevant stakeholders, brainstorm ideas (usually in a workshop). Brainstormed ideas are then narrowed down using appropriate techniques at the analysis and evaluation phase. At the development phase, retained ideas are scrutinised. It is also at the development phase where sketch plans and viability and feasibility studies are prepared. The selection phase involves completion of the final proposal, including calculations and the costs involved. The conclusion phase is where the final proposal is presented to a client (Ashworth, 2010).

Quantity surveyors can be the cost consultant's member of the value management team. The cost planning and life-cycle skills of quantity surveyors allows them to perform their value management tasks. The knowledge base of management and synthesising data of quantity surveyors, allows them to be value-management team co-ordinators (Kelly and Poynter-Brown, 1990).

2.4.7.10 Life-cycle costing or whole-life cycle costing (LCC)

Whole-life cycle costing is a costing method that captures all the costs involved in the life cycle of a building, which are directly assumed by one or more participants in the life-cycle of the building (Fauzi et al., 2019; Swarr et al., 2011). Hoar and Norman (1992: 140 in Brandon, 1992) define a life-cycle cost of an asset as, "…*the present value of the total cost of that asset over its operating life including initial capital cost, occupation costs, operating costs and the cost or benefit of the eventual disposal of the asset at the end of its life.*"

In LCC, quantity surveyors use discounting techniques to convert all future costs and benefits to present values. This service assists clients to assess the economic worth of investment options. LCC involves LCC planning, LCC management and LCC analysis. In LCC planning, initial capital cost, the running cost and the residual value of the building (the total cost of a building), are identified. The three costs

are then expressed in a way that they can be compared using discounting techniques (Hoar and Norman, 1992 in Brandon, 1992).

Quantity surveyors use their cost analysis techniques to also analyse the life-cycle costs of the in-use completed building. Once LCC analysis is complete, the LCC management process is then used to identify areas where costs in use can be reduced (Hoar and Norman 1992 in Brandon, 1992).

2.4.7.11 Summary of the discussion of quantity surveyors' tasks that are at risk of being lost to technology

From the discussion of the tasks at risk of being lost to technology, and the discussion on the knowledge, skills and competencies of quantity surveyors, the quantity surveying profession is instituted in terms of the foundation theories. The knowledge, skills, competencies, tasks and similar are the aspects that legitimise the quantity surveyors' position in society and the fees they charge. If quantity surveyors' privileged position accorded to them by their specialist knowledge is threatened, then their legitimacy in society will also be threatened. The threat of substitution will, according to the critical theories, have a negative impact on their fees.

Since there are claims that the tasks performed by the professions can be improved through technology, then on what basis can the professions continue to hold their elitist position in society? The next section discusses the threat of technology and the Fourth Industrial Revolution on the quantity surveying profession.

2.4.8 The threat of technology and the Fourth Industrial Revolution on the quantity-surveying profession

Many authors claim that the greatest threat brought to the professions by the Fourth Industrial Revolution is artificial intelligence (AI) or big data (Desai, 2018; Korinek and Stiglitz, 2017). No one definition exists for AI. For example, (DeCanio, 2016: 280) defines it as "*…[a] broad suite of technologies that can match or surpass human capabilities, particularly those involving cognition.*" Syam and Sharma (2018: 136) describe AI as the "*… ability of machines to mimic intelligent human behaviour, and specifically refers to 'cognitive' functions that we associate with the human mind, including problem solving and learning.*" In (Desai, 2018:1), AI is "*…algorithms which aid in decision making.*"

From the definitions of AI provided, AI is therefore able to compete with cognitive abilities of humans. Cognitive abilities, such as thinking, problem solving and learning, have always been regarded as the preserve of humans. Are machines and systems able to outperform human beings in performing professional tasks? There are divergent views. This section looks at the threats of technology, in

particular on the quantity-surveying profession. In another section, opportunities presented by technology to the quantity surveying profession are discussed.

To what extent technology is a threat to the professions is unknown. There seems, however, to be some consensus amongst authors that technology such as AI will influence the future of the professions (Desai, 2018; McGinty and Allen, 2018; Susskind and Susskind, 2017; Wood and Evans, 2018). Within the quantity surveying profession, BIM is set to replace certain professional quantity surveying tasks (Kulasekara et al., 2013; Nigam and Dixit, 2016). BIM is regarded in some quarters of the quantity surveying profession as a major threat to the profession (Beukes, 2014; Olatunji et al., 2010). Table 2.9 shows traditional quantity surveying tasks at risk from BIM.

Table 2. 9 Traditional quantity surveying tasks versus BIM alternatives (Source: Kulasekara et al., 2013; Nigam and Dixit, 2016)

Traditional Quantity Surveying Task	BIM Alternatives to the Traditional Quantity Surveying Tasks
• *Quantities take-off* • *Bills of quantities preparation* • *Cost estimation* • *Cost planning* • *Cost reporting* • *Cost control* • *Material procurement* • *Payment application* • *Value management* • *Life-cycle costing*	• *Autodesk QTO, BIM Measure from Causeway* • *CostOSTM, Nomitech* • *DProfiler, Beck Technology* • *Vico Cost Planner* • *Vico Office Client* • *Vico Office Explorer* • *Quantities of material can be obtained using BIM tools* • *Bentley* • *BIM tools can be used to obtain the estimated costs of various design options* • *Integrated Environmental Solutions Virtual Environmental*

2.4.9 BIM alternatives to the traditional quantity surveying tasks

BIM is described as a collaborative method for producing building models, where relevant stakeholders in the built environment can insert, extract, update or modify information in the model at different stages of a project (BIM Academy Africa, 2018). Instead of having multiple sources for data storage, data is stored and updated on one data source (Ibid). Storing data in one source eliminates many challenges associated with the transfer of data from one source to another (Kulasekara et al., 2013). Table 2.10 shows BIM applications within a construction project.

Table 2. 10 The application of BIM within a construction project (Source: Kjartansdottir et al., 2017; Kulasekara et al., 2013)

Model	Description	Capabilities
3D	Design	Designs of buildings and building elements are shown in three-dimensional (3D) models. 3D enables improved visualisation, better design coordination and clash detection of services.
4D	Scheduling	In a 4D simulation, time parameters can be added, thereby enabling BIM is able to link the components of the model to the construction schedule or programme. Through BIM 4D model planning and tracking of construction activities is made possible.
5D	Costing	The design (3D) and schedule (4D) models are combined to form a 5D model that incorporates costs. The 5D model is used mainly for cost estimation.
6D	LC or FM Management	The 6D BIM model is a useful tool in facilities management as able to use information stored in the model to determine maintenance and operational costs.
nD	Tenant use, environmental, sustainable design	The Nd model or the model based analysis is an information models that analysis qualitative costs related to the tenants' use of the building, environmental and sustainability issues.

Instead of the conventional 2D drawings, which only show lengths and widths, BIM models have models that can show all the important aspects of a construction projects, such as cost and construction programme. The 3D BIM model enables a building to be viewed in three dimensions, which enables better visualisation, promotes better coordination between designers, and clashes of service can be detected. In the 4D model, the addition of time parameters enable proper planning and tracking of construction activities. The 5D model, a combination of design (3D) and schedule (4D) makes costing possible. The 6D and 7D models are concerned with facilities management and the life-cycle management of the building including the sustainability aspects thereof (BIM Academy Africa, 2018; Kulasekara et al., 2013).

The next section looks at how BIM is able to substitute traditional quantity surveying tasks. Theories on the professions are used to discuss the implications of the threat of BIM to the quantity surveying profession.

2.4.9.1 Quantities' take-off versus BIM alternative

Instead of using scale rulers and spreadsheets to take off quantities from designs, the BIM model has software that is able to extract quantities from the model (Kulasekara et al., 2013; Nigam and Dixit, 2016). BIM is able to extract quantities automatically, instantly and more accurately than quantity surveyors because the BIM model contains 3D objects with geometrical information that enables extracting quantities in volumes and areas instantly and automatically possible (Jiang, 2011; Kymmell, 2008).

2.4.9.2 Bills of quantities preparation versus BIM alternative

By using 3D BIM models in the preparation of bills of quantities, bill preparation is reduced by up to 80% (Ashworth et al., 2013). BIM is able to produce bills of quantities by using all the information stored in the BIM model (Gee, 2010). The use of BIM eliminates errors associated with data transfer from one file to the other, missing take-off elements and double accounting (Baldwin and Jellings, 2009 in Kulasekera et al., 2013; Nigam et al., 2016).

2.4.9.3 Cost estimation versus BIM alternative

Cost estimation involves two aspects, that is, quantities take-off and pricing. The 5D BIM model incorporates construction cost and enables cost estimates to be prepared. While claims about BIM's ability to extract quantities accurately and faster than a human being seem undisputed, BIM's ability to price accurately is debatable. A BIM model cannot analyse prices. Pricing a construction project requires some knowledge of building materials and components. Moreover, an understanding of how they are assembled and installed on site is imperative (Bazjanac, 2005; Kulasekara et al., 2013; Nigam and Dixit, 2016).

Even though the BIM 5D model can perform cost estimations in real time, cost data has to be updated by quantity surveyors (Bazjanac, 2005; Mitchell, 2012). Pricing is, therefore, still the preserve of quantity surveyors. BIM therefore, presents a limited threat to the cost-estimating task of quantity surveying. In cost planning, however, the view is different.

2.4.9.4 Cost planning versus BIM alternative

The findings of a case study by Zhoue et al. (2012), of an SME's readiness to adopt BIM in the UK, revealed that there is a perception that BIM is able to do cost planning more accurately and effectively than quantity surveyors. Mitchell (2012) argues that the 5D Cost Manager can perform cost planning more quickly an infinite number of times and combining many complexities. Real-time cost plans can also be provided (Mitchell, 2012).

2.4.9.5 Cost reporting versus BIM alternative

Quantity surveyors usually prepare monthly cost reports (Gee, 2010). Through the 5D BIM model, cost reporting is made possible in real time instead of monthly (Mitchell, 2012). This means that costing keeps pace with design and changes in the programme. By using the 5D BIM model, clients are able to get real-time costs instead of monthly reports.

2.4.9.6 Cost control versus BIM alternative

Cost controlling is a task that is performed from the inception of a project and throughout its life cycle (Gee, 2010). As cost control incorporates cost planning, monitoring and reporting, time and money spent on the cost-controlling task can be reduced with the 5D BIM model (Ibid).

2.4.9.7 Material procurement

Procurement of materials can be done through the 5D BIM. Not only can the model extract quantities for materials and building elements automatically, but it can also perform the analysis for the materials and building elements (Baldwin and Jellings, 2009 in Kulasekera et al., 2013).

2.4.9.8 Payment application

Consolidated Contractors Company used BIM to produce bulky monthly payment applications for the Dubai Mall project (Baldwin and Jellings, 2009 in Kulasekera et al., 2013). The combined tasks of producing payment applications, cost reports and estimates involved only eight modellers and two BIM engineers, instead of 25 full-time quantity surveyors (Ibid).

2.4.9.9 Value management

The 3D BIM model allows value management to be carried out throughout the design phase of the project. By using BIM, different design options can be assessed more realistically, thereby resulting in time and cost savings (Eastman et al., 2008 in Gee, 2010). It is not, however, a foregone conclusion that BIM can replace quantity surveyor's value management task. Since the task of value management involves speculation, analysis and evaluation, there may still be opportunities for quantity surveyors in value management (Gee, 2010).

2.4.9.10 Life-cycle costing

The 6D BIM model or the asset information model (AIM), includes facilities management information that is useful for life-cycle costing. Data that relates to the frequency of maintenance of building items, stored in the model, is used to determine maintenance and operational costs (Kjartansdóttir et al., 2017). The nD BIM model, also referred to as the model-based analysis, is mainly used for analysing costs related to tenant use of the facility, and environmental and sustainable issues. Life-cycle cost can also be analysed using nD BIM model.

2.4.9.11 Summary of BIM capabilities

From the above discussion, it is apparent that BIM is able to perform traditional quantity surveying tasks. BIM is able to perform quantity surveying tasks in a much faster and more efficient manner than quantity surveyors, thereby making it superior in comparison to quantity surveyors (Ashworth et al.,

2013; Kulasekara et al., 2013; Wu et al., 2014). What are the implications of BIM's encroachment on traditional quantity-surveying tasks?

Shifting a quantity-surveying task from humans to technology has implications on the institutionalisation of the profession. Tasks form one of the pillars in the institutionalisation of the profession according to the foundation theories, particularly the trait approach. On what basis can a profession continue to uphold its position in society, if one of its founding pillars is removed?

Losing tasks reduces the profession's jurisdiction according to the systems theory. The greater the jurisdiction, the greater the influence and respect in society. A weakened and reduced jurisdiction will affect the profession's ability to hold its elitist position in society and thereby potentially reduce its earning power. Earning power, according to the critical theories, is determined by position in society. Highly regarded professions in society command a higher earning power than lower ranked professions.

In some quantity-surveying circles, BIM is considered an opportunity rather than a threat (Beukes, 2014; Matipa et al., 2010; Wong et al., 2014; Wu et al., 2014). BIM is an enabler and enhancer to the quantity surveying profession (Ibid). What are the opportunities that BIM creates for the quantity surveying profession? The next section looks at the possible opportunities that BIM can create for the quantity surveying profession.

2.4.10 Possible opportunities created by BIM for the quantity surveying profession

BIM's ability to speed up and efficiently perform traditional quantity surveying tasks is seen as an opportunity for quantity surveyors to provide clients with advice on other considerations, such as investment options, sustainability, value management and whole life-cycle costing (Beukes, 2014; Gee, 2010). Wong et al. (2014) identified benefits of BIM to the quantity surveying profession,

- Cost appraisals and cost analysis can be done quickly;
- Updating of cost plans easily done;
- Accurate cost estimates easily generated for alternative designs;
- Changes in the designs are reflected consistently in all the drawing views;
- Cost estimations for design changes done without the need to manually re-measure the quantities;
- Cost-estimate revision errors are reduced;
- Improved understating of designs because of 3D models;
- Automatic quantification for bills of quantities; and
- Data is stored in a central coordinated model.

Within a traditional procurement method, the supposed opportunities created by BIM to the quantity surveying profession might also have negative implications on the fees. Quantity surveyors may be inclined to offer discounts on their fees, especially because of the efficiencies and time saving BIM provides. Clients might also demand discounts (Ashworth et al., 2013). To retain their income level, quantity surveyors might need to, in terms of the systemic and neo-institutional theories, increase the cost of their services (Beukes, 2014; Gee, 2010). New services might also be contested with other professions (Abbott, 1988). In South Africa, the addition of new services might require vetting by the SACQSP, and possibly the Council for the Built Environment (CBE) before they are approved as new quantity surveying roles. Furthermore, the agility of quantity surveyors in transforming to new roles must also be considered.

If the quantity surveying profession is not agile enough to seize the new roles BIM and other technology might present, there is a risk that role of the quantity surveying profession in society might be relegated to a subordinate position (Abbott, 1988). The claim that BIM may provide quantity surveyors with opportunities is, thus, debatable.

2.4.11 Other threats and opportunities to the quantity surveying profession

Ramdav and Harinarain (2020) identified strengths, weaknesses, opportunities and threats (SWOT) of the quantity surveying profession through a questionnaire of 58 South African quantity surveyors. Table 2.11 shows the strengths, weaknesses, opportunities and threats of the quantity surveying profession. Strengths and weaknesses are internal factors as they are within the quantity surveying profession's control; opportunities and threats are external factors as they are outside the quantity surveying profession's control (Odubiyi and Oke, 2016; Ramdav and Harinarain, 2020).

Table 2. 11 The strengths, weaknesses, opportunities and threats of the quantity surveying profession (Source: Ramdav and Haranarain, 2020)

Strengths	Weaknesses	Opportunities	Threats
• *Trustworthy* • *Leadership* • *Creative problem-solving* • *Negotiation skills* • *Communication skills* • *Knowledge management* • *Strategic planning* • *Accuracy*	• *Inability to change* • *The lack of suitably skilled and experienced QS* • *Lack of marketing of the QS profession* • *Lack of competencies in the QS*	• *Demand for QS* • *Efficiency increases brought about by technological advances* • *Building Information Modelling (BIM)* • *Ability to perform*	• *Lack of knowledge management* • *Competition amongst quantity surveying firms* • *Changes in technology* • *Changes in clients' demand* • *Fee cutting*

• *Ensuring a suitable organisational structure* • *Team working/ interpersonal skills* • *Self-confidence/ can do attitude* • *Data management/ Record keeping* • *Client relationship* • *Management* • *Dispute resolution/ Conflict management* • *Measurement/ quantification* • *Cost accounting and financial anagement* • *Construction law and contract management* • *Problem-solving* • *Cash flow forecasting and budgeting* • *Value management/ construction economics* • *Estimating and pricing* • *Networking skills* • *Political skills* • *Construction technology knowledge* • *Life-cycle costing* • *Industry knowledge* • *Feasibility studies*	*profession* • *Inability to adopt building information modelling (BIM) in the profession* • *Lack of training/ experience* • *Inaccuracies in cost estimates* • *Few candidates become professional QS* • *Overqualified with lack of experience* • *Lack of IT/ computing skills* • *Poor attitude towards continuous professional development* • *Lack of awareness of quantity surveying as a profession* • *Decline in measuring skills* • *Little attention to lifelong learning* • *Low levels of innovation*	*multiple services* • *Quantity surveying Firms – an asset to PPP* • *Market for facilities management services* • *Market for quantity surveyors in civil infrastructure and engineering projects* • *Sector specific work experience* • *Proficiency and information technology* • *New roles for quantity surveyors in alternate procurement methods* • *Market for core quantity surveying services*	• *The use of CAD* • *Other professions performing quantity surveying services* • *The global financial crisis* • *Shortfalls in the quantity surveying qualifications offered at tertiary institutions* • *Lack of suitably skilled and experienced quantity surveyors* • *The ageing workforce and the undersupply of new entrants* • *The profession's 'lack of voice' because of relatively small number of practitioners compared to other professional groups* • *Lack of formal registration and chartered status* • *Lack of marketing of the quantity surveying profession*

• *Design economics*			• *The perception that quantity surveyors are non-critical to project success*

From Table 2.11, the strengths of a quantity surveyor include knowledge of cost and contracts. Cost accounting, financial management, cash flow forecasting, budgeting, construction economics, estimating and pricing, construction law, and contract management are listed as strengths (Ramdav and Harinarain, 2020)**.** If technology and systems such as BIM threaten core strengths of the quantity surveying profession, by outperforming the profession its core strengths, what are the possibilities that it will still exist in its current form in the future. One of the claims of the foundation theories is that a profession is given its legitimacy through its functions or traits. If technology replaces the profession's functions or traits, then on what basis can a profession continue to exist?

Included amongst the quantity surveying profession's weaknesses are its inability to change, its inability to adopt building information modelling (BIM), inaccuracies in cost estimates and a lack of IT/ computing skills (Ramdav and Harinarain, 2020). BIM proponents claim that BIM can be a tool that quantity surveyors can use to enhance their skills (Beukes, 2014; Gee, 2010; Wong et al., 2014), then the profession will need to change its attitude towards technology.

2.5 Summary of Chapter 2

In this chapter, the concept of the professions was introduced. Even though there is no universal definition for the professions, there are some common features of the professions, such as specialist knowledge and regulation. Since quantity surveying has these features, it can thus be classified as a profession, and hence is used as a case study to analyse the possible implications of the socio-technical changes on the professions.

There are a number of theories that also seek to explain the existence of the professions in society. The quantity surveying profession in this study is thus, analysed using the foundational theories as these theories address the reasons the professions exist in society. By using the foundational theories to analyse the quantity surveying profession, the question of why the quantity surveying profession exists in society is addressed. The study also uses the critical theories to analyse the possible implications of the loss of professional status, should the quantity surveying profession lose its professional status.

Since the quantity surveing profession in most Commonwealth countries evolved from their British counterpart, the British quantity surveying profession is used as a comparison to the profession in other

countries. The role of quantity surveyors, their knowledge, skills and competencies were discussed. Literature also identified quantity surveying skills that are threatened by technology. Other possible threats and opportunities to the profession were also identified.

In the next chapter, the study discusses the factors influencing the quantity surveying profession and their possible implication on the current profession. The summary of Chapter 3 demonstrates how the research and literature objectives were met in Chapters 2 and 3.

Chapter 3: Literature Review: Factors Influencing the Construction Sector and the Quantity Surveying Profession

3.1 Introduction

Chapter 3 is a continuation of Chapter 2. In this chapter, factors influencing the quantity surveying profession and their possible implications are discussed. Possible futures for the profession are also identified. As the quantity surveying profession in the UK is used as a comparison with the profession elsewhere, the chapter begins by identifying factors influencing the quantity surveying profession in the UK before identifying factors influencing the profession in other Commonwealth countries, including South Africa. The chapter concludes by providing a summary of how the literature and research objectives were addressed in Chapters 2 and 3.

3.2 Factors influencing the quantity surveying profession and their possible implications on the current quantity surveying profession

3.2.1 Factors that have influenced the quantity surveying profession in the UK in the past

Since quantity surveyors operate within the construction sector, changes in the construction sector are likely to influence the role of quantity surveyors. The legitimacy of the quantity surveying profession, and ultimately the position of the quantity surveying profession in society, will also be influenced. By looking at the how past changes in the construction sector has influenced the evolution of the current quantity surveyor, it is possible to provide possible futures for the quantity surveying profession.

One of the assumptions of the study is that, "*factors that are driving change in the built environment socio-technical system and the quantity surveying profession elsewhere in the world will also affect the South African built environment socio-technical system and the quantity surveying profession in South Africa.*" Thus, the study first identifies the factors that have an influence on the construction sectors, in the UK and elsewhere.

From the history of the quantity surveying profession, it is evident that the First Industrial Revolution and the associated economic activities played a major role in the development of the quantity surveying profession. Technology, urbanisation, the structure of the construction sector and demand from clients have played a major role in shaping the profession. It is important to look at factors that are currently influencing the profession to determine how the profession may evolve in future.

3.2.2 Past reports and studies on the factors that have an influence on the construction sector in the UK

The Latham Report (1994) identified meeting a client's demand as the major driving force for a need for change in the construction sector. Clients were generally dissatisfied with the performance of the construction sector and did not always receive value for money from their construction investment (Latham, 1994). To improve the performance of the construction sector, the report identified collaboration, early involvement of the whole design and construction teams, proper risk sharing and transparency in costs and profits, as factors that are likely to improve the performance of the built environment socio-technical system (Latham, 1994).

A subsequent report by Egan (1998) noted the following developments in the construction sector: change in materials and construction methods, collaboration, new technology, benchmarking, value management, team working, lean construction, concurrent engineering and Total Quality Management (Construction Task Force and Great Britain, 1998).

Cartlidge (2006) identified the following as factors that were likely to cause change in the socio-technical system of the built-environment: 1) public-private partnerships (PPPs), 2) information technology (IT), 3) added value procurement, 4) globalisation, 5) fee competition, 6) client satisfaction and 7) the 1990 recession.

In developing future scenarios for the future of construction in the UK, Harty et al. (2007) identified a number of factors that were likely to bring changes in the built-environment's socio- technical system. They divided these factors into technological, environmental, human, economic, governance, and other. The following were some of the factors they identified, as likely to affect the socio-technical system of the built-environment in the UK:

Technological

- Off-site construction and standardisation;
- ICT and information-sharing platforms;
- Construction automation and robotics;
- 3D technology; and
- Smart construction materials.

Environmental

- Sustainability; and
- Urbanisation.

Human

- A decrease in skilled trades or a consolidation of professions;
- Education and training requirements; and
- Occupational health and safety.

Economic

- Consolidation and defragmentation of the construction industry;
- Whole-life cycle costing (LCC);
- Facilities management;
- Public-private partnerships (PPPs) and Public Finance Initiatives (PFIs);
- Profitable, efficiency and competition; and
- Foreign competition and globalisation.

Governance

- Government policy
- Legislation and regulation

Other

- Wild cards
- Major shocks

The classification of Harty et al. (2007) is similar to a PESTEL framework, which includes the political, economic, social, technological, environmental and legislative factors (Ghotge et al., 2020). PESTEL is usually used to analyse the macro-environment that influence organisations. After identifying the factors that have influenced the construction sector, it is important to look at the implications these factors have had on the quantity surveying profession. The Harty et al. (2007) classification is used to demonstrate how the these factors have influenced the quantity surveying profession in the UK.

3.2.3 The influence on the current role of the quantity surveying profession in the UK

3.2.3.1 Economic factors

3.2.3.1.1 Consolidation and defragmentation

Some of the factors that were identified by Cartlidge (2006), the Egan Report (1998) and the Latham Report (1994), have shaped the construction sector in the UK and are continuing to do so. For instance, the Latham Report (1994) recommended the use of the NEC form of contract instead of the litigious JCT and ICE forms of contracts. The NEC suite of contracts have since been widely adopted in the UK. NEC3 is regarded as the preferred form of contract by the UK Government, and has been used in major construction projects, such as "*London 2012, Crossrail, High Speed Two, Hinkley Point C, Thames Tideway Tunnel and the UK's nuclear decommissioning programme*," (Brookfield, 2017: 99). In comparison to traditional forms of contracts, the NEC engender collaborative practices (Barnes, 2013).

Collaborative practices within the construction sector may have a negative influence on the quantity surveying profession. As stated in Chapter 1, collaborative practices, for instance, have the potential to reduce the need for quantity surveyors (Winch, 2000). The apparent decline in the use of bills of quantities in the UK is partly attributed to the use of non-traditional procurement methods, such as turnkey, design and build contract, management contracting, PFI, etc. (Rashid et al., 2006).

Within the traditional form procurement, bills of quantities were once regarded as the "bread and butter" of the quantity surveying profession and is still in a number of other countries, including South Africa (Nigam and Dixit, 2016; Rashid et al., 2006). AIQS (n.d) claim that the term "quantity surveyor" is derived from bills of quantities. In a non-traditional procurement method, however, the need for the

bills of quantities is greatly reduced (Ibid). In most of these non-traditional procurement methods, a lump-sum figure of the cost is often sufficient (Ibid).

Ashworth et al. (2013) argue, however, that bills of quantities are still prepared by a few quantity-surveying practices. In a non-traditional procurement, method bills of quantities are prepared for contractors instead (Ibid). The reduced need for the bills of quantities means that quantity surveyors in the UK have had to find other ways of generating income, such as value management (VM), whole-life cycle costing (LCC) and risk analysis and management (Ashworth et al., 2013). Table 3.1 shows the decline in the use of bills of quantities in the UK.

Table 3. 1 Percentage of project by value where bills of quantities are used as tender documents in the UK (Adapted from RICS, 2020 and Ashworths and Hogg, 2007 in Abdullah and Bandi, 2013)

	1985	1987	1989	1991	1993	1995	1998	2001	2004	2007
	%	%	%	%	%	%	%	%	%	%
The use of BOQ by value of projects	64.7%	55.5%	55.9%	50.8%	45.7%	46.1%	30.1%	23.1%	26.1%	15.2%

The fact that quantity surveyors in the UK have been able to successfully increase their role, in spite of the demise of the bills of quantities and the increased use of collaborative practices, is testament to claims that they are able to adapt to changes placed upon them. Although collaborative practices tend to be unfavourable towards quantity surveyors (Winch, 2000), quantity surveyors in the UK were able to create other roles for themselves to replace their loss. Are South African quantity surveyors able to emulate their UK counterparts?

3.2.3.1.2 Public-private partnerships (PPPs) or private finance initiatives (PFIs)

The wider adoption of PPPs or PFIs since the early 1990s have also created new roles for quantity surveyors in the UK. Quantity surveyors provide a wide range of services to private parties, funders, public party and consortium building contractors (Cartlidge, 2006). Table 3.2 shows the participation of UK quantity surveyors in PPPs.

Table 3. 2 The role of quantity surveyors in PPPs/PFIs in the UK (Adapted from Cartlidge, 2006 in Llale, 2015: 84–85)

The Role of the Quantity Surveyor	Services Offered

For the private party (SPV)	• Advice on procurement • General cost advice • Reviewing bids prior to submission • Advice on whole-life costing • Specialist advice
For funders	• Due diligence
For the public party	• Procurement advice • The outline business case • Advice on facilities management
As joint public/private monitor certifier	• Monitoring facilities management operations
For consortium building contractors	• Preliminary cost advice • Preparation and pricing of bills of quantities • Supply chain management

3.2.3.1.3 Whole-life cycle costing (LCC)

Quantity surveyors have been able to shift their role from merely providing capital cost of construction to providing cost for the life of a building (Ashworth et al., 2013). The construction sector's shift to LCC has therefore had a positive influence on the quantity surveying profession.

3.2.3.1.4 Facilities management

Another role that quantity surveyors have added to their traditional role is that of facilities management (FM). The RICS (in Ashworth et al., 2013: 399–400) describes facilities management thus, "*FM involves the total management of all services that support the core business of an organisation*." The range of services provided in FM includes space planning, maintenance management, budgeting, cost control, and benchmarking (Ashworth et al., 2013). Quantity surveyors' skills and knowledge, such as cost control can, thus, also be applied to facilities management (Ibid).

3.2.3.1.5 Recession

The recession in 1990 and the 2008 global financial crisis also had a negative influence on construction sector and the quantity surveying profession. The National Bureau of Economic Research (NBER) (2008) defines a recession as "*a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP, real income, employment, industrial production, and wholesale-retail sales*." The decline in the economy had a negative influence on the construction sector. For instance 2 785 construction company failures were recorded in 2008 and in 2009, the number had increased to 3 784 (Department for Business, Innovation and Skills, UK Government in Tansey et al., 2013 in Tansey et al., 2013). The slow-down in economic activity in the economy and the construction sector had an adverse influence on the quantity surveying profession.

The results of the research done in 2009 by the Construction Industry Council on the impact of recession on construction professionals in the UK revealed that during recession, professional firms (including quantity surveying firms), shed jobs. From the 301 professional services firms employing five or more staff surveyed across the UK, 46% reported that laying off staff was how they responded to the economic downturn. However, what was notable from the results was that 16% of these firms reported that they recruited staff with different specialisations, such as environmental and renewable energy specialists, in order to gain territory into new sectors (Construction Industry Council, 2009).

Past financial global recessions have had a negative influence on the quantity surveying profession. From the Construction Industry Council (2009), it seems that some quantity surveying practices are able to expand into other areas of specialisation, both within and outside the construction sector.

3.2.3.1.6 Profitable, efficiency and competition

Construction firms face challenges of having to satisfy quality, safety and meeting the client's demand in the competitive market of tendering (Harty et al., 2007). The need to meet these demands is possibly one of the reasons the quantity surveyors in the UK prepared bills of quantities for contractors and move into the role of project and construction management also. Through the role of project and construction management, quantity surveyors are also able to offer services to the contractor side of the construction sector's socio-technological system (Ashworth et al., 2013). Contractors are becoming increasingly aware of the value of bills of quantities and schedules of quantities in the tendering and administration of building projects (Ibid). The need for profitable, efficiency and competition might be a positive influence for the quantity surveying profession.

3.2.3.1.7 Foreign competition and globalisation

Marcuse and Kempen (2000 in Haggag, 2004) describe globalisation as a phenomenon that, "*seeks to encompass all countries in one economic unit, possibly without governments or borders.*" The building needs of multinational firms have compelled many construction and quantity surveyors to forge international partnerships (Ashworth et al., 2013; Cartlidge, 2006). Technology has made the world inter-connected (Ibid). Besides building demands from multinationals firms, fee competition and economic booms across the globe, demand in places such as the Middle East has allowed a few quantity surveying firms in the UK to look beyond its borders to survive (Ashworth et al., 2013). Foreign competition and globalisation has had a positive effect on the quantity surveying profession.

3.2.3.2 Governance

3.2.3.2.1 Government policy, legislation and regulation

Government policies, legislation and regulation are some of major influencers in the construction sector (Harty et al., 2007). In 2011, for instance, in an attempt to achieve its objective of reducing procurement

costs by 20%, the UK Government announced that by 2016 all its projects should be implemented through BIM (Cabinet Office, 2011; Smith, 2014).

A study by Wu et al. (2014) on BIM-based cost estimating by quantity surveyors in the UK revealed that BIM adoption within quantity surveying practices was still limited. Quantity surveying practices were still struggling to find the best use of BIM within their practices (Wu et al., 2014). Farmer (2016) argues that wider adoption of BIM depends largely on defragmenting the traditional design and construction barriers, and shifting towards collaboration.

Even though the policy on BIM has not had a major influence on the wider adoption of BIM in the quantity surveying profession, the policy has set the agenda for the UK Government and the construction sector – quantity surveyors who wish to participate in public projects will have to adopt BIM.

3.2.3.3 Environmental factors

3.2.3.3.1 Sustainability

Sustainability in construction is defined as "*…the ways in which built assets are procured and erected, used and operated, maintained and repaired, modernised and rehabilitated and reused or demolished and recycled constitutes the complete life cycle of sustainable construction activities*" (Cartlidge, 2009: 29). And there does seem to be a heightened awareness of the importance of sustainability in the construction sector (Ashworth et al., 2013; Cartlidge, 2009; Harty et al., 2007).

The growing importance of sustainability is also evident in the quantity surveying profession. The RICS has developed a sustainability action agenda, which shows its initiatives regarding the issue of sustainability (RICS, 2019). Furthermore, the Building Research Establishment Assessment Method (BREEAM) was established by the UK Building Research Establishment (BRE), to measure the environmental performance of buildings in the 1990s (Cartlidge, 2009; Roderick et al., 2009; Schweber, 2013). In 2000 it became mandatory for public sector contractors to achieve BREEAM excellence in new buildings (Duncan, 2009; Schweber, 2013).

The implications of sustainability have been positive for the quantity surveying profession as quantity surveyors can advice on the whole-life cost of the building, and not just the initial capital cost. Wider adoption of sustainability in construction has been partly impeded by perceptions that the capital cost of 'going green' is about 10% more expensive than the capital cost of conventional methods of construction. Through life-cycle costing, quantity surveyors are able to provide clients with the capital cost, maintenance costs and operational costs of the building, over the total life of the building, to enable them to make an informed decision that is not only based on the capital cost (Duncan, 2009).

Sustainability is also one of the RICS' eight mandatory competencies required of candidate quantity surveyors (RICS, 2017). Ashworth et al. (2013) provide the role of sustainability advisor as one of the current roles of a quantity surveyor in the UK. This is further evidence that sustainability has had a positive influence on the quantity surveying profession by adding to its jurisdiction.

3.2.3.3.2 Urbanisation

An increase in demand for infrastructure such as accommodation is a benefit for the quantity surveying profession. In 2018, urbanisation in the UK was at 83.4%, an increase of about 3% over the past ten years (Statista, 2020). Furthermore, there are currently more construction jobs in the UK than at any other time since 2007 (Rhodes, 2019). The increased urbanisation and in the number of jobs in the UK is an indication that urbanisation has a positive effect on the jobs in the construction sector, including that of the quantity surveyor.

3.2.3.4 Human

3.2.3.4.1 A decrease in skilled trades or a consolidation of professions

Collaborative practices and technologies (such as BIM) have the potential to blur professional boundaries (Kulasekara et al., 2013). BIM also has the potential to create new roles (Akintola et al., 2017b). What is not clear is whether current built environment professionals will assume new BIM roles (Ibid). From Abbott's system of theory, a consolidation of professions is only positive if quantity surveyors assume a position of leadership over other built-environment professions. Since wider adoption of BIM within the quantity surveying profession is still limited, consolidation of professions is yet to be a major influence on the quantity surveying profession in the UK.

3.2.3.4.2 Education and training requirements

There are potential opportunities and threats in changing construction education to produce "*broad-based and flexible construction professionals,*" (Harty et al., 2007: 488). One of the threats is eroding the authority of current built-environment professionals (Ibid). Opportunities lie in attracting new entrants into the professions (Ibid). A study by Madgwick and Wood (2015) on education of the built-environment professionals in the UK indicated that even though the future needs of the construction sector might demand a professional with consolidated expertise, education in the built-environment was still offered in silos. Education and training requirements have, therefore, had a limited effect on the quantity surveying profession.

3.2.3.4.3 Occupational health and safety

As in many other countries of the world, the construction sector in the UK is known for its hazardous nature (Donaghy et al., 2009; Wang et al., 2016). ILO (2005: 2) stated that "*one in every six work-related fatal accidents occurs on a construction site.*" Although there has been some improvement in

the UK since the Lathan (1994) and Egan (1998) reports, one death is too many according to Donaghy et al. (2009). Technological support for the sector, such as automation and robotics, is recommended for use in dangerous areas (Donaghy et al., 2009; Harty et al., 2007).

The RICS (2017) lists health and safety as one of the mandatory competencies of a quantity surveyor. Quantity surveyors should be able to prepare health and safety documentation for tendering and procurement purposes (RICS, 2017). The increased emphasis on safety has thus expanded the role of the quantity surveyor.

3.2.3.5 Other

3.2.3.5.1 Wild cards and major shocks

Wild card and major shocks are events or developments that are discontinuous with current norms and practices, but are catalysts to major overhauls in the construction sector (Harty at al., 2007). Examples of major shocks include world wars, the invention of the computer, terrorist attacks, the Internet and the increased use of steel as a major construction material in the construction sector (Ibid). In spite of wild card and major shocks of the past, which include two world wars and terrorist attacks, the quantity surveying profession has survived intact. The survival of the quantity surveying profession is, thus, testament to its ability to adapt to change (Ashworth et al., 2013).

3.2.3.5.2 Corruption

Corruption is one of the factors affecting the construction sector. The construction sector is one of the sectors that is most plagued with corruption (De Jong et al., 2009; Ebekozien, 2020; Transparency International, 2005). Corruption is defined as "*the abuse of entrusted power for private gain*," (Transparency International, 2019). Forms of corruption include patronage, nepotism, bribery, ghosting, kickback, fronting, embezzlement, bid rigging, collusion, fraud and price fixing (Brown and Loosemore, 2015).

Many factors contribute to the prevalence of corruption in the construction sector. One of the major contributors to corruption is the fragmentation of the construction sector (Bowen et al., 2012; Brown and Loosemore, 2015; Nordin et al., 2013; Wong, 2004). The traditional procurement method, which favours awarding a project on a competitive tender to the lowest tender, is prone to corruption (Bowen et al., 2007, 2012; Brown and Loosemore, 2015; CIOB, 2013; Yap et al., 2020). In an effort to win a tender, contractors are susceptible to indulge in malfeasance, such as bribery, to win a tender (Bowen et al., 2007; CIOB 2013; Yap et al., 2020). Corruption is most common between Government officials and contractors (Le et al., 2014; Owusu et al., 2019).

Corruption has a negative effect on the construction sector, and results in project delays, cost overruns, poor workmanship, low productivity, abandonment of projects, low return on investment, and an underperforming construction sector (Yap et al., 2020). How has corruption's influence on the construction sector affected the quantity surveying profession?

Corruption within the construction sector is widespread (Goldie-Scot, 2008). One hundred and twelve construction companies were accused of bid rigging in 2008 (Ibid). However, a 2013 CIOB report on corruption stated that it had decreased. The level of corruption within the quantity surveying profession is not established, in spite of quantity surveyors participating in the survey study by CIOB (2013).

Respondents in the CIOB (2013) report identified the pre-qualification and tendering phase as the stages most at risk from corruption (CIOB, 2013). Quantity surveyors prepare tender adjudication reports, advising the client on the eligibility of contactors for the tender during pre-qualification and tendering phase. In Northern Ireland, a senior Ministry of Defence quantity surveyor was found guilty of corruption, for receiving bribes related to the tender of CCTV contracts (Dunton, 2012). It is, therefore, plausible that there may be more quantity surveyors engaged in unethical behaviour in the UK.

The RICS has rules of conduct for its members and member firms (RICS, 2020a). Members are expected to avoid areas of conflict and to act with integrity (RICS, 2020b). The effectiveness of codes of conduct to curb corruption is debatable. However it is clear that corruption has a negative influence on the quantity surveying profession.

Unethical practices within the professions erodes one of their core tenets, namely trust (Abbott, 1988; Susskind et al., 2017). Clients trust quantity surveyors to act in their best interest when proferring their services. If quantity surveyors cannot be trusted, then clients are obliged to look for alternative service providers. The need and legitimacy of quantity surveyors in society will become questionable if trust is lost.

3.2.3.6 Technological factors

3.2.3.6.1 ICT and information-sharing platforms

The increased adoption of information and communication technology (ICT) in the construction sector has had a major influence on the role of the quantity surveyor (Ashworth et al., 2013; Cartlidge, 2006). ICT has led to increased productivity and an addition of services within the quantity surveying profession (Ibid). The increase in the adoption of BIM in the construction sector has led to the automation of several time-consuming traditional tasks, such as take-off, bills of quantities' preparation and estimations (Ashworth et al., 2013; Olatunji et al., 2010; Wu et al., 2014).

3.2.3.6.2 Off-site construction and standardisation

Off-site construction means that building elements, such as walls, individual rooms, or whole buildings are assembled in a factory and not on the construction site itself (Green et al., 2019). Although the use of off-site construction is increasing, wider adoption is still limited in the UK (Fleming et al., 2019). The reason for the slow adoption is contractors' financial and business abilities (Ibid). Unless it makes financial and business sense to use off-site construction, contractors are unwilling to use off-site construction as a substitute for traditional on-site tasks.

The implication of the wider adoption of off-site construction and standardisation on the current quantity surveying profession are yet to be determined. In future, there is a possibility that it might adversely affect the quantity surveying profession. By using off-site construction, it means the cost of 'building' becomes a manufacturing cost and not a building cost (Chan and Gao, 2019). In a traditional construction method, quantity surveyors break down the various components of the building into items and trades priced by contractors. What role will the quantity surveyor play in costing a factory-manufactured element?

3.2.3.6.3 Construction automation and robotics

The benefits of using construction automation and robotics (CAR) include improved safety, high productivity, better quality and reduced construction costs (Vähä et al., 2013). The study by Fleming et al. (2019), on the adoption of CAR to improve productivity in house building in the UK, revealed that house builders prefer off-site construction and other modern construction methods over robotics. The results concur with other studies that claim that the adoption of CAR in many countries, including the UK, has created a lag behind the motor and manufacturing industries (Cartlidge, 2006; Oesterreich and Teuteberg, 2016). The influence of CAR on the current role of the quantity surveyor is therefore minimal.

3.2.3.6.4 3D technology

3D technology is a method through which an object is automatically fabricated by stacking and affixing individual layers of predetermined configurated fabrication material (USA Patents, 1996). Within the construction sector this offers many benefits, including reduced cost and construction time, an environmentally friendly construction method and improved safety on construction sites (Hager et al., 2016; Khoshnevis, 2004). As with CAR and off-site construction, the use of 3D technology is still limited in the UK (Ajayi et al., 2019). The biggest barrier to the wider adoption of these technologies in the construction sector is contractors' negative opinion of them (Ajayi et al., 2019; Goodier and Gibb, 2007).

A study by Goodier et al. (2007), on the future opportunities for off-site construction in the UK, revealed that 65% of the 80 construction stakeholders questioned had a negative opinion of off-site construction. Lack of knowledge of off-site construction by construction professional was also one of the barriers to wider adoption (Ajayi et al., 2019; Goodier and Gibb, 2007). 3D technology has not had much influence on the construction sector, and therefore similarly no influence on the quantity-surveying profession.

3.2.3.6.5 Smart construction materials

Smart construction materials are materials with thw ability to respond to changes to the condition or the environment to which they are subjected (Hamakareem, n.d.) They change in a manner that continues to be beneficial and controlled (Ibid). Smart materials are classified according to their environmental and/or temporal stimuli, such as moisture, heat and suchlike (Zhang et al., 2019). There are thermo-responsive, moisture-responsive, photo-responsive, electro-responsive and magneto-responsive materials, to name a few (Ibid).

The use of smart construction materials has many benefits. For instance, in the construction of smart buildings, smart construction materials are used to control vibrations, noise mitigation, improved safety, better performance, environmental control and improved comfort (Hamakareem, n.d.).

Thus, in spite of claims by Harty et al. (2007), that smart construction materials, off-site construction and standardisation, ARC and 3D will influence the construction sector meaningfully, there has not been much influence on the construction sector and the quantity surveying profession in the period between 2007 and 2017 in the UK.

Some of the factors identified in past reports are still influencing the current construction sectors and are likely to influence the construction sector in future. For instance, fragmentation continues to be a factor. Some of the factors identified in past reports are yet to have a major influence of the construction sector, such as the use of automation and robotics (CAR) in construction, for example. There are predictions that in future, however, CAR might become a major factor in the construction sector. The next section discusses current reports and studies on the construction sector in the UK.

3.2.4 Current reports and studies on the current factors that are influencing the construction sector in the UK

In a report titled, "*The Farmer Review of the UK construction labour model: Modernise or die*" commissioned by the UK Government, and prepared by Farmer (2016) on behalf of Construction Leadership Council (CLC) on the labour-model in the construction sector, the following were identified as factors facing the UK construction sector:

- Low productivity;

- Low predictability;
- Structural fragmentation;
- Leadership fragmentation;
- Low margins, adversarial pricing models and financial fragility;
- A dysfunctional training funding and delivery model;
- Workforce size and demographics;
- Lack of collaboration and improvement culture;
- Lack of research and development (R&D);
- Lack of investment in innovation; and
- Poor industry image.

When Farmer's report was compiled, the construction sector in the UK was faced with an ageing labour force (HM Government, 2017). There were more people leaving the industry than entering it (Farmer 2016). The construction sector's construction methods were also becoming outdated, and were akin to those in the First Industrial Revolution (Wolstenholme, 2016 in Farmer, 2016). To compete with global contenders and to meet demand, the UK Government deemed it necessary to review the construction sector in order to be able to chart a way forward (Farmer, 2016).

Farmer's report highlighted the need for transformation in the construction sector. For instance, reliance on an on-site labour force is unrealistic for the future of the sector, given the growing demand for infrastructure. The UK construction industry also hires much of its workforce from labourers originally fro EU countries. The exit of the UK from the EU (Brexit) could see a collapse of many construction firms (RICS, 2017). To boost production and to promote safety, off-site construction was recommended. (Donaghy et al., 2009; Farmer, 2016).

Although off-site was recommended to boost house building, its use might spread beyond house building (Fleming et al, 2019). The wider adoption of off-site construction might have negative implications on the construction sector's profitability, by transferring profits to manufacturing (Ibid). Quantity surveyors' estimating role might be diminished. The task of itemising various components will be transferred to manufacturing.

The construction sector is also struggling with a poor image, which makes it unattractive for young entrants (Farmer, 2016). Poor image includes poor job security, working conditions, and health and safety concerns (Ibid). The sector has identified women as a potential new demographic for entry into the sector. For the sector to attract women, it will need to deal with this poor image (Ibid). In lieu of addressing its poor image, there have been suggestions that construction automation and robotics should be adopted to augment future labour force and increase productivity (Fleming et al., 2019).

Another issue that still bedevils the construction sector in the UK is fragmentation. In spite of measures introduced to reduce fragmentation, structural fragmentation and leadership fragmentation still persist in the sector (Ahmed et al., 2018; Farmer, 2016). Structural fragmentation manifests itself with the sector indicating the highest number of self-employed jobs in the UK, with 36% of the industry made up of self-employed people (Rhodes, 2019). Jobs in the construction sector are usually contracts for work on specific projects (Ibid). Given the cyclical nature of the sector, it provides flexibility and reduces overheads (Donaghy et al., 2009). Self-employment, however, does not promote a culture of safety and training (Ibid).

Leadership fragmentation refers to the division between the client and the construction sector (Farmer, 2016). This means that the same issue raised by the Latham Report has yet to be fully addressed. Measures that were introduced to promote collaboration between the client and the sector, such as new contracts and procurement methods have been inadequate in attempting to de-fragment the sector. The discussion of the current factors influencing the quantity surveying profession is not meant to be exhaustive, but it does highlight factors literature has identified as influencing the current construction sector. The question is, what are the implications of the factors facing the construction sector on the quantity surveying profession?

3.2.4.1 The implications of factors currently influencing the construction sector on the quantity surveying profession in the UK

After identifying the current factors influencing the construction sector in the UK, it is important to look at how they also influence the quantity surveying profession. To what extent do the factors identified in Farmer's report affect the quantity surveying profession in the UK?

3.2.4.1.1 Low productivity

Some of the factors that make productivity in the UK's construction industry to be low is that client briefs are now well defined in the early stages of the project; the client's change in requirements late in the construction process, and the separation between design, procurement and construction (Farmer, 2016).

The production of buildings is predicated upon various organisations working together in different processes and activities to produce services, materials and components to design, procure and deliver a building (Cartlidge, 2009). Figure 3.1 shows a typical construction supply chain. Quantity surveyors' role within the supply chain is mainly related to looking after the commercial interests of the client (Ahmed et al., 2018).

The construction sector's supply chain has, however, come under severe criticism (Ahmed et al., 2018; Cartlidge, 2009; Farmer, 2016). Most of the "malaise" in the construction sector, such as low productivity, have been blamed on the current supply chain (Ibid). There are suggestions that quantity surveyors can play a role as supply chain managers (Cunningham, 2014; Eugene, 2009; Harun and Torrance, 2006). An argument is made that their skill sets of contract and cost management allows them to fulfil this role (Wao, 2016).

The aim of placing quantity surveyors in a supply-chain management position is to improve the outcomes of the current supply chain model. Figure 3.1 shows a typical construction supply chain. Are there quantity surveyors already fulfilling this role in the UK or is this a future role? Cunningham (2014) claims that larger quantity surveying firms are more likely to offer such services. Quantity surveyors as supply chain managers currently appears to be an emerging trend (Harun and Torrance, 2006). Low productivity may therefore create future opportunities for quantity surveyors.

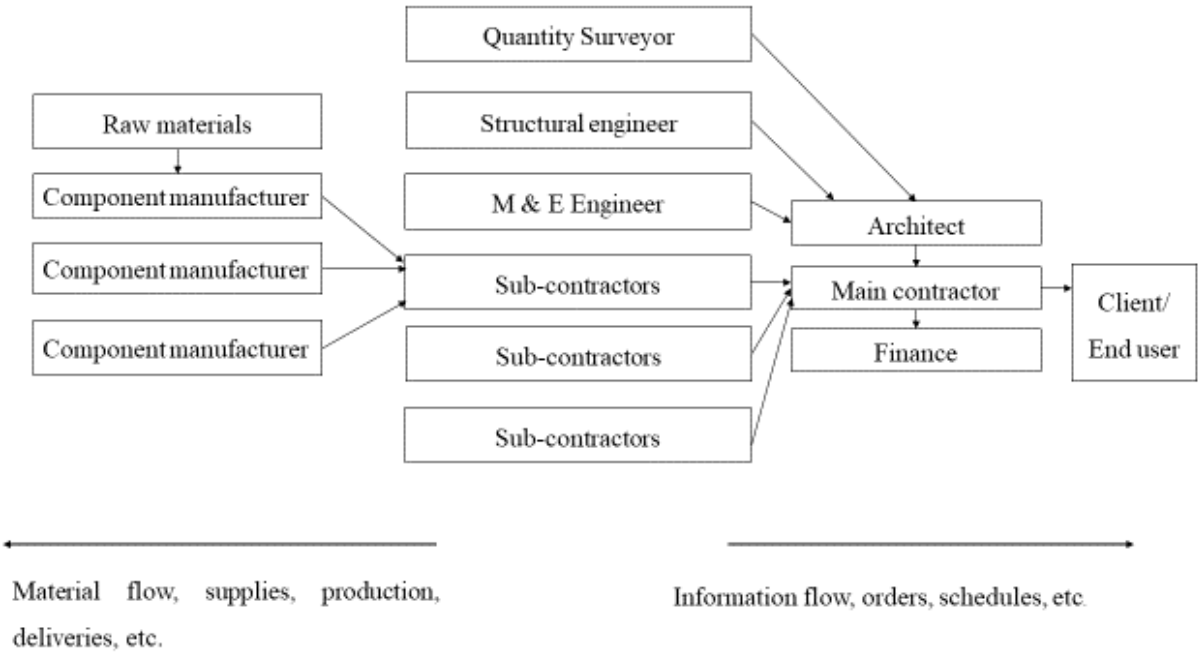


Figure 3. 1 Typical construction supply chain (Cartlidge, 2009)

3.2.4.1.2 Low predictability

The construction sector does not always deliver in accordance with the required timelines, cost and quality. Time delays, cost overrun and poor quality are the result of many factors. Budget overruns are attributed to the lack of skills in the sector. Contingency funds and risk provisions within projects have resulted in misuse. Instead of using the funds to accommodate unforeseen circumstances in the projects,

the funds are often used to cover preventable issues and poor planning. In some larger projects and to counter-act, low predictability, the sector has adopted other approaches, such as incentivisation, structured and robust project planning, design and construction collaboration (Farmer, 2016).

Many quantity surveyors in the UK are assuming the role of project manager (Ashworth et al., 2013; Cartlidge, 2009). Project managers are usually responsible for ensuring that the requirements for quality, time and cost are met (CIOB, 2002 in Ashworth, 2013). Quantity surveyors' knowledge of cost make them suitable for this role (Ashworth et al., 2013). In the past, quantity surveyors offered the service of project management as an extension to existing services (Ibid). In recent times, however, quantity surveyors are appointed as project managers for construction projects in the UK (Ibid). Some firms are appointed as quantity surveyors and project managers in distinct roles (Cartlidge, 2009).

Acting as a project manager or supply chain manager, places quantity surveyors in leadership position (Ashworth et al., 2013; Ofori and Toor, 2009). The traditional role of quantity surveyors is often criticised for being reactionary rather than proactive (Ashworth et al., 2013). The implications of low predictability may create more opportunities for quantity surveyors to be appointed as project managers, as their knowledge, such as construction technology, construction economics, financial management, business administration, construction law and measurement rules and conventions, places them at an advantage, in comparison to other built-environment professionals (RICS, 1992 in Ashworth et al., 2013).

3.2.4.1.3 Structural fragmentation and leadership fragmentation

Fragmentation within the UK's construction sector has created a discrete role for the quantity surveyors (Ahmad et al., 2017). Quantity surveyors are often excluded from participating in the conceptual and design stages of the project, often resulting in cost overruns (Ibid). This means the construction sector still confines the role of the QS to cost and contractual advice after designs have been agreed upon.

3.2.4.1.4 Low margins, adversarial pricing models and financial fragility

The construction sector is still plagued by low profitability, which is partly attributed to the professional system that is still entrenched in the sector. In many cases and based on advice, clients are still inclined to seek the lowest tenderer, who may have lowered their tender price or even made a mistake in pricing. The sector is still cost-based rather than value-based, outcome-based or performance-based. Non-traditional procurement methods are not widely used (Farmer, 2016).

Project and construction failures can be reduced by applying risk analysis techniques and risk management principles. Even though risk analysis and risk management are usually project management responsibilities, quantity surveyors can play the role of risk analysis and management for

clients and contractors. Traditional contracts incorporated a contingency fund, which was reserved for unanticipated project eventualities. The contingency fund was usually determined instinctively. This often resulted in cost overruns as a result of poor risk allocation. There are currently more professionally accepted methods for calculating contingency, which can be used to cover for costs of any eventualities (Ashworth et al., 2013).

Beyond a contingency fund, quantity surveyors can use their risk management skills to assist clients to identify potential risk and to adopt an appropriate response to the identified risk. For contractors, the risk management skills of quantity surveyors can be of benefit during tendering stage. Quantity surveyors may be able to identify the demands of a project and may provide an effective response (Ashworth et al., 2013)

Even though the RICS (2017) requires quantity surveyors to be competent in risk allocation and risk allowances, it is not clear to what extent quantity surveyors in the UK are offering risk analysis and risk management services. The implications of the low margins, adversarial pricing models and financial fragility on the quantity surveying profession might be positive. Quantity surveyors can, thus, provide risk analysis and risk management as added services.

3.2.4.1.5 A dysfunctional training funding and delivery model

In spite of the Construction Industry Training Board (CITB) incentivising employers to train and directly employ recruits, training levels are low. Attrition levels are also high, as most trainees end up in self-employment. Within the built-environment professions, many firms are using cheap international locations to provide their services instead of training locals (Farmer, 2016).

One of the sectors in which quantity surveyors can work in is the public sector (Cunningham, 2014; Rahmani, n.d.). Quantity surveying skills, such as financial management, can assist the public sector in managing public funds to meet the objectives for which they were intended (Ibid). The public sector's shortcomings might create opportunities for quantity surveyors to offer their skills. Quantity surveyors can work within public sector organisations as either employees or consultants (ASAQS, n.d. a). Working in the public sector as an employee might provide the job security that many self-employed seek. To what extent the UK quantity surveying profession is taking advantage of opportunities within the public sector is not known.

3.2.4.1.6 Workforce size and demographics

There is a possibility that the construction sector in the UK might become unfit for purpose if it keeps failing to meet demand. Failure to meet demand is attributed to, amongst others, an ageing workforce,

low levels of new entrants and recurrent economic recessions. There are not enough skills to meet demand (Farmer, 2016).

There are concerns within the quantity surveying profession that the profession is also not attracting enough recruits into the profession. In future, there might be a shortage of quantity surveyors if the trend continues. To address the shortage of skills, in 2017 the UK Government introduced an apprenticeship level. There is some scepticism about the effectiveness of such measures if underlying structural issues are not addressed (Matsu, 2017).

Another possible solution to addressing the issue of skills shortage, is through attracting foreign skills. In 2015/16, immigrants filled over 285 000 jobs in the UK construction sector while only over 21 000 apprenticeships were initiated. One of the implications of the shrinking workforce and ageing demographics on the quantity surveying profession is that the profession is more open to global competition (Matsu, 2017).

3.2.4.1.7 Lack of collaboration and improvement culture

The current adversarial nature of the professional system prevents the sector from widely adopting collaborative technology such as BIM. Wider adoption of BIM will partially depend on closing the barrier between design and construction, which is at the heart of the traditional procurement system.

As argued in Chapter 1, quantity surveyors are in favour of retaining the professional system, as the system maintains their current status in society (Ahmed et al., 2018). As part of a study, Ahmed et al. (2018) interviewed nine stakeholders regarding the position of quantity surveyors in a collaborative production setting within the construction sector. The findings revealed that stakeholders within the construction sector view collaboration with scepticism.

Collaboration means collusion to quantity surveyors (Ahmed et al., 2018). Quantity surveyors' role within the construction sector is that of custodian of the client's commercial interests. Managing the contract through adversarial standard contracts is therefore more important to a quantity surveyor than managing production (Ahmad et al., 2017; Pasquire et al., 2015). The lack of collaboration and improvement culture is therefore advantageous to the quantity surveying profession.

3.2.4.1.8 Lack of research and development and lack of investment in innovation

Lack of research and development and lack of investment in innovation makes the construction sector lag behind other sectors when it comes to adopting technologies that will boost productivity and assist in meeting demand (Farmer, 2016). Current construction methods and technologies, which are still akin

to when the profession emerged in the First Industrial Revolution, are yet to challenge the quantity surveyor's position. The lack of research and development and lack of investment therefore benefit the quantity surveying profession.

3.2.4.1.9 Poor industry image

Matsu (2017) cites quantity surveyors as one of the professions within the UK construction sector that has failed to attract sufficient new entrants to keep pace with demand. There are firms that are turning down work because of staff shortages (Ibid). To attract new entrants, such as women, the sector will need to address issues, such as poor working conditions, job security and health and safety issues (Farmer, 2016). If the status quo remains, the profession might open itself up to foreign competition and encroachment from other professions both within and external to the construction sector, such as accountants (Abbott, 1988; Ashworth et al., 2013). The construction sector's poor self-image places the quantity surveying profession at a disadvantage.

Past and present factors affecting the construction sector in the UK, and their implications on the quantity surveying profession, were discussed. It is evident that some of the past and present factors, however, will continue to influence the construction sector in future. For instance, technology will always have an influence on the construction sector. The next section looks at future factors that are likely to influence the construction sector in the UK and their possible implications on quantity surveying in the UK.

3.3 Future factors influencing the quantity surveying profession

In 2013, the UK Government published its policies regarding the construction sector in a document known as *Construction 2025* (Rhodes, 2019). The main objectives of the policies were:

- To reduce the initial cost of construction and the whole-life cost of assets (from 2010/09 levels) by 33%;
- To reduce the overall time, from inception to completion for new buildings and refurbished buildings (using industry standards of 2013) by 50%;
- To reduce greenhouse gas emissions in the built environment (compared to 1990) by 50% ; and
- To reduce the trade gap between total exports and total imports for construction products and materials (from February 2013 deficit of £6 billion) by 50% (Rhodes, 2019).

Subsequent to *Construction 2025* and the *Farmer's Review* (2016), the Construction Sector Deal was published in response to the two reports (Rhodes, 2019). The Construction Sector Deal (2018) outlines

the future vision of the UK government for the construction sector (GOV.UK, 2019). What the Construction Sector Deal aims to achieve is:

- Buildings that perform better, which are built quicker and at a lower cost;
- Reduced energy use in buildings;
- Better jobs, which includes an increase of 25 000 apprenticeships a year by the year 2020;
- Provide value for money for taxpayers and investors, from the £600 billion infrastructure and construction investment; and
- Create a globally-competitive sector that exports more (GOV.UK, 2019).

To meet these goals, the UK Government will target the following three areas:

- Implementation of digital techniques in all the phases of design to achieve certainty during construction and operation;
- Collaboration between clients' design teams, construction teams and the supply chain to improve quality, safety and production during construction and optimum performance during the life of the building;
- The use of off-site manufacturing technologies to minimise waste, inefficiencies and delays that affect onsite construction. Off-site manufacturing technologies will accelerate construction and reduce disruption by making production and site preparation to happen in parallel;
- Application of whole-life asset performance to shift focus from the capital costs to the costs of a building across its life cycle, with emphasis on its use of energy (Gov.UK, 2019).

Forty per cent of UK energy consumption is attributed to buildings. Buildings are also responsible for 19% of greenhouse emissions (House of Commons, 2016). To achieve reduced energy use, construction will include new technologies in buildings, such as sensors and the use of smart materials and systems that aim to halve the use of energy in new buildings by 2030 (HM Government, 2018) .

From the foregoing discussion, sustainability, technology and whole-life cycle costing are the major factors that will affect the UK construction sector in the future. What will be the possible implications of this on the quantity surveying profession? How will the profession respond?

3.4 The possible implications of factors from the construction sector that will influence the quantity surveying profession

In a 2019 RICS report called "*Future of the Profession: Consultation Response Report*", the quantity surveying profession recognises the influence that changes in the construction sector will have on the profession and provides a 5–10 year strategic response to some of them. The report outlines how the

profession will respond to digital techniques and collaboration, the use of off-site manufacturing technologies, and application of whole-life asset performance (RICS, 2019d).

3.4.1 Digital techniques and collaboration

The use of digital techniques in design and technology that promotes collaborative practices will change the current status quo in the construction sector and influence the quantity surveying profession (RICS, 2019d). Collaboration technologies have the potential to reduce the status that quantity surveyors enjoy as custodians of the client's commercial interests. The RICS recognises that future collaboration within the construction sector is inevitable and recommends an attitude change (Ibid). To keep pace with technological advancement, a change in training and continuous education is recommended (Ibid). The quantity surveying profession in the UK recognises that change is inevitable. How the profession operates in future will be different regardless.

3.4.2 The use of off-site manufacturing technologies

Off-site manufacturing will move some of the cost items from construction to manufacturing (Chan and Gao, 2019). The moving of on-site construction to manufacturing has the potential to negatively influence the quantity surveying profession. Quantity surveyors' responsibilities and associated fees, will be inadvertently reduced. The RICS (2019) report on the future of the profession does not provide a direct response to the potential threat to the quantity surveying profession, of off-site manufacturing technologies, except to state that the RICS will assist its members to anticipate change.

3.4.3 Application of whole-life asset performance

As stated before, the application of whole-life cycle costing has a positive influence on the quantity surveying profession. Instead of providing capital cost, as they do in their traditional role, quantity surveyors are able to provide cost for the life of the building. The role of providing whole-life cycle costing, however, might be contested with other professions, such as accountants and a facilities management specialist (Ashworth et al., 2013). How the quantity surveyor will respond to the wider application of whole-life asset performance is not stated in the 2019 RICS report. The omission could be because UK quantity surveyors are already providing whole-life costing as a service.

After discussing the construction sector and the quantity surveying profession in the UK, the discussion shifts to other Commonwealth countries. What are the factors that are currently affecting the quantity surveying profession in those countries? One of the assumptions of this study is that factors that are affecting the quantity surveying profession elsewhere will also affect the South African quantity surveyor. It is for this reason that the discussion on factors affecting quantity surveying in the UK and other Commonwealth countries are included.

There are 54 Commonwealth countries. Thus, for practical reasons, only four countries are discussed. For comparison purposes, two developed countries and two developing countries are discussed. Current factors influencing the construction sector in general globally are discussed first. These factors are like to have implications on the quantity surveying profession currently, but more especially in the future.

3.4.4 Factors affecting the construction sector globally

WEF (2016) in its document titled the "*Shaping the Future of Construction: A Breakthrough in Mindset and Technology*" identified megatrends that will shape the future of the construction industry (refer to Figure 3.2). Megatrends are enduring social, economic, political and technological developments that shape human lives (Seyler, 2020). The duration, the scale and the effects of a megatrend, in comparison to a normal trend, are longer, larger and stronger (Ibid).

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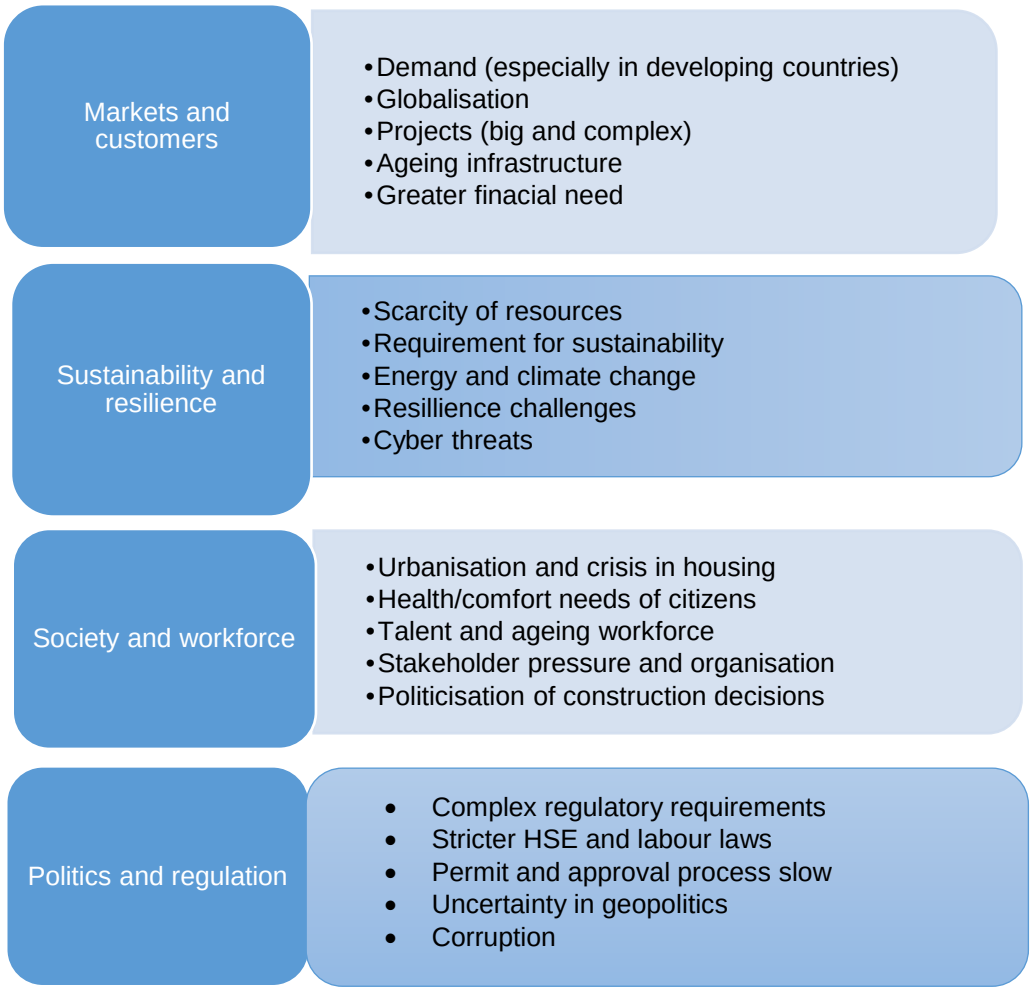


Figure 3. 2 Megatrends that will shape the future construction sector (WEF, 2016)

3.4.5 Markets and customers

WEF (2016) predicts that 65% of the growth in construction in the next ten (10) years will be in developing countries. About 50% of construction companies will have a footprint in other global markets. Construction projects will become bigger and more complex. To close the current infrastructure gap, US$1trillion in infrastructure investments will be needed annually (WEF, 2016).

3.4.6 Sustainability and resilience

The construction sector is the number one consumer of raw materials. Buildings contribute 30% to global greenhouse gas emissions. Natural disasters and the issue of solid waste management will continue to plaque the sector. Cyber threats are also becoming common (WEF, 2016).

3.4.7 Society and workforce

The increase in the urban population will have an influence on the demand for housing and associated services. There is a lack of experienced skilled workers. Comfort and health needs will increase as people spend more time indoors. For example, in the USA people spend on average of 90% of their time indoors. Stakeholders such as communities will have more influence on construction projects. For example, 67 000 signatures were collected, opposing the construction of the Stuttgart train station. Governments may also use construction projects as forms of politicisation. As an austerity measure, the Portuguese Government cancelled a high-speed train line project (WEF, 2016).

3.4.8 Politics and regulation

The regulatory framework for construction is becoming complex. In India, to acquire a permit for building a warehouse, 25 different procedures are required. Labour laws, and health, safety and environment (HSE) laws are also becoming stricter. Approvals for construction permits are slow. It is estimated that US$1. 2 trillion could be added to infrastructure if specific time limits to permit approvals in all countries were agreed upon (WEF, 2016).

An earlier report by Hampson and Brandon (2004) identified similar ‘drivers’ as influencing the construction sector. Drivers are “… *issues that will impact on the industry but are not under its control*” (Hampson and Brandon, 2004: 2). After completing foresight exercises, 30 countries identified the following as the drivers that will influence the construction sector:

- Globalisation;
- Change in the demographics;
- Urbanisation and growth in city dwelling;
- Sustainability and climate change;
- A need for an improved quality of life;

- New construction materials and technologies;
- Information, knowledge management and communication technologies; and
- Governance and regulation (Hampson and Brandon, 2004).

Sustainability, globalisation, urbanization and labour issues are some of the recurrent factors in the WEF (2016) and Hampson and Brandon (2004) reports. Furthermore, in their study, Harty et al., (2007) identified similar factors as likely to have an influence on the construction. There seems to be a common thread globally on some of these factors. Thus, they are not unique to any one country. South Africa is, therefore, likely to be influenced by issues, such as sustainability, globalisation, urbanisation and labour issues.

How will these factors influence the construction sector and its professionals? What is the state of the quantity surveying profession in other Commonwealth countries, given the megatrends identified by the WEF (2016) and Hampson and Brandon (2004)? The next section provides a brief discussion on the state of quantity surveying in Australia, Hong Kong, Malaysia and Nigeria. What are the factors affecting the construction sector and the quantity surveying profession in these four Commonwealth countries?

3.4.9 Australia

3.4.9.1 Factors influencing the construction sector in Australia

In 2004, a document called "*Construction 2020: A Vision for Australia's Property and Construction Industry*" was published (Hampson and Brandon, 2004). The document was based on data collected from questionnaires and workshops with sector stakeholders. Nine themes emerged about the future of Australia's property and construction sector from the two data sets. They are:

- Sustainability;
- Meeting the needs of client;
- Improvement in the business environment;
- Welfare and improved labour force;
- Information and communication technologies for construction;
- Off-site manufacturing;
- Improvement in the process of manufacturing construction products; and
- The leadership of Australia (Hampson and Brandon, 2004) .

Ptasznik (2019) and Meere (2019) postulate that the following will influence the construction sector in Australia in future: better waste management, renewable and efficient energy use, sustainable materials, the Modern Slavery Act, workplace equality, prefabrication and modular construction, indigenous

procurement policy and technological solutions. To what extent has the factors identified by Hampson and Brandon (2004), Ptasnik (2019) and Meere (2019) influenced the quantity surveying profession in Australia? The next section discusses factors influencing the construction sector in Hong Kong.

3.4.10 Hong Kong

3.4.10.1 Factors influencing the construction sector in Hong Kong

Since 1997, Hong Kong, is no longer classified as a Commonwealth country. However, its quantity surveying profession has been greatly influenced by the UK quantity surveying profession (HKIS, 2020). In 2001, the Construction Industry Review Committee (CIRC) published a document called "*Construct for Excellence*" for the Hong Kong Government. Some of the challenges facing the construction sector in Hong Kong at the time were:

- Poor safety on site;
- Unsatisfactory performance with regards to the environment;
- Lack of client focus;
- Wider use of traditional labour intensive methods for construction;
- Lack of trained labour, awarding of tenders based on lowest tenderer;
- Low productivity;
- High building costs; and
- Fragmentation and an adversarial culture (CIRC, 2001).

The CIRC (2001) recommended a vision for the construction sector that was more integrated and client focused. To drive this vision, the CIRC (2001) recommended the following as factors that will influence transformation in the construction sector in Hong Kong:

- A culture of quality;
- The achievement of value in the construction procurement;
- Developing a professional workforce;
- Growing an efficient, innovative and productive industry;
- An improved safety and sustainability performance; and
- A new institutional framework that will drive the implementation of the change (CIRC, 2001).

In 2015, the Construction Industry Council (CIC), the coordinating organisation for the construction sector in Hong Kong, released its vision for the construction sector in Hong Kong. The CIC envisions a construction sector that is "productive', "safe" and "green". To be more productive, the CIC

recommends the adoption of "cutting-edge" technologies in the design, construction and maintenance of building projects. In terms of safety, training and compliance, designing for safety, advanced technologies, the tightening of the law, and a culture of safety are some of the measures or factors that will assist in achieving a safer environment. In terms of meeting its vision of going "green", the CIC, advocates for the use of green design methods, green materials, green building facilities and energy-efficient operational measures, including renewable energy technologies (Wong et al., 2015).

Recent reports by Business Wire (2020) identified the economy, the political environment, demographics, COVID-19, and the risk profile, as some of the factors that are going to influence the future construction sector in Hong Kong. How do these factors compare with factors influencing the construction sector in Malaysia?

3.4.11 Malaysia

3.4.11.1 Factors influencing the construction sector in Malaysia

One of the aims of the Malaysian Government was to become a developed country by 2020 (Economic Planning Unit, 2004; Khan et al., 2014). Infrastructure development and construction have been identified as some of the means through which the Government can attain its objective (Ibid).

In 2003, the Malaysian Construction Industry Development Board (CIDB) and Building Industry President Council (BIPC) of Malaysia in a roundtable discussion titled "*Establishing Priorities to Improve the Malaysian Construction Industry for the Future*" identified ten areas of improvement in the Malaysian construction industry for the period 2006–2015 (Dwikojuliardi, 2015). Ten working groups were assigned to look at the following areas:

1. Construction Industry Master Plan (CIMP);
2. Technology, knowledge and research & development (R&D);
3. Local and foreign projects;
4. Human resources;
5. Productivity and quality;
6. Safety and health;
7. Industrialised Building Systems (IBSs);
8. Building materials;
9. Payment; and
10. Finance (Dwikojuliardi, 2005).

The working group identified the following as the strategic thrusts for the construction sector:

- Integration of the construction industry value chain to boost production and efficiency;
- Strengthening the image of the construction industry;
- Aiming to achieve high standards in quality, occupational health and safety (OHS) and in environmental practices;
- Developing human resource capabilities and capacities;
- Innovation through research and development, including the adoption of new construction methods;
- Leveraging the use of ICT; and
- Taking advantage of globalszation and the exportation of construction products and services.

In 2019, the Malaysian ICW (2019) identified the following as the five construction trends to be aware of in 2019:

- Green and sustainable construction;
- New technologies in construction, such as augmented reality (AR), modular construction, drone technology, advanced robotics, mobile and the Internet of Things (IoT), real-time collaborative software;
- Smart buildings;
- Diversity and inclusivity in labour; and
- Shortages in labour.

Once again sustainability, globalisation and labour issues are factors that seem to be common in most countries. The next section discusses the factors influencing the construction sector in Nigeria.

3.4.12 Nigeria

3.4.12.1 Factors influencing the construction sector in Nigeria

In 2016, the Nigerian construction sector contributed 4% to the GDP (HTA, 2018). Unlike in other countries, the construction sector in Nigeria is not regulated by a governing body (Oyedele, 2016). The main challenges facing the sector in 2006 were lack of financing, the unavailability of materials, shortage of skilled labour, unethical practices, insufficient electricity, awarding of tenders to incompetent companies, and social tensions in the country that often disrupted construction projects (Dantata, 2007). In spite of the challenges the construction sector faced, there were also opportunities identified in ICT, education, and subcontracting sectors (Ibid).

Emiedafe (2017) and Oyedele (2016) list the following as the common challenges faced by the Nigerian construction sector, a change in the scope of the project, a lack of funding, corruption, poor quality control and abandoned projects and low return as some of the problems besitting the Nigerian construction industry.

In light of the challenges facing the Nigerian construction sector, there have been suggestions on how the sector can improve in future. These recommendations are the establishment of a a regulating body, adopting modern procurement systems. such as design and build, construction management and project management systems, establishing a training board for new entrants into the sector, improved health and safety, and alternative dispute resolution, such as adjudication and mediation (Onashile, 2018). The challenges and recommendations are likely to become factors that could possibly shape the construction sector in Nigeria in future. Furthermore, they will also have an influence on the quantity surveying profession in Nigeria.

3.4.12 Summary of factors influencing the construction sector in Australia, Hong Kong, Malaysia and Nigeria

Table 3.3 provides a summary of factors influencing the construction sector in the UK, Australia, Hong Kong, Malaysia and Nigeria.

Table 3. 3 Factors that have an influence on the construction sector (Source: Harty et al., 2007)

Group	Issues	UK	Australia	Nigeria	Hong Kong	Malaysia
Technological	Off-site construction and standardisation	✔	✔		✔	✔
	ICT and information-sharing platforms	✔	✔	✔	✔	✔
	Construction automation and robotics				✔	✔
	3D technology					
	Smart construction materials					✔
Environmental	Sustainability	✔	✔		✔	✔
	Climate change	✔	✔		✔	✔
	Resources/energy conservation	✔	✔		✔	
	Energy crisis	✔	✔	✔	✔	✔
	Waste management and pollution		✔			
	Urbanisation					
	Demographic changes	✔	✔			✔
Human	Decrease in skilled labour /consolidation of professions	✔		✔		✔

	Change in education and training	✔		✔	✔	✔
	Better health and safety, welfare and working conditions	✔	✔	✔	✔	✔
	Flexible working					
	Reduced households					
	Change in healthcare needs and requirements					
	Vulnerability and security					
Economic	Increased profitable, efficient and competitive construction industry	✔	✔	✔	✔	✔
	Increase in foreign competition and globalisation	✔				✔
	Consolidation and defragmentation of construction industry	✔			✔	
	Increased use of whole-life costing, PPP and PFI initiatives	✔				✔
	Increased gap between rich and poor					
	Vulnerability and security					
Governance	Amendments to government policy	✔	✔	✔	✔	✔
	Increased or alignment of legislation and regulation	✔	✔	✔	✔	✔
Other	Wild cards					
	Major shocks					

Corruption and unethical practices are not included in the summary but they do appear to be factors influencing the construction sector in Hong Kong, Malaysia and Nigeria (CIRC, 2001; Emiedafe, 2017; Nordin et al., 2013; Onashile, 2018; Oyedele, 2016; Yap et al., 2020). Using Harty et al.'s (2007) broad classification, the factors influencing the construction sector (and therefore the quantity surveying profession), in Australia, Hong Kong, Malaysia and Nigeria are discussed. Harty et al.'s (2007) broad classification is technological, environmental, human, economic, governance and other. The state of the quantity surveying profession in the Commonwealth countries is discussed first.

3.4.13 The state of quantity-surveying profession in other Commonwealth countries

The quantity surveying profession is legislated by an Act of Parliament in Hong Kong, Malaysia, Nigeria and South Africa (HKISb, 2020; Maritz and Siglé, 2016; Nasir, 2014). In Australia and the UK, however, the profession is self-regulated (RICS, 2020c; Smith, 2004). The Australian Institute of Quantity Surveyors (AIQS) is a voluntary organisation that oversees the Australian quantity surveying

profession (Smith, 2004). It is compulsory though, for quantity surveyors in the state of Victoria, to register with the AIQS (Ibid).

3.4.14 The quantity surveying profession in Australia

The Australian Institute of Quantity Surveyors (AIQS) (n.d) includes cost planning, estimating, cost analysis, cost-in-use studies, valuing progress payments during construction, and depreciation schedules as some of the roles played by the quantity surveyor in Australia.

Smith (2004) describes the traditional role of the quantity surveyor in Australia as preparation of bills of quantities or builders quantities, cost planning or budgeting, estimating and contract administration. In addition to their traditional role, quantity surveyors in Australia also perform non-traditional roles such as feasibility studies, life costing, programming, tax advice, alternative dispute resolution services (such as arbitration and mediation), performing as an expert witness or appraisal, insurance valuations, risk management, quality management, value management, project or construction management and facilities management (Smith 2004). The next section looks at the quantity surveying profession in Hong Kong.

3.4.15 The quantity surveying profession in Hong Kong

The Hong Kong Institute of Surveyors (HKIS) is the regulating body of the quantity surveying profession in Hong Kong (HKIS, 2020a). HKIS was established in 1984, through legislation as the body responsible for the professional registration of quantity surveyors after the dissolution of the RICS' Hong Kong branch (HKIS, 2020b). According to HKIS (2020), the core services provided by quantity surveyors in Hong Kong are:

- Cost Planning;
- Life Cycle Costing;
- Value Management;
- Preliminary Cost Advice
- Procurement Methods;
- Contractual Advice;
- Tendering;
- Valuation of Construction Work;
- Cost Control & Financial Management;
- Financial Claims & Programme Analysis;
- Dispute Resolution;
- Insurance Advice;

- Facilities Management; and
- Project Management (HKIS, 2020c).

The current core services of a quantity surveyor in Hong Kong include both the traditional role and the non-traditional role. For instance, the contractual advice service includes the preparation of bills of quantities, a traditional role of a quantity surveyor (HKIS, 2020d). Life-cycle costing, value-management, dispute resolution, insurance advice, facilities management and project management are the non-traditional role of the Hong Kong quantity surveyor.

The preparation of bills of quantities for tendering purposes is associated with the traditional procurement method, which implies that in Hong Kong, the traditional procurement method is still widely used (HKIS, 2020d). Even though the quantity surveying profession in Hong Kong evolved from the UK quantity surveying profession, it does not seem to have kept pace with the UK profession, which has advanced into many non-traditional roles. Whether the profession will evolve to incorporate more of the non-traditional roles in the future, as occurred in the UK, remains to be seen.

3.4.16 The quantity surveying profession in Malaysia

Chong et al. (2012) classified the role of quantity surveyors into three broad categories: the traditional role, the non-traditional building services and the non-building services. The traditional role includes providing services, such as estimating, cost planning, the preparation of bills of quantity surveyors and contract administration. The non-traditional role includes preparation of feasibility studies, value management, facilities management, project management, cost benefit analysis, quality management, due diligence reports, construction planning, insurance valuation, expert witness, arbitration, mediation, life-cycle costing, premises audits, tax advice, post-occupancy evaluation, risk management and other (Chong et al., 2012).

Non-building services include providing services in infrastructure works, civil works, marine works, aeronautical, transport, mining, manufacturing, ship building, petrochemical, oil & gas, and similar (Ibid). Chong et al. (2012) do not specify the type of services that quantity surveyors provide in non-building services. It is also not clear whether quantity surveyors, for instance, provide services similar to what they provide in their traditional role in non-building services.

The Royal Institution of Surveyors Malaysia (RISM, n.d) divides the role of quantity surveyors into basic services and supplementary services (refer to Table 3.4). Basic quantity surveying services provided by the Malaysian quantity surveyor are similar to the traditional services provided by the South African quantity surveyor (refer to Table 3.4). The traditional services are based mainly on the traditional procurement method.

Table 3. 4 The role of quantity surveying in Malaysia (RISM, n.d)

Basic Services	Supplementary Services
• Preliminary cost estimates and cost plans • Cost estimating • Procurement, tendering and contractual advice • Preparation of the bill of quantities or specification document • Tendering • Adjudication of tenders • Preparation of the contract documents • Interim valuation of works in progress • Cost reporting during the construction period • Final accounts	• Preparing feasibility studies for the project • Estimated project or development expenditure projection and cash flows • Prequalification evaluation of contractors • Cost studies comparisons • Project management • Life-cycle costing • Bills of quantities pricing or schedule of rates negotiations and agreements • Evaluating contractual claims for arbitrations litigation cases • Insurance claims valuations • Auditing contracts including related budgets and expenditure • Quantity surveying services for turnkey or privatisation contracts

3.4.17 The quantity surveying profession in Nigeria

The Nigerian Institute of Quantity Surveyors (n.d) states that the quantity surveying profession in Nigeria is patterned, as it is in the UK and other Commonwealth countries. In identifying the place of the quantity surveyor within the Nigerian construction sector, Olanrewaju (2013), identifies the traditional role of the quantity surveyor as similar to other Commonwealth countries, such as the UK, South Africa, Malaysia and Hong Kong. For instance, Olanrewaju (2013) includes feasibility and viability studies, cost planning and management, feasibility and viability studies, preparation of tender or contract documents, and tendering, as some of the traditional roles of quantity surveyors. As in other developing countries, such as South Africa and Malaysia, the role of the quantity surveyor in Nigeria is still confined to traditional tasks, that is, managing the capital cost (Olanrewaju, 2016).

Olanrewaju (2013) recommended that areas of growth for the Nigerian quantity surveyor could be found in the use of ICT to provide certain quantity surveying services, such as the preparation of bills of quantities and electronic tendering, value management, technical auditing, risk management and facilities management. Technical auditing was recommended in order to tackle corruption, as it involves technical evaluation of a construction project (Olanrewaju, 2013).

The findings of a survey study by Olanrewaju (2016), on the extent to which non-traditional roles are fulfilled by Nigerian quantity surveyors, revealed that quantity surveyors' role in non-traditional services is still limited. Using relevant literature, Olanrewaju (2016) classified the non-traditional role of the quantity surveyor in an emerging economy such as Nigeria as:

- Preparation of bills of quantities for engineering services;
- Insurance advice;
- Preliminary cost advice/cost planning;
- Preparation of cost options;
- Preparation of project appraisal;
- Preparation of contract documents and participation in contract administration;
- Arbitration;
- Services in relation to the future use and management or maintenance of buildings;
- Cost benefit analysis;
- Negotiations of claims with the contractor
- Advising on liquidated and ascertained damages
- Advising on litigation matters
- Assist in application of grants and its documentations
- Value engineering and value management
- Risk assessment and risk management
- Adjudication including proceedings
- Project management
- Life-cycle cost studies and operational cost
- Advising on the effect of capital and revenue expenditure
- Advising on fire or other damage, and preparation of associated claims
- Advising on environmental impact assessment; and
- Advising on insolvency services.

Olanrewaju (2016) claims that there is no consensus on the role that quantity surveyors play in each country. By simply looking at the role that quantity surveyors play in the UK, South Africa, Australia, Hong Kong, Malaysia and Nigeria, the claim by Olanrewaju (2016) is somewhat supported. The traditional role of the quantity surveyor seems to be a uniform one across all Commonwealth countries, although the traditional role still dominates in the developing countries, more so than it does in the developed countries. Developed countries seem to be ahead of the pack in relation to their role as a non-traditional one, with the UK leading other developed countries.

3.4.18 The factors that influence the construction sector and the quantity surveying profession in Commonwealth countries

3.4.18.1 Technological

3.4.18.1.1 ICT and information-sharing platforms

Similar to the UK, other Commonwealth countries are experiencing the influence of ICT and other-sharing platforms on the quantity surveying profession. In looking at the trends in the Australian quantity surveying practice and in the use of IT, the findings by Smith (2004) revealed that quantity surveying firms that did not change their practice to include the wider use of IT were at risk of losing their competitive advantage and market share. The study was based on data collected from five national surveys conducted between 1995 to 2003 (Ibid).

Australia's Standing Committee on Infrastructure, Transport and Cities (SCITC, 2016) made a recommendation to the Australian Government that public project over AU$50m should be implemented through the use of BIM by 2016 (Babatunde et al., 2019; Jin et al., 2019).This means that quantity surveyors who wish to participate in any public project valued at more than AU$50 million should employ BIM during the project's roll-out. The use of BIM in Australia is, however, still limited (Smith, 2014). Resistance to change and the high cost of investment and training are some of the reasons for this limited adoption (Ibid). However, if quantity surveyors are keen for a distinct share of the Australian market, they will need to adopt the use of BIM, as the BIM market was expected to grow to AU$6.5 billion in less than 10 years (from AU$1.8 billion in 2012) (Byrne, 2015).

The adoption of BIM in Hong Kong, Malaysia and Nigeria is not much different from Australia and UK, in that it is slow. Hong Kong is cited among those countries that are advancing in terms of driving the need for wider adoption of BIM. However, the rate of adoption is still in its infancy, even in the quantity surveying profession (Chan et al., 2019; Cheng and Lu, 2015; Takim et al., 2013).

Wider adoption of BIM in Hong Kong is likely to take place in future, as there are numerous initiatives driving the need for wider adoption. For instance, the Construction Industry Council (CIC) released a BIM adoption roadmap in 2013, as well as the CIC BIM Standards in 2015 (HKCIC, 2013; 2015). CIC declared 2014 as the "BIM Year" (Cheng and Lu, 2015). Besides the CIC, various public organisations, such as the MTR Corporation, Architectural Services Department (ArchSD), Housing Authority (HA) and other non-governmental organisations, such as the Hong Kong Institute of Building Information Modelling (HKIBIM), have adopted BIM and have been encouraging wider adoption (Ibid). These initiatives for wider adoption in Hong Kong are proof that wider adoption of BIM in Hong Kong is

imminent. Therefore, quantity surveyors in Hong Kong will need to adopt BIM if they want to have a meaningful contribution in the construction sector in Hong Kong.

As developing countries, Malaysia and Nigeria share similar challenges in the wider adoption of BIM. Saka et al. (2019) classified these challenges as technological, economical and process- or people-related barriers. Technological barriers include poor connectivity, insufficient power supply, lack of IT infrastructure, lack of ICT tools and interoperability (Ibid). Interoperability refers to the exchange of data between computer software or hardware (Technopedia, n.d.). According to Saka et al. (2019), interoperability is the greatest barrier to the adoption of BIM in developing countries. Economical barriers include the high capital cost of investment, such as training (Ibid). People- and process-related barriers include resistance to change, lack of awareness, no government mandates and a lack of demand from clients (Ibid). Similar to the UK, Australia and Hong Kong, there is evidence that wider BIM adoption is on the horizon for Malaysia and Nigeria.

From 2020, the Malaysian Government has undertaken various BIM pilot projects, to introduce BIM to government officials (Haron, 2017). The CIDB in Malaysia has also been hosting workshops related to the wider adoption of BIM (Ibid). In addition, from 2017, the Malaysian CIDB has funded the acquisition of BIM software and training programmes through a RM1 billion scheme, called the Transformation Scheme Fund (Gurung, 2020). By 2018, 30 companies had benefited (Ibid). The Nigerian Government is too willing to embrace innovation that will advance the construction sector including the wider adoption of BIM (Hamma-adama et al., 2018).

It is clear that BIM adoption within the quantity surveying profession in Malaysia and Nigeria has been slow (Babatunde et al., 2019; Zainon et al., 2016). In Malaysia, the primary reason has been the fear of BIM replacing the role of the quantity surveyors (Zainon et al., 2016). Nigerian quantity surveyors' poor adoption rate of BIM has mainly been a lack of awareness (Babatunde et al., 2019). Given the positive attitude that both the Malaysian and Nigerian governments have shown towards BIM's wider adoption in the construction sector, quantity surveyors in Malaysia and Nigeria will likely be required to adopt BIM in future to remain relevant.

3.4.18.1.2 Off-site construction and standardisation

Construction 2020's vision for wider adoption of off-site construction in Australia are yet to be fully realised. Only 3% of the Australian construction sector uses off-site manufacturing (Johanson, 2018). In a case study of three Western Australian housing projects, on the cost of off-site construction, it was revealed that one of the major barriers to wider adoption of off-site construction is the contractor's reluctance to adapt to new and unfamiliar methods of construction and costing (Sutrisna et al., 2019). Ptasznik (2019) claims that off-site manufacturing will grow to the value of AU$157 billion by 2023.

The growth will mainly be driven by a need to save construction time, improve quality and the need for sustainability (Hampson and Brandon, 2004; Ptasznik, 2019).

Given the limited adoption of the use of off-site construction in Australia, the influence on the quantity surveying is thus limited. There is a need, however, for quantity surveyors to prepare for the growth in off-site manufacturing if the profession hopes to remain relevant in the sector. In a roundtable discussion on the skills required for off-site construction, knowledge of off-site manufacturing, that is design for manufacture and assembly (DfMA), was cited as one of the skills needed to meaningfully participate in off-site construction by the Australian sector's stakeholders (Ginigaddara et al., 2019).

Off-site manufacturing in construction is used mainly in the provision of public housing (Wong et al., 2015). In the construction of public housing, the Hong Kong Housing Authority (HKHA), uses pre-fabricated external facades, slabs, staircases, partition walls and beams, instead of on-site construction (Mak, 2013). Even though the use off-site manufacturing is still limited in the private sector in Hong Kong, its benefits, such as reducing construction waste by 56%, construction time by 20%, labour by 9.5%, and dust and noise, are likely to drive the demand for off-site construction in other areas of construction (Jaillon and Poon, 2009). Figures 3.3 and 3.4 show the use of pre-fabricated elements in construction in Hong Kong.

It is not clear how the use of off-site manufacturing has had an impact on the quantity surveying profession in Hong Kong. Given that off-site construction is mainly used in providing housing and is done in a limited manner, its effect may thus far be minimal.



Figure 3. 3 Pre-manufactured facade, slab and staircases (Hong Kong Housing Authority, 2015 in Wong et al., 2015)



Figure 3. 4 Precast bathroom and kitchen components (Hong Kong Housing Authority, 2015 in Wong et al., 2015)

Similar to Hong Kong, off-site construction in Malaysia is used mainly in the provision of public housing. Off-site construction is called the industrialised building systems (IBS) in Malaysia. IBS was introduced to alleviate the housing backlog the country faced due to rapid urbanisation (Ling et al., 2017). What influence the use of IBS has had on the role of quantity surveyors is not clear. A study by Abdullah and Haron (2006), on future directions of the Malaysian quantity surveyor, concluded that the profession would be influenced by the country's industrialisation drive, the economy, technological advancement, ICT and globalisation. From the evidence of key literature, it seems as though the predictions by Abdullah and Haron (2006) are yet to be fully realised, as quantity surveyors continue in their traditional and established non-traditional role (RISM, n.d).

In the Nigerian construction sector, off-site construction is relatively unknown in the construction sector (Kolo et al., 2014). Barriers to wider adoption of off-site construction include resistance to implementation by clients, a negative perception towards off-site construction, a shortage of required skills, and limited manufacturing capacity (Rahimian et al., 2017). The influence of off-site manufacturing on the quantity surveying profession is thus negligible currently. With a housing deficit of 17 million, however, there is a great possibility of wider adoption of off-site manufacturing to alleviate the housing backlog in future (Kolo et al., 2014; Okonjo-Iweala, 2014; Rahimian et al., 2017). Quantity surveyors in Nigeria might need to adjust their current practices in order to participate in off-site construction.

3.4.18.1.3 Construction automation and robotics

Hong Kong prides itself as the regional leader in the adoption of automation and robotics in the construction industry (Wong et al., 2015). Technology such as laser scanning technology and

unmanned aerial vehicle (UAV) have been used to provide accurate site information and construction progress on site (Ibid). Robotic arms and exoskeletons have also been used (Pan et al., 2020). Research is currently underway at the University of Hong Kong, on the development of a robotics system that could be used in areas that are ordinarily too dangerous for human workers (Wong et al., 2015). The Hong Kong University of Science and Technology is developing a robotics and autonomous systems (RAS) (Ibid).

Some of the factors driving the wider adoption of automation and robotics in Hong Kong is high labour cost, skills mismatch, an ageing workforce, scarcity of land, and safety and sustainability (Pan et al., 2020; Wong et al., 2015). In spite of the use of automation and robotics in construction in Hong Kong, the market for CAR is still in an early stage, in comparison to France and Japan (MHC, 2014). Thirty-nine per cent of French contractors lead terms of construction equipment and the Japanese contractors (35%) lead in terms of the use of robotics (Ibid).

The current influence of the use of CAR on the role of quantity surveyors in Hong Kong seems to be minimal. For example, valuation of construction work is one of the roles still carried out by quantity surveyors, according to HKIS (2020e). It means that the use of laser scanning technology and unmanned aerial vehicle (UAV) has not yet assumed this role from quantity surveyors even though it has not been ascertained whether quantity surveyors uses laser scanning technology and unmanned aerial vehicle (UAV) to conduct construction valuations.

The use of construction automation and robotics is at 10% in Australia (MHC, 2014). One of the reasons for the slow rate of adoption is the requirement that before robotics are introduced on site, building union representatives must be assured that robotics on site will not threaten their jobs (Mahbub, 2008 in Yahya et al., 2019). Robotics have thus not had a major influence on the quantity surveying profession in Australia.

Wider adoption of robotics in Malaysia and Nigeria has also been slow, although there are signs that robotics and automation might become an integral part of the construction sector in the future. Major barriers to the wider adoption of ARC in Malaysia include high capital and maintenance costs, fragmentation in the construction sector, difficulty in using the technology, a mismatch between current practices and the new technology, difficulty in securing the technology, technological illiteracy amongst workers, and reactionary workers resistant to new technology (Mahbub, 2012). Wider adoption of CAR has been recommended in Malaysia as a means of promoting (among other things) productivity, quality, safety, as well as achieving Malaysia's goal of becoming a developed country (Kamaruddin et al.,

2016). It is therefore likely that wider adoption will take place in Malaysia in the near future, and quantity surveyors are likely to be influenced by it in their practices.

In Nigeria, the adoption of CAR has been minimal (Oke et al., 2019). Given the many benefits of CAR in construction (such as improved safety, productivity and quality), it is likely that CAR will be adopted more widely in future in Nigeria. The present influence of CAR on the Nigerian quantity surveyor has, therefore, been minimal.

3.4.18.1.4 3D technology

The use of 3D technology in construction in Australia, Hong Kong, Malaysia and Nigeria is still limited. There are currently no known 3D printed buildings in any of these countries. Given the benefits of 3D printing, such as shortening construction time, reducing cost, allowing more geometric freedom, increasing productivity, reducing the supply chain, increasing sustainability, lowering wastage, reducing the need for formwork and safety (El-Sayegh et al., 2020), its wider adoption is possible in future. Wider adoption of 3D technology in developing countries, such as Malaysia and Nigeria, might be limited as 3D printing technology is expensive and has the potential to reduce the number of construction workers in a construction project (Ibid).

3D technology has, therefore, not had much effect on the quantity surveying profession. Future wider adoption of 3D technology, might challenge cost estimation skills and techniques of quantity surveyors (El-Sayegh et al., 2020). Quantity surveyors will need to understand the technology to be able to cost estimate accurately (Ibid).

3.4.18.1.5 Smart construction materials

There is currently limited use of smart construction materials in construction in the Commonwealth countries under review. In future, the use of smart materials might become common (De Valence, 2019), as its benefits (such as improved comfort, safety and performance) become apparent (Materials and Guide, 2012). Research on various smart construction materials is also ongoing (Dogne and Choudhary, 2014). Thus, the use of smart construction materials has had an insignificant influence on the quantity surveying profession.

3.4.18.2 Environmental

3.4.18.2.1 Sustainability

Australia has set its ambitions on reducing carbon emissions – from 2000 levels – by 60% in 2050(Australia Government 2008 in Xia et al., 2013). The Green Building Council of Australia (GBCA) established the Green Star as a national standard for assessing buildings' design and performance in terms of sustainability requirements (Roderick et al., 2009; Xia et al., 2013). The results of a survey and

interviews with quantity surveyors in South Australia by Ma and Luu (2013) revealed that quantity surveyors have adapted their traditional role to include sustainability.

Capital cost advice for green building and life-cycle costing analysis are the main services provided by quantity surveyors in sustainability in Australia (Ma and Luu, 2013). Other roles played by quantity surveyors in sustainability include sustainability advisory services, value management facilitation, feasibility studies for green projects and sustainability strategy development (Ibid). Sustainability in the construction sector in Australia has thus had a positive influence on the quantity surveying profession in Australia.

In 1996, the Hong Kong Green Building Council (HKGC) developed the Building Environmental Assessment Method, referred to as BEAM Plus, to encourage sustainability in construction. BEAM Plus is the equivalent of the Australian Green Star and the UK's BREEAM. In addition to BEAM Plus, the government of Hong Kong passed a policy in 2011, requiring BEAM Plus certification before issuing gross floor area (GFA) concessions (Chan and Leung, 2017).

GFA concessions may include the exclusion of certain areas from GFA calculations and/or granting additional plot ratio and permitted site coverage (Chan, 2012). BEAM Plus certification and GFA concessions are some of the initiatives driving sustainability in Hong Kong. HKIS (2019) reported that quantity surveyors' involvement in sustainability is in the cost benefit analysis of green features and life-cycle cost analysis. Sustainability has, therefore, increased the role of quantity surveyors in Hong Kong.

In spite of numerous government incentives to promote sustainability in construction, its adoption in Malaysia has been slow (Zainul Abidin, 2010; Shari and Soebarto, 2014; Algburi et al., 2016, Zaini and Endut, 2018). Lack of awareness and knowledge of sustainable construction, the high cost of implementation and stakeholder's self-interest, have been cited as barriers to wider implementation of sustainability in Malaysia (Hammond et al., 2019).

Che Haron et al. (2016) identified possible roles that Malaysian quantity surveyors can play in sustainable construction in Malaysia. They include cost planning, value management, risk management, green procurement (which is used to facilitate the procurement of green materials and technologies), life-cycle costing, BIM in sustainability, and the preparation of carbon footprints that can be used to measure carbon emissions between two properties (Che Haron et al., 2016).

In spite of opportunities that exist for them in sustainability, quantity surveyors face challenges in taking full advantage of them (Che Haron et al., 2016). At the feasibility stage, the greatest challenge the quantity surveyor faces is a delay in decision-making by clients (Ibid). Another challenge is that at design stage, quantity surveyors and architects often cannot agree on the selection of green materials (Ibid). Selecting the appropriate 'green' contractor, and valuing progress on site in sustainable construction, are some of the challenges facing quantity surveyors in taking advantage of the opportunities offered by sustainable construction (Ibid). Unless, these challenges are addressed, the growth in sustainable construction in Malaysia will not benefit the quantity surveyor.

The findings of a survey study by Ifije and Aigbavboa (2020) revealed that major impediments to the adoption of sustainable construction in Nigeria include lack of client awareness, associated extra building costs, the public's ignorance of the benefits of sustainability, and a lack of building regulations to guide the implementation of sustainable construction. Given the limited adoption of sustainability in construction, its influence on the current role of quantity surveyors is thus negligible. Ade-Ojo and Fasuyi (2013) recommend the use of quantity services in the design phase of sustainable construction to inform design decisions. It is highly likely that as the implementation of sustainable construction grows in Nigeria, the scope of services offered by quantity surveyors will also increase.

3.4.18.2.2 Urbanisation

From the First Industrial Revolution, construction has been associated with industrialisation and urbanisation (Khan et al., 2014). As the Malaysian Government aims to transform Malaysia into a developed country, construction has been used as a means through which the country can be industrialised and urbanised into a developed country (Ibid). In Malaysia, urbanisation increased from 25% in the first quarter of 1960, to 65% in the third quarter of 2005 (Shahbaz et al., 2015). By 2020, the level of urbanisation is expected to reach 75%, and 80% by 2030 (Ibid).

From the First Industrial Revolution to date, urbanisation has had a positive effect on the quantity surveying profession. As the demand for infrastructure increases, the need for quantity surveying services increase. Urbanisation in Malaysia has increased the demand for quantity surveyors. Chong et al. (2012) claim that the rapid economic growth in Malaysia has been influential in the growth of the profession in Malaysia.

In 2018, the rate of urbanisation in Nigeria was estimated at 50.34% (Plecher, 2020). The UN (2014) estimates that the global urban population will increase to 2.5 billion by 2050, with China, India and Nigeria accounting for 37% of the global urban population. Urbanisation is likely to have a positive effect on the Nigerian quantity surveying profession and will likely to continue to do so in future.

In Hong Kong, the rate of urbanisation between 2015 and 2020 was estimated at 0.82% (CIA, 2019). Hong Kong is 100% urbanised (Ibid). In Australia, the rate of urbanisation between 2015 and 2020 was estimated at 1.43% and at 86.2% respectively (Ibid). The influence of urbanisation on the quantity surveying profession in developed economies, such as Hong Kong and Australia, is thus negligible in comparison to developing economies such as Malaysia and Nigeria.

3.4.18.3 Human

3.4.18.3.1 A decrease in skilled trades or a consolidation of professions

As BIM and other collaborative practices have the potential to blur professional boundaries, quantity surveyors in the Commonwealth countries reviewed are advocating for education and continuous professional development to keep their position in the construction sector (Saka and Chan, 2020a). Unlike in the UK and Australia, where the profession is not regulated, the legislation in Hong Kong, Nigeria and Malaysia might be the quantity surveyors' saving grace, in the midst of technological contenders such as BIM.

Clients still rely on quantity surveyors to provide them with cost and contractual advice. It is debatable whether legislation will be sufficient to continue to uphold the quantity surveying profession in the long term. This is because the social contract that society has with the professions is based mainly on trust (Susskind and Susskind, 2017). If clients shift their trust from quantity surveyors to technology, what effect can legislation have on shifting dependence on quantity surveyors to technology?

In the UK and Australia, the potential for consolidation of the profession with other professions is high, because there is no legislation to prevent consolidation. From Abbott's systems theory, a few outcomes can emanate from consolidation. One outcome is reinforcing one's professional status in society by absorbing other professions, akin to business mergers and acquisition (Abbott, 1988). Another outcome is to be absorbed within another profession, or relegation to a lower position with the socio-technological system (Ibid). Absorption or relegation to a lower position would be undesirable to the quantity surveying profession, as their current professional status is esteemed in society (Abbott, 1988; Susskind and Susskind, 2017). Given also the rankings within the professions, professions aspire to be amongst the highly ranked professions for prestige and associated income. If the quantity surveying profession is absorbed within another profession or relegated to a lower position, that might mean the end of the profession or the end of the profession as it is currently instituted.

Consolidation of professions can therefore be positive or negative towards the quantity surveying profession. It is positive only if the quantity surveying profession assumes leadership and absorbs other professions; it is negative if quantity surveyors are absorbed by other professions or relegated to a

lower position. In the short-term, the risk of absorption or relegation seems minimal (Saka and Chan, 2020). What is not certain is the profession's future in the long term, that is, whether it will remain independent or be consolidated.

3.4.18.3.2 Education and training requirements

Education and training are regarded as important tools in advancing the construction sector (Abudayyeh et al., 2004). Therefore, as one of the professionals within the construction sector, quantity surveyors are also expected to keep abreast with developments within the sector if they want to remain relevant. Education and training, particularly with regards to technology, ICT and BIM, seem to dominate literature because the world and construction are moving more towards technology and digitisation. For example, Nigerian quantity surveyors are advised to develop knowledge and skills in ICT, knowledge management, communication and e-tendering processes (Oke et al., 2017; Olanrewaju, 2013; Tunji-Olayeni et al., 2019).

Malaysia shares similar sentiments with Nigeria. Quantity surveyors are encouraged to develop their knowledge of BIM to participate in construction beyond their traditional role (Zainon et al., 2016). Kamarudin et al. (2019) advocates for the inclusion of BIM education in the university curriculum. Continuous Professional Development (CPD), through the Board of Quantity Surveyors Malaysia (BDSM) is also encouraged (Shazali et al., n.d.).

Olatunji et al. (2010) argue that BIM challenges the role and relevance of quantity surveyors in the construction sector, both generally and in Australia particularly. Measuring and estimating can be carried out through BIM (Olatunji et al., 2010). They recommend reviewing quantity surveying curricula (Ibid). The conclusion that can be drawn from the study by Olatunji et al. (2010) is that the measuring and cost estimating function of quantity surveyors may not be needed in future. Universities and institutions of higher learning must therefore train students to follow another direction. Smith (2014), however, shares a different opinion. After a literature review of current BIM adoption trends and interviews with quantity surveyors using BIM in Australia, the study by Smith (2014) concludes that BIM should not be regarded as a threat but as an enabler. The study recommends quantity surveyors be BIM 5D literate in order to produce estimates and cost plans in real time (Smith, 2014).

While there are divergent views in Australia regarding the future direction of BIM education, in Hong Kong, the Hong Kong Polytech University includes BIM in its quantity surveying curricula. The need for BIM education within the quantity surveying profession is further corroborated by an international Delphi study by Saka and Chan (2020a), on the knowledge and skills requirements for quantity surveyors in BIM. Experts from the UK, Hong Kong, Australia, Nigeria, Malaysia, South Africa, Canada, Ghana and UAE participated in the study. The study concludes that while most quantity

surveyors were BIM illiterate, quantity surveyors were generally reluctant to adopt BIM because of the fear of BIM substituting their traditional role. To overcome this fear, the study recommends education institutions to train quantity surveyors in BIM (Saka and Chan, 2020a).

Besides technology, BIM and ICT, other areas of development for quantity surveyors include sustainability, value management and engineering courses (Olanrewaju, 2013; Tunji-Olayeni et al., 2019). Education is, therefore, regarded as a positive factor in survival and the advancement of the quantity surveying profession.

3.4.18.3.3 Occupational health and safety

The hazardous nature of construction is well documented. Developing countries' safety records tend to be worse than those in developing countries (Manu et al., 2018). In 2017, the Malaysian construction sector had the highest number of occupational accidents than any other sector, with 15 fatalities recorded (DOSH, 2017 in Abas et al., 2020). Accidents in construction in Nigeria are generally unreported and the data on accidents is therefore unreliable (Umeokafor et al., 2020). Even though the data on safety is disputed, in 2006 it was reported that there were five injuries per labourer, and two accidents per 100 labourers (Ezenwa, 2001; Umeokafor et al., 2014). There were 33 fatalities in Australia, in construction in 2015 (SWA, n.d). In 2017, 76% of industrial fatalities were in construction in Hong Kong (Shafique and Rafiq, 2019).

Each country has put in place measures to improve safety on site. For instance, Hong Kong introduced safety management system (SMS) in 1991, to address the safety issues on site (Shafique and Rafiq, 2019). The SMS has, however, not been effective in improving safety on site (Ibid). In addition to current safety measures within the SMS, Shafique and Rafiq (2019) recommends the use of construction robotics in dangerous places (See Figure 3.5).

The Australian Work Health and Safety Strategy (2012–2022) is a regulatory framework introduced in Australia, with the aim of reducing work-related fatalities by 20%, and serious injuries by at least 30% by 2022 (SWA, n.d). Construction has been cited as one of the sectors that will assist in meeting the 2022 targets (Ibid). Both Nigeria and Malaysia have OHS regulationsalthough compliance and enforcement is poor (Umeokafor et al., 2020; Belayutham et al., 2019).

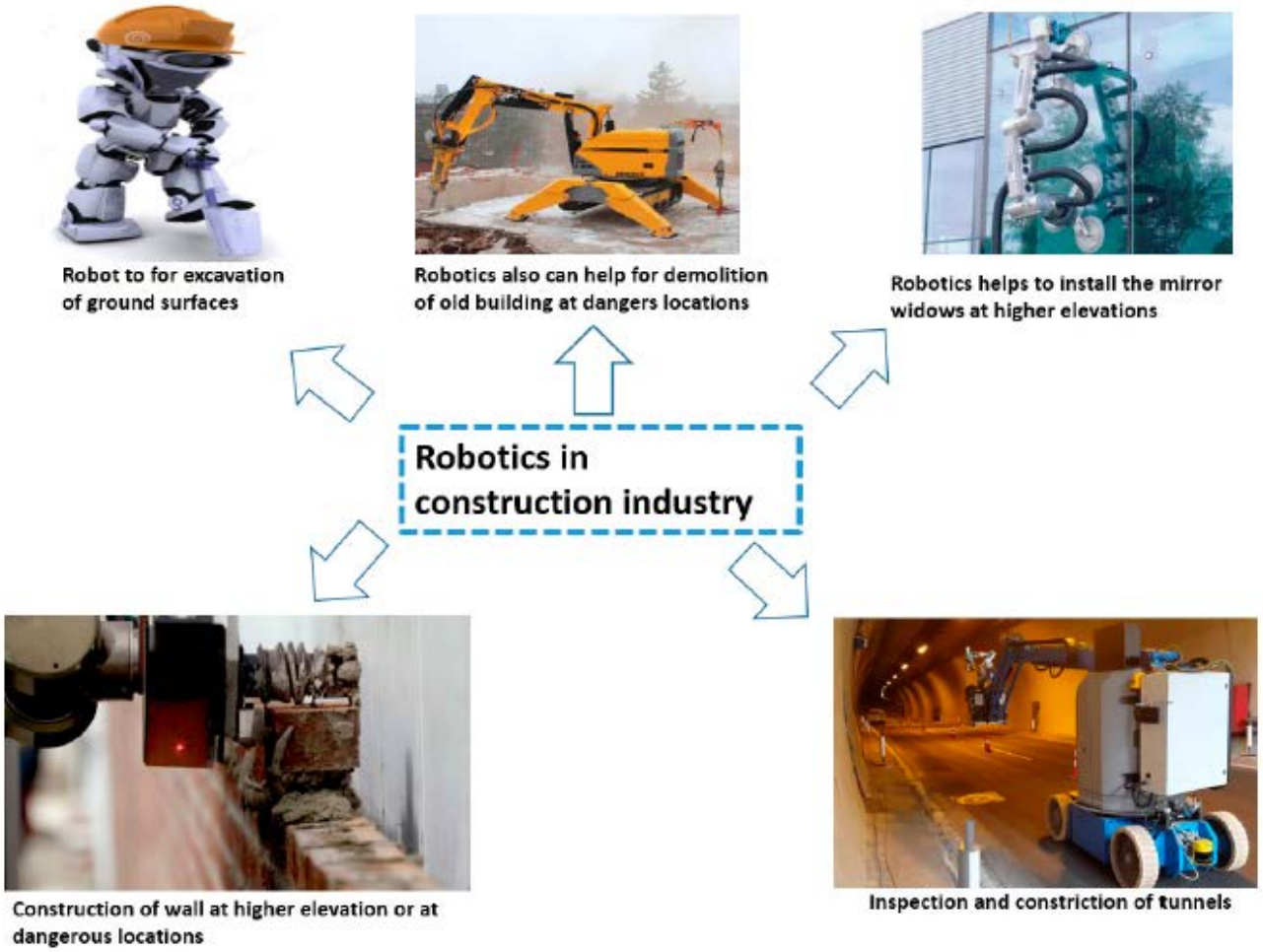


Figure 3. 5 Construction robotics (Shafique and Rafiq, 2019)

From the foregoing discussion, it is evident that OHS is also a major issue in Commonwealth countries. What has been the influence of OHS in the quantity surveying profession? Unlike the UK, health and safety is not a mandatory competence for quantity surveyors in Hong Kong (HKIS, 2012). In Australia, knowledge of OHS is classified as a support quantity surveying competency (Australian Institute of Quantity Surveyors, 2012).

In a study on the perceptions of Nigerian quantity surveyors on OHS in Nigeria by Famakin and Fawehinmi (2012), they recommend quantity surveyors to incorporate health and safety in their contract documents. According to Salleh et al. (2014), the competencies of a quantity surveyor as identified by the RICS are also recognised competencies in Malaysia. Therefore, knowledge of OHS is a mandatory quantity surveying competency in Malaysia.

What is not certain in all the Commonwealth countries under review is the extent of the role that quantity surveyors play in OHS. It is also not clear if their role is new, or an extension of their current role. Nevertheless, it is evident that OHS has a positive effect on the quantity surveying profession.

3.4.18.4 Economic

3.4.18.4.1 Whole-life cycle costing (LCC)

LCC has been embraced by quantity surveying in all the four Commonwealth countries as one of the non-traditional role of a quantity surveyor (Chong et al., 2012; HKIS, 2020c; Olanrewaju, 2013; RISM, n.d; Smith, 2004). What has not been established is the extent to which LCC is practised by quantity surveyors in all the Commonwealth countries. Olanrewaju (2013) study of quantity surveyors in Nigeria revealed that LCC was one of the services infrequently provided in Nigeria. LCC may not be as widely practised in developing countries as in developed countries.

3.4.18.4.2 Facilities management

Facilities management is listed as one of the non-traditional role of quantity surveyors in all the Commonwealth countries of Australia, Hong Kong, Malaysia and Nigeria (Chong et al., 2012; HKIS, 2020c; Olanrewaju, 2013; RISM, n.d; Smith, 2004). Similar to LCC, the extent of service may vary from country to country, with the developing countries lagging behind the developed countries.

3.4.18.4.3 Recession

The Global Financial Crisis (GFC) of 2008 had an influence in global construction markets (Frei, 2010; Ho, 2013; Ramdav and Harinarain, 2020). As the construction sector is one of the socio-economic systems within which quantity surveyors operate, any influence on the construction sector is likely to have an influence on the quantity surveying profession (Frei, 2010). Frei (2010) claims that, within the built-environment professionals, quantity surveyors tend to be more sensitive to recession than other built-environment professions. There are no scientific reasons provided for this tendency, except the possibility that quantity surveyors are operating at lower profit margins than their counterparts, or their high sensitivity to economic forces, which made them to act quicker and more radically than other built-environment professionals (Frei, 2010).

As in the UK, one of the responses to recession is downsizing of human resources. In Australia, there was an oversupply of about 1 000 professionals between late 2008 and 2009 (Frei, 2010). A survey study by Rahim et al., (2013) on the survival of quantity surveying firms during times of recession in Malaysia also corroborated the claim to some degree, stating that quantity surveying firms tend to downsize during recession. Out of the 125 Malaysian quantity surveying firms that participated in the survey study, 48% did not hire new staff during recession (Rahim et al., 2013). Other implications of recession on quantity surveying include delayed fee payment from clients, clients cutting quantity

surveyors' fees, a decrease in a number of projects, and the termination of quantity surveying services (Ibid).

It is not clear how quantity surveyors in Hong Kong dealt with the global financial crisis. Responses in other countries, such as downsizing, might be indicative of the response of Hong Kong's quantity surveyors. Ho (2013) and Mo (2004) claim that during other recessions, quantity surveyors survived by seeking opportunities outside Hong Kong. A study by Olanrewaju et al. (2018), on the causes and effects of recession on the construction sector, revealed that recession had a negative effect on the construction sector and often resulted in high rates of unemployment. Although, the study did not focus solely on quantity surveyors, the majority of the respondents in the survey study were quantity surveyors. Quantity surveying firms in Nigeria are, therefore, likely to also downsize during recession.

The influence of global recession on the quantity surveying profession is, therefore, generally negative. Demand for quantity surveyors tends to decline with many quantity-surveying firms resorting to downsizing in order to survive. National recession can, however, have a positive influence on the profession. As in Hong Kong, quantity surveyors can look to other global markets to survive.

3.4.18.4.4 Consolidation and defragmentation

According to Hindle (2004), the hierarchical nature of the social structure in Britain also contributed to fragmentation in construction. Fragmentation in construction in other Commonwealth countries is, therefore, a by-product of the British class system that was brought by colonisation (Hindle, 2004). Figure 3.6 shows the social structure of the construction sector.

In the construction sector's social structure, the built-environment professionals are the masters and the contractors the subjects (Hindle, 2004). The built-environment professionals are there to protect the interest of the client against the 'charlatans', that is, the contractors. Construction contracts were developed to reinforce these adversarial relationships within the construction sector (Ibid). From Hindle's (2004) argument, fragmentation is therefore not a product of rapid urbanisation and rationalisation of work that took place during the First Industrial Revolution, but fragmentation in construction is a social construct. If fragmentation is a social construct, then the use of collaborative practices, such as the use of NEC contracts and management contracting, might be met with resistance where the hierarchical social structure is entrenched.

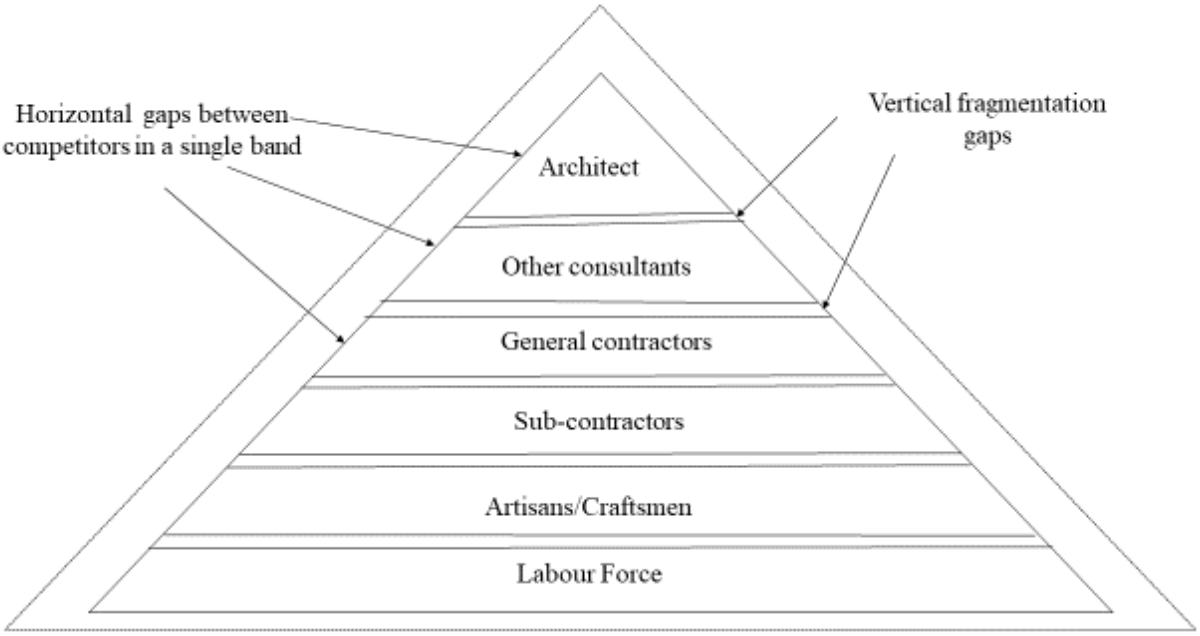


Figure 3. 6 The social structure of the construction industry (Hindle, 2004)

Although collaborative practices are becoming a norm in the UK and quantity surveyors have been able to adapt to them, the case is different in the Commonwealth countries under review. The traditional form of procurement is still widely used (Abdullah and Bandi, 2013; Brown and Loosemore, 2015; Chiu and Lai, 2020; Saka and Chan, 2020a). The current fragmentation in construction favours the built-environment professionals, including quantity surveyors, as it places them in an elite position, as compared to the contractors, as elitism means high income from the critical theories' perspective. Built environment professionals may be reluctant to embrace other procurement as this has the potential to reduce their income. Clients are likely to continue to use the traditional procurement method, partly based on the advice of those who ostensibly look after their interests. It is likely for collaborative practices to be adopted in future, especially when the benefits of such practices become imminent. Even though the NEC suite of documents is used Hong Kong and Australia (Brookfield, 2017), there is still fragmentation in the construction sector. The fragmented nature of the construction sector is arguably beneficial to quantity surveyors.

3.4.18.4.5 Public-private partnerships (PPPs)

Australia's market for PPPs as an alternative procurement method is relatively mature, as compared to Hong Kong, Malaysia and Nigeria (Refer to Figure 3.8). Hong Kong is cited amongst the early adopters of PPP (Cheung et al., 2009). The Build, Operate and Transfer (BOT) procurement system, which is a type of PPP, have been in use in Hong Kong since the 1960s (Ibid). Figure 3.7 shows the PPP maturity level of different countries between 2006 and 2011. Australia is in the same stage as the UK.

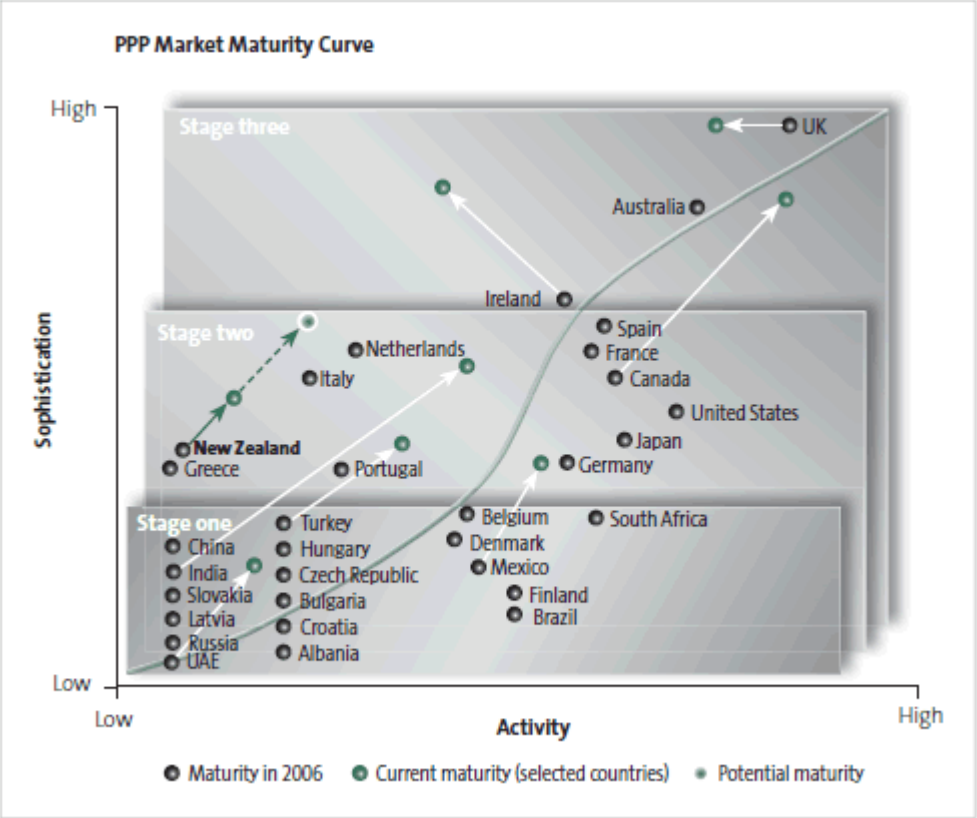


Figure 3. 7 PPP maturity curve (Office of the Auditor-General, NZ, 2011)

About 25 major projects have been implemented using PPP projects in Nigeria, which has a target to invest N32 trillion in infrastructure projects by 2020 (Alitheia, 2010 in Babatunde et al., 2012). The Nigerian Government aims to partner with the private sector in the delivery of some of its infrastructure (Babatunde et al., 2012). In comparison to other countries, Malaysia seems to lag behind other common wealthy countries in the adoption of alternative procurement methods. According to the Malaysian CIDB (2012), the traditional lump sum method was still the preferred form of procurement in Malaysia. In 2012, over 94% of construction projects were procured through the traditional lump-sum method (Abdullah and Bandi, 2013).

It is not clear what role quantity surveyors play in PPP projects in the Commonwealth countries under review. In Nigeria, the role of quantity surveyors in PPPs is currently limited (Mudi, 2016). The study by Mudi (2016), on the role of quantity surveyors in highway concession projects in Nigeria, concludes by recommending that quantity surveyors should have wider involvement in PPPs. There is no statistical data available on the extent of quantity surveyors' involvement in PPPs in other Commonwealth countries.

In Hong Kong, the HKIS (2020d) mentions that quantity surveyors are able to provide advice on the procurements methods, including the design and build, which is a type of PPP. Quantity surveyors'

level of involvement in PPPs beyond procurement advice in PPPs is not provided. The role of quantity surveyors in PPPs in Australia and Malaysia is also not clear. Given that the PPP market is still limited in Malaysia, it is reasonable to assume that the involvement of quantity surveyors in PPPs is also limited. In the case of Australia, however, where the PPP market is mature, to draw an inference that it is the same as the UK, that the quantity surveyor's role in PPPs is wide, would be irrational. Other professionals compete for roles that are available within PPPs (Mudi, 2016). PPPs, however, have the potential to increase the role of quantity surveyors (Ibid).

3.4.18.4.6 Profitability, efficiency and competition

In the study by Smith (2014), of global issues facing the project cost management professions, the study revealed that quantity surveying profession is not as widely recognised in society as the architectural or the engineering professions. Smith (2014) argues that quantity surveyors possess the skills, knowledge and competencies that can bring much-needed profitability and efficiencies in the construction sector, yet their use within the construction sector is limited. Some of the challenges facing the construction sector, such as cost overruns, can be attributed to the limited use of the quantity surveyors (Ibid).

Participants in Smith's (2014) study were the following associations for project management professionals: the International Cost Engineering Council (ICEC) , the Pacific Association of Quantity Surveyors (PAQS), the African Association of Quantity Surveyors (AAQS), the International Project Management Association, the Association for the Advancement of Cost Engineering, the China Engineering Cost Association, and the Royal Institution of Chartered Surveyors (RICS). This means that the study includes views of a sample of project cost managers from the entire globe. As stated before, in some parts of the world, different titles are used for quantity surveyors. The term 'project cost management' is therefore all encompassing (Smith, 2004).

Smith's (2014) study is further evidence that the need for a more profitable, efficient and competitive construction sector can have a positive influence on the quantity surveying profession, yet the profession remains obscure in society. Wider marketing of the profession might change the "*status quo*" (Smith, 2014).

3.4.18.4.7 Foreign competition and globalisation

Foreign competition and globalisation has an influence in all Commonwealth countries under review. For instance, in Malaysia, the increase in urbanisation has necessitated a need for different construction methods including the use of foreign companies to meet the demand (Awil, 2004). In 1998, the CIDB reported that Malaysian construction companies were active in 36 countries (CIDB, 1998 in Torrance, 2004). In Nigeria, one of the benefits of using foreign companies in construction companies is to leverage on safety in construction sites (Idoro, 2004). Chan and Leung (2017) argue that globalisation is one of the drivers of the sustainability agenda in Hong Kong. The global financial crisis of 1998–

1999 had a negative influence on the construction sector in Australia, with a decrease of 10% in the number of lenders providing loans to the construction sector (Frei, 2010).

The study by Wao and Flood (2016: 126) on "*the role of quantity surveyors in the international construction arena*," revealed that in a global market, quantity surveyors faced various complexities and competition from other professionals. Complexities faced by quantity surveyors include language barriers and the use of different contract documents and measurement methods. Competition from other professionals was mainly from civil engineers and architects who claimed that they could perform quantity surveyors' role, especially that of measuring and valuation of work on site (Wao and Flood, 2016) .

The findings by Wao and Flood (2016) are somewhat supported by the findings of a study by Oke et al, 2013. Oke et al (2013) looked at "*the impact of globalization on the role of quantity surveying in Nigeria*". Competition and legal or ethical issues have an influence on the quantity surveying profession (Oke et al., 2013). According to Oke et al. (2013), opines that globalisation can advance the quantity surveying profession. Both studies by Wao and Flood (2016) and Oke et al (2013) advocate for continuous professional development to keep abreast with global trends and competition.

In a survey study on the profile of quantity surveyors in Malaysia, only 13.5% of the 52 firms that participated in the survey provide their quantity surveying outside of Malaysia. The main reasons for not providing services outside include lack of opportunities, capabilities and resources. Singapore and China are the main markets for Malaysian quantity surveyors. England, Vietnam, Dubai, India, Brunei, Qatar, Thailand, Indonesia, Dubai and Qatar made up other markets. Income from international markets varied from 2%–30% of quantity surveyors' firms' total income (Abdullah and Haron, 2006).

In light of the financial global crisis of 2009–2010, Frei (2010) recommends quantity surveying firms in Australia to shift their international ties from western markets to Asia-Pacific. It was also the recession in the early 2000s that drove quantity surveyors to seek for opportunities outside Hong Kong (Ho, 2013). Macau, Mainland China and the Middle East provide the ideal foreign markets for Hong Kong quantity surveyors (Ibid).

However, following the 2008–2009 global recession, massive investment by Government in infrastructure has boosted the Hong Kong economy and driven the need for private accommodation and quantity surveyors (Ho, 2013). Demand for private accommodation has exposed the short supply of qualified quantity surveyors in Hong Kong (Ibid). The low pass rate in HKIS's assessment of professional competence (APC) and the number of retiring qualified members is attributed to the shortfall (Ibid). Ho (2013) claims that the shortage in quantity surveyors has resulted in unhealthy competition within the profession. To meet demand, Ho (2013) recommends the importation of foreign quantity surveyors.

From the foregoing discussion, globalisation has generally had a positive effect on the quantity surveying profession. Quantity surveyors are able to apply their skills and knowledge beyond their shores and geographic borders. The negative effects of globalisation, such as competition can be overcome by continuous professional development.

3.4.18.5 Governance

3.4.18.5.1 Government policy, legislation and regulation

Government policy, legislation and regulation has an influence on the construction sector (Harty et al., 2007; WEF, 2016). For instance, the UK's Government policy on the use of BIM is often cited as one of the drivers of wider BIM adoption in the UK (Cheng and Lu, 2015; Smith, 2014; Tang et al., 2019). Cheng and Lu (2015) argue that the government plays an important role in the adoption of BIM. Amongst the roles that government plays in the implementation of BIM is that of initiator and driver (Ibid) (Refer to Figure 3.8).

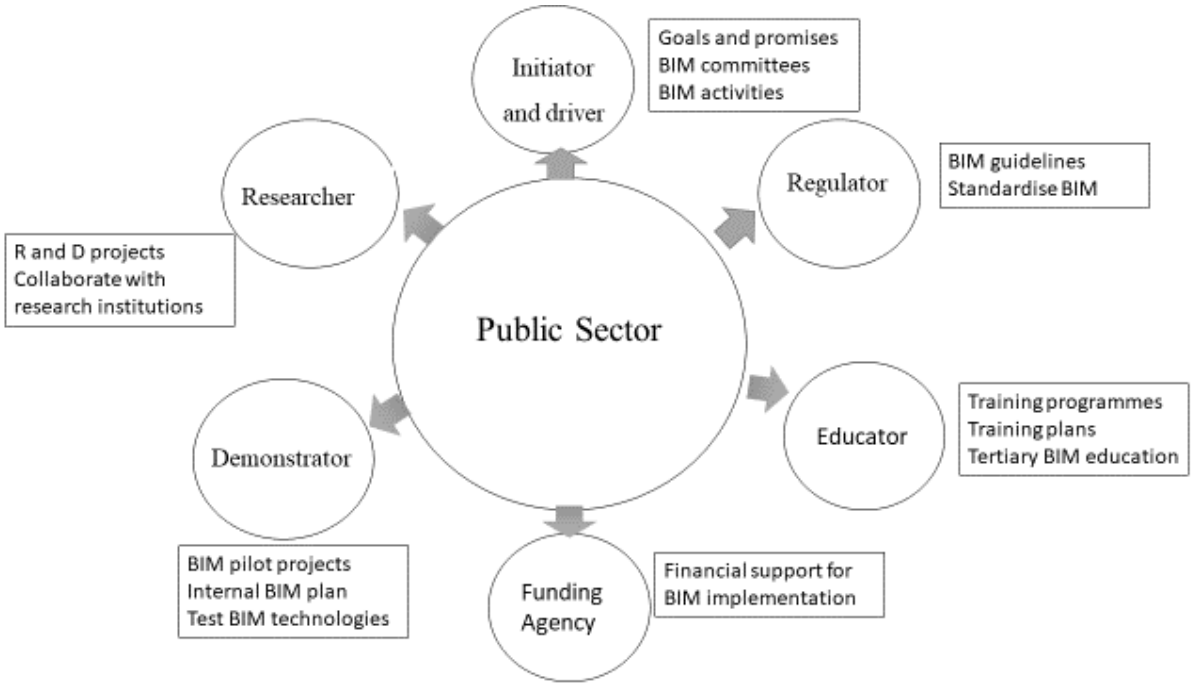


Figure 3.8 The role of government in the implementation of BIM (Cheng and Lu, 2015)

In Hong Kong and Australia, there are some standards and guidelines on BIM. The inadequate role played by the Malaysian Government in BIM adoption is cited as one of the reasons for the slow adoption of BIM in Malaysia (Cheng and Lu, 2015; Haron, 2017; Tang et al., 2019). The same sentiments are shared in Nigeria (Saka and Chan, 2020a; Alufohai, 2012).

Government policy on BIM adoption is likely to influence the wider adoption of BIM. The wider adoption within construction is also likely to influence adoption within the quantity surveying

profession. Therefore, government regulation has an influence on the quantity surveying profession. The influence might be positive or negative.

3.4.18.6 Other

3.4.18.6.1 Wild cards and major shocks

The quantity surveying profession was introduced at different times in the various Commonwealth countries. In Malaysia, the profession was introduced in the 1930s, 1843 in Hong Kong and the 1970s in Nigeria (HKIS, 2020b; Olanrewaju, n.d.; Shazali et al., n.d.). It is not clear when the profession began in Australia. There is a perception that the profession may have begun with the early English settlers (AIQS, n.d. b). Major disruptions in society and within the construction sector seem not to have had any negative influence on the profession, as the profession seem to have increased in scope.

Chong et al. (2012) claim that the quantity surveying profession in Malaysia has increased in volume and complexity. Since, its introduction in Nigeria in the 1970s, there were over 16 universities and 39 polytechnics offering quantity surveying courses (Olanrewaju, n.d). There were only 85 quantity surveyors registered with HKIS in 1984; in 2020 membership had grown to over 10 000 (HKIS, 2020b). As registration with AIQS is not compulsory in Australia, the number of quantity surveyors is unknown. In 2001, however, there were over 3 000 quantity surveyors in Australia on the AIQS database (Peter, 2004). The growth in the number of quantity surveyors is evidence that the profession has been able to survive whatever changes that were imposed on it.

3.4.18.6.2 Corruption

3.4.18.6.2.1 Nigeria

Developing countries such as Nigeria are more likely to experience high levels of corruption than developed countries (Owusu et al., 2020a; Yap et al., 2020). This is because of "*the complex nature of the construction industry, negative encouragement, and flawed regulatory systems,*" (Yap et al., 2020: 8). In developing countries, systems to minimise and curb corruption are often lacking (Owusu et al., 2020a; Yap et al., 2020). In 2019, Nigeria was ranked 146th out of the world's 180 least corrupt countries (Tranparency International, 2020a). Transparency International uses the Corruption Perceptions Index (CPI) to rank perceived levels of public sector corruption in 180 countries and territories (Tranparency International, 2020b).

Examples of construction projects that were found to have had some form of corruption in Nigeria include the vice-president's three-bedroom gatehouse apartment worth approximately US$694 444, and the East–West Road, with an initial project cost of US$580.5 million in 2006 (but a final cost of US$1.997 billion in 2017) (Ebekozien, 2020).

A study by Ameh and Odusami (2010), assessing the perceptions of the built-environment professionals regarding ethics in the Nigerian construction sector, revealed that quantity surveyors were perceived to be more susceptible to corruption in the form of bribery than any other built-environment professional. Besides receiving bribes, quantity surveyors tend to over measure certain quantities in the bills of quantities, make over-payments in interim payment certificates by paying work not carried out, inflating costs of variations, day-works and escalation (Ameh and Odusami, 2010). The unethical behaviour of quantity surveyors is attributed to situational factors within the construction sector, such as low remuneration for quantity surveying services, late payment of quantity surveying fees, and a need to bribe, in order to receive payment of professional quantity surveying fees early (Ibid). Corruption in the construction sector in Nigeria has not escaped the quantity surveyors. Ameh and Odusami (2010) recommended that the role of quantity surveyors in the procurement process of the contractor should be curtailed and quantity surveyors should be subject to continuous auditing.

3.4.18.6.2.2 Malaysia

According to the 2018 Corruption Perception Index (CPI) rankings, Malaysia was ranked 61 among 180 countries (Yap et al., 2020). Bribery, embezzlement, graft and mismanagement are common in the Malaysian construction sector (Sanusi et al., 2011). As cost and contract administrators of construction projects, Ofori and Toor (2009) suggest that quantity surveyors should curb corruption by establishing more transparent and more accountable methods in their duties. Mohamad et al. (2015) suggest education in ethics as a way of curbing corruption within the built environment professions, including amongst quantity surveyors.

RISM (2019) provides a code of conduct for its members in its constitution. Clause 13 (f) of the constitution states that, "*No member shall accept or give any illicit or secret trade or other discount, commission, or allowance in connection with any professional business which may be entrusted to him, or any goods he may order on behalf of clients,*" (RISM, 2019: 23). Whether these measures are sufficient to curb corruption is unknown.

3.4.18.6.2.3 Hong Kong

While levels of corruption in developed economies is lower than in developing economies, corruption is still prevalent in developed economies, such as Hong Kong (Locatelli et al., 2017; Owusu et al., 2020b). The Independent Commission Against Corruption (ICAC) (1998) in Hong Kong reported that a director of a construction company offered a public official HK$265 000 to disclose confidential information regarding other competing tenderers. The director used that information to offer the lowest tender and to win the tender.

Another ‘landmark’ case was that of the 26 housing blocks in the late ’60s and ’70s that were built using sub-standard building materials (ICAC, n.d; Sum 2004). Hong Kong Housing had a policy called “build cheap and build quick” (Ibid). This policy was abused, as contractors tendered at a low price and resorted to the use of sub-standard materials to make a profit (Sum, 2004). Investigations revealed that public officials were bribed by contractors with large sums of money to turn a blind eye to sub-standard work (Ibid).

In 2017, a quantity surveyor in Hong Kong was found guilty of defrauding the government of Hong Kong of an estimated amount of HK$3.9 million through the use of falsified quotations for building work (Ng, 2017; The Standard, 2017**).** Similar to Malaysia, to curb corruption within the built-environment professionals, education in ethics and codes of conduct is advocated (Liu et al., 2004). Clause 1.3 of the rules of conduct for HKIS state that members shall conduct themselves in an ethical manner (HKIS, 2017). Whether these measures are effective in curbing corruption within the quantity surveying profession is not clear.

3.4.18.6.2.4 Australia

An empirical study by Zarkada-Fraser and Skitmore (2000) revealed a willingness amongst stakeholders to engage in collusive tendering practices in Australia. Other forms of corruption in the Australian construction sector include bribery, extortion and threats of violence (Brown and Loosemore, 2015). In 2014, the prime minister of Australia established a Royal Commission to investigate issues regarding corruption (Ibid).

In another study by Vee and Skitmore (2003), where a survey was used to determine the level of professional ethics in the construction industry in Australia, the respondents indicated that they have witnessed or experienced unethical behaviour, such as collusive tendering (44%), fraud (35%) and bribery (26%). Even though the respondents were project managers, architects and building contractors, the findings are indicative of unethical practices within the built environment professionals.

AIQS has a code of conduct to which its members must adhere. Clause 3 of the code of conduct states that members must carry out their duties in an ethical manner (AIQS, 2020). Since AIQS membership is not necessary in Australia, it is uncertain how effective the code of conduct in dealing with unethical practices amongst quantity surveyors is.

Unless corruption within the quantity surveying profession is not dealt with effectively, corruption might ‘murder’ the profession. In fact, corruption might be an even a bigger threat to the profession

than technology or BIM. Trust is core to the client and profession's relationship (Abbott, 1988; Susskind et al., 2017).

3.4.18.7 Summary of discussion on factors influencing the construction sector in Commonwealth countries

It is evident that there are similar factors affecting the construction sectors in the Commonwealth countries under review. What differs is the extent of the effect. Developing countries seem to share similar effects and developed countries seem to share common effects. Corruption for example, is more common in developing countries than it is in developed countries. Wider BIM adoption in developed countries seems to be advancing much faster and wider than it is in developing countries.

The next section not only looks at the development of the quantity surveying profession in South Africa and the factors that are influencing change in the profession. Evidence that shows that the factors that are influencing change in the quantity surveying profession in the UK and other Commonwealth countries, are also influencing the South African quantity surveying profession, is also provided.

3.5 Factors that are influencing the construction sector and their possible implications on the quantity surveying profession in South Africa

3.5.1 Past factors that have influenced the construction sector

The history of the quantity surveying profession shows that politics and the economy have had an influence on the construction sector and the quantity surveying profession. Other factors that have influenced the construction sector in the past include innovation in design and the increased use of steel and concrete in buildings (Maritz and Sigle, 2016).

The next section provides evidence of factors that are starting to influence the quantity surveying profession in South Africa, as in the UK and elsewhere in the world. As with other countries, the Harty et al. (2007) framework is used to analyse the implications of these factors on the quantity surveying profession in South Africa.

3.5.2 The implications of current factors influencing the construction sector and the quantity surveying profession

3.5.2.1 Technological

Brandon et al. (1990) claims that professions survive as a result of the uniqueness of their knowledge. As stated before, one avenue for a profession's claim to its legitimacy and existence is through its jurisdiction over specialist knowledge (Abbott, 1988). It is mainly construction cost knowledge that gives the quantity surveying profession legitimacy to claim its position in society. It allows it to create, what Abbott (1988) describes as a jurisdiction or a 'heartland' over this knowledge. Anyone who wants

to exercise this authority must go through the process of professionalisation. Transgressors are often liable for punishment by law, particularly in countries where the professions are legislated.

The work identified by SACQSP as quantity surveying work sets a boundary of jurisdiction for the South African quantity surveyor. It gives them a heartland and full rights to exercise their function without interference from encroachers. Quantity surveyors in South Africa therefore have a monopoly over construction cost knowledge.

Technology, such as the Internet of Things (IoT) is threatening the jurisdictional claims of the quantity surveying profession, by making its knowledge easily accessible to the broader society (Susskind et al., 2017). For instance, costing software could see the demise of the quantity surveying profession. These software applications are able to do, amongst other things, quantity take-off, estimating, valuations, cost reporting and cash-flow projections. Developers of these software usually market these software applications to non-quantity surveyors (Buildsmart, n.d). It is not known how many contractors, estimators or clients are using these software applications in South Africa. The extent of the encroachment technology and its influence on the quantity surveying profession is, thus, not yet determined.

Similar to other Commonwealth countries, the use of BIM in South Africa is still limited. Lack of support from Government, in the form of legislation or policy, is cited as one of the reasons for the slow adoption of BIM. There are currently no BIM standards or BIM guidelines in the implementation of BIM in South Africa. Other reasons for the slow adoption is a lack of demand from clients and resistance to change within the Architectural, Engineering and Construction (AEC) sectors (Chimhundu, 2016).

In spite of this, BIM technology was used in the construction of Nelson Mandela Bay and the Mbombela soccer stadiums in preparation for the 2010 FIFA World Cup. The use of BIM technology in South Africa is, however, still limited to 3D modelling and clash detection (Gurung, 2020). The main users of BIM technology are managers or designers in organisations, who use BIM for construction simulation, cost estimation, and management purposes (Kekana et al., 2015).

Even though BIM adoption in South Africa has slowed down because of lack of interest from the private sector, underfunded public sector and cheap labour force (Korf, 2019), there is evidence that wider adoption in future is likely to happen. Organisations such as the BIM Institute for Africa, the BIM Academy Africa, and BIM Africa are working on creating BIM standards and guidelines for wider adoption, not only in South Africa, but also in Africa. Sixteen universities received curricula from BIM Academy Africa (Harris, 2019). BIM Africa aims to educate 500 000 African construction organszations on BIM in three African countries by 2025 (Akintola et al., 2017a; Kekana et al., 2015; Korff, 2019).

The influence of BIM on the quantity surveying profession is currently limited. Wider adoption of BIM, in future in South Africa may reduce the jurisdictional control the profession has over construction cost. The reduction or the loss of jurisdictional control has the potential to lead to the de-professionalisation of the profession or relegation to a subordinate profession or extinction of the profession. Since the quantity surveying profession in South Africa is legislated by the Quantity Surveying Profession Act, 2000 (Act 49 of 2000), the threat of de-professionalisation raises questions of relevance of the Act and its juristic persons, the SACQSP. What are the implications of the reduction or possible loss of jurisdiction for the quantity surveying profession, including the legislative framework that governs the profession? This study seeks to answer this question.

3.5.2.1.1 Standardisation and off-site construction

The use of off-site construction in South Africa is limited. Unlike in other countries, such as Malaysia, where off-site construction is used in the provision of residential apartments, in South Africa, off-site construction is mainly used in the provision of toilets, temporary site offices, and as extensions to existing buildings (Dupwa, 2017).

Findings of the study by Dupwa (2017) on the use of modular construction in South Africa revealed that the built-environment professionals' client's incorporated modular construction in 11% of residential, 39% of commercial, 28% of industrial, 22% of institutional, and 4% of mining projects. The poor adoption of off-site construction in South Africa is attributed mainly to the negative attitude that the general public of South Africa have towards off-site construction. South Africans value personal space and the notion of being in direct contact with the land. Thus, having one's own land and dwelling is preferred over other forms of residences (Dupwa, 2017).

Another barrier to wider adoption of off-site construction was high cost. To overcome the challenge of cost, the study by Dupwa (2017) recommends financial institutions and banks to offer clients using off-site construction funding. The study further recommends that quantity surveyors should be used to sway financial institutions and banks into funding off-site construction, "*I recommend new construction funding vehicles to be offered by innovative financial institutions, utilizing novel methods such as independent quantity surveyors to measure and guarantee performance,*" (Dupwa, 2017: 88).

Given the current limited use of off-site construction in South Africa, quantity surveyors' involvement in off-site construction must therefore be limited. From Dupwa (2017), it is likely that the quantity surveyors' role in off-site construction might increase in future. Whether, this will be positive or negative for the profession is uncertain. In the UK, there are fears that off-site construction might take away some of the tasks of the quantity surveyor, such as measuring and costing (Chan and Gao, 2019).

In South Africa, however, it seems as though off-site construction might create a new and extended role for the quantity surveyor.

3.5.2.1.2 Automation and the use of robots

Similar to other developing countries such as Nigeria, the adoption of CAR in the construction sector in South Africa is limited. Findings of a study on the willingness of the South African construction sector to adopt CAR revealed that the built-environment professionals are willing to adopt CAR (Akinradewo et al., 2018). Wider adoption of CAR in South Africa might not be desirable, given that the use of CAR may lead to unemployment (Frey and Osborne, 2017). In spite of the benefits of CAR and the willingness of the built environment professionals to adopt CAR wider adoption of CAR in the near future is unlikely.

Unemployment in South Africa was at 27.5% in 2018 (StatsSA, 2018a). The South African Government aims to reduce unemployment to 6% by 2020 (NDP, 2011). One of the strategies used by the Government to create jobs is through the use of labour-intensive projects (DPW, 2015). Currently, the influence of CAR on the quantity surveying profession is minimal.

3.5.2.1.3 3D technology (3D printing of buildings)

There is currently no evidence of the use of 3D technology in South Africa. The use of 3D technology in South Africa has, however, the potential to improve housing delivery (Aghimien et al., 2020). It is unlikely that the benefits of 3D printing, such as better quality and faster delivery, will persuade stakeholders in the construction sector to shift from current delivery practices. Currently, the influence of 3D on the quantity surveying profession is negligible.

3.5.2.1.4 Smart construction materials

Similar to other Commonwealth countries, the use of smart materials in construction in South Africa is limited. Given the benefits of the use of smart materials, such as better performance and being environmentally friendly, it likely that the use of smart material might increase in future. Currently, however, the influence of smart construction materials on the quantity surveying is limited.

3.5.2.2 Environmental

3.5.2.2.1 Sustainability

South Africa is the 14th largest carbon emitter worldwide (Anon, 2018). Buildings contribute 25% of all national greenhouse emissions (Ampofo-Anti et al., 2016). The Green Building Council of South Africa (GBCSA) is one of the organisations that is driving the green agenda in South Africa (GBCSA, 2017). Using various rating tools, the GBCSA assesses buildings and certifies them compliant if they meet the set requirements (Ibid).

Since the GBCSA was established in 2007, 36 buildings in South Africa have since been awarded the Green Star SA rating [1,3] (World Green Building Council, n.d). The study by Windapo (2014), on the drivers of green building in the construction sector in the Western Cape in South Africa, revealed that the key drivers of the green building were the Green Star rating system, competitive advantages, the increasing energy cost, and legislation.

From 1 June 2019, the Carbon Tax Act (Act No. 15 of 2019) came into effect in South Africa (Department of National Treasury, 2019). The Act aims at reducing greenhouse emissions by making polluters pay (SARS, 2020). It is evident that the sustainability agenda in construction in South Africa is growing.

Findings of the study by Coetzer and Brent (2015) revealed that the perceptions held by property developers (that green building design is too expensive) were misguided. Given their construction cost knowledge, quantity surveyors are best suited to deal with perceptions that clients have regarding cost of green buildings. The current traditional procurement method may be a limiting factor in the increased involvement of quantity surveyors in sustainability. Early involvement of quantity surveyors in the design phase of buildings is always recommended if quantity surveyors are going to make a meaningful contribution (Ade-Ojo and Fasuyi, 2013).

Given that the sustainability agenda in still relatively new in South Africa, the extent of quantity surveyors' current involvement in green buildings is not yet determined. Some of the skills required to operate in sustainability is the ability to perform energy and carbon calculations (Chamikara et al., 2020). Courses included in quantity surveying university curricula should incorporate such calculations. Whether that is the case in South Africa is not established. Limited knowledge of sustainability in construction may, thus, inhibit quantity surveyors from taking advantage of advising in sustainability in the built environment even when they are involved from the design phase.

It is not determined how quantity surveyors in South Africa will take advantage of increased awareness of sustainability. Sustainability advice is currently not listed amongst quantity surveyors' role. The SACQSP APC does not mention sustainability as one of the competencies required by a professional quantity surveyor (SACQSP, 2015b).

3.5.2.2.2 Urbanisation

Rapid urbanisation strains the supply of housing and associated infrastructure in urban areas (Oke et al., 2017; WEF, 2016). The rate of urbanisation in South Africa between 2015 and 2020, was estimated at 1.97% (CIA, 2019). In 2016, the housing backlog in South Africa was estimated at 2.1 million

(*Engineering News*, 2016). As a developing country, urbanisation has a positive influence on the quantity surveying profession in South Africa (Feinberg, 2017).

3.5.2.2.3 Occupational health and safety (OHS)

Similar to other developing countries, South Africa has poor health and safety records. It was reported that in 2012, there were 258 accidents and 56 fatalities in the South African construction sector (Enslin, 2013). In an effort to improve safety on site, the Department of Public Works (DPW) requires quantity surveyors to include, in the bills of quantities, the provisions of the Occupational Health and Safety Act. In the preliminaries section on the bills of quantities, items related to the provisions of the OHS Act must be itemised and properly described for pricing by contractors (DPW, 2014). The inclusion of OHS provision within the bills of quantities seems, however, to be an extension of the current role of quantity surveyors and not a new role. OHS influence on the quantity surveying profession is currently minimal.

3.5.2.3 Human

3.5.2.3.1 A decrease in skilled trades or a consolidation of professions

Current legislative framework governing the built-environment professionals in South Africa does not encourage a consolidation of professions. The identification of work, as envisioned in Section 20 of the CBE Act of, for instance, are meant to create clear demarcations for the roles of the built environment professionals (CBE, 2000). The six built-environment councils regulated by CBE are, the SACQSP, SACAP, ECSA, South African Council for the Landscape Architectural Profession (SACLAP), SA Council for the Property Valuers Profession (SACPVP), and the South African Council for Project and Construction Management Professions (SACPCMP) (CBE, 2018a, 2008b). Each of the built environment councils have their own act governing them (Maritz and Sigle, 2016).

Even though technology, including BIM, has the potential to blur professional boundaries, it is not certain how the legislative framework will respond to technological encroachment. Will the wider adoption of BIM, for instance, make the legislative framework redundant or will legislation keep the professional boundaries intact?

Current legislative framework governing the quantity surveying profession is, however, favourable towards the profession. Through legislation, the profession is able create its own monopoly and to keep competition at bay. The reservation of work for quantity surveyors through legislation is akin to apartheid laws that reserved work for Whites (Hepple, 1963; Mariotti, 2012). During the apartheid era, transformation within the labour markets was brought by economic forces (Mariotti, 2012). As the Whites felt constrained by the apartheid laws and moved up the economic ladder through education, the Blacks filled the gaps left in semi-skilled jobs (Ibid). The current legislation is meant, amongst others, to protect the public from being taken advantage of by unscrupulous quasi-professionals. However, legislation might inadvertently keep the profession from meeting changing market demands.

3.5.2.3.2 Education and training requirements

As a developing country, South Africa has major infrastructure needs, which requires skilled human resources to meet these needs. The South African Government adopted the National Development Plan (NDP) in 2010, as its 20 year economic growth plan (KPMG, 2014). According to the NDP, R11.8 trillion is the required budget amount required to reach the NDP's infrastructure target by 2030 (KPMG, 2013).

South Africa has a shortage of skilled construction workers, such as plumbers, electricians, fitters, welders and carpenters (Windapo, 2016). Poor basic education is one of the reasons attributed to this shortage (Ibid). Within the built-environment professions, the quantity surveying profession is listed amongst the critical skills needed in South Africa (DHA, 2014). The Department of Home Affairs (DHA) is currently inviting foreign skills through critical skills visa applications (Ibid). An ageing workforce and minimal new entrants into the profession are contributing factors to the shortage of quantity surveyors (Eppenberger and Haupt, 2009). The average age of a practising quantity surveyor in 2009 was 53 years' old (Venter, 2009).

The needs of a developing country, such as South Africa, require more quantity surveyors to be trained. There are currently 13 institutions of higher learning offering studies in quantity surveying in South Africa (SACQSP, n.d.a). No data on the number of students registered is currently available. Pandor (2009 in Venter, 2009) states that the number of entrants into the profession needs to quadruple to meet demand.

In 2018, there were 2 236 professionally registered quantity surveyors and 2 303 registered candidate quantity surveyors in South Africa (PR Newswire, 2019). Only half of the 600 new applicants accepted each year attain candidate registration (Lyons, 2015). Failure to attain registration is attributed to inadequate education or lack of employment suitable for training a candidate quantity surveyor (Ibid).

It is evident that the current supply of quantity surveyors does not meet the demands of the economy, hence, the need to import foreign skills. Besides importing skills, there are initiatives to develop skills within the construction sector, such as the Expanded Public Works Programme (EPWP) and Construction Education and Training Authority (CETA).

The Expanded Public Works Programme (EPWP) is a South African Government programme that aims to reduce poverty by providing training to the unemployed through providing temporary employment in labour-intensive projects (Skosana et al., 2019), Amisi, Maseko and Lukwago-Mugwerwa, 2016, Henderson, 2017). CETA provides monetary incentives to employers who provide learnerships to candidate quantity surveyors (Lyons, 2015). Whether these initiatives will be enough to fill the shortage of skills gap remains to be seen.

Currently, the shortage of skills is advantageous to the quantity surveying profession as they can command high fees. ASAQS (2018) states that the salary of quantity surveyors per annum was R971 000 in the Western Cape, R868 485 in Gauteng and R769 374 in Limpopo. Global middle-class income is (after tax) an income of between US$700 and US$5 000 per month (CDE, 2013). A quantity surveyor in the Western Cape earns about US$4 760 per month. Quantity surveyors in South Africa are, therefore, well paid. A shortage of quantity surveyors versus demand could possibly be one of the contributing factors to high salaries of quantity surveyors.

3.5.2.4 Economic

3.5.2.4.1 A consolidated and defragmented construction industry

The professional system, which is still widely used in South Africa, was firmly entrenched in the 1860s (Winch, 2000). Ashworth et al. (2013) refers to the professional system as the value and measure system. Even though the professional system has some advantages, its biggest disadvantage is that it is litigious (Cartlidge, 2006). The division between design and construction is the main reason for most of the disputes in the construction industry, as contractors and sub-contractors are not involved in the design stage of the process.

The professional system makes it conducive for contractors to claim for additional payments. If contractors are not happy with the final account amount they are more likely to put forward claims for additional payment. Furthermore, during lean economic times, contractors usually look for 'loop holes' in the contract to see where they can claim (Ashworth et al., 2013; Cartlidge, 2006).

The contract documents used in the professional system are usually adversarial and inadvertently promote claims (Cartlidge, 2006). Final accounts usually take time to conclude (if ever concluded) in this system (Ibid). This has resulted in the industry seeking to consolidate and unify the parties involved in construction through new forms of contract documentation and other types of contractual arrangements such as 'design and build', turnkey and Public-Private Partnerships (PPPs). New forms of contract, such as the New Engineering Contract (NEC) were introduced in the UK in the 1990s, with the aim of engendering teamwork between the various parties involved in construction (Barnes, 2013). Because of the NEC's simple and clear language, disputes and ambiguity associated with the language often used in the traditional contracts have been reduced (Patterson, 2009). In the 12 years since the NEC's introduction, there was only one case law regarding the implementation of the NEC (Ibid).

Although the South African construction sector still follows the professional system, and still uses litigation-prone traditional contracts, the contractual developments in the UK provide sufficient evidence to suggest that the South African construction sector will follow suit. Even though the NEC contract document is not currently widely used in the construction sector in South Africa, the Construction Industry Development Board (CIDB) includes it amongst the list of construction contracts

that can be used in construction projects in South Africa (CIDB, 2015). In spite of possible resistance from the users of current practices, this is evidence that the South African construction sector may in the near future move towards collaboration and teamwork. With these envisaged 'teamwork' and 'collaboration' developments in the construction sector, what will the role of the quantity surveying profession be?

As stated, previously, of all the built environment professionals, the quantity surveying profession is the most dependent on the retention on the 'professional system' for survival. Collaborative practices within the built-environment socio-technical system warrants a need for the quantity surveying profession to redefine its role within the system. Will the profession in South Africa be able to retain its status? Will it be relegated to a subordinate role in comparison to other professional members? Will it survive? The study attempts to address some of these questions.

3.5.2.4.2 A wider use of whole-life costing

One of the drivers for the demand for whole-life cycle costing (LCC) in the construction sector is the need to conserve and use non-renewable resources efficiently (Brandon, 1990). Clients also want to see evidence of their cost of ownership (Ashworth et al., 2013). Advantages of whole-life cycle costing include that LCC takes into account not only the initial capital building cost but also the repairs, running and replacement costs (Ibid).

The implication of LCC on the quantity surveying profession in South Africa is that quantity surveyors will be thrust to the front with the design team. The days of the 'professional system', of waiting for the design team to complete the drawings before the quantity surveyor provides an initial cost, seem to be numbered. Quantity surveyor's knowledge of construction materials and technology will play more of an important role than before. In addition, the calculations associated with whole-life cycle costing are complex and involve an understanding of the principles of discounting the value of future receipts and payments (Ashworth et al., 2013). If quantity surveyors are thrown to the forefront, what changes will this bring to the structure and arrangement of the current built environment socio-technical system?

3.5.2.4.3 Facilities management

Currently, facilities management is not listed as one of the roles of quantity surveyors in South Africa (ASAQS, n.d). In a SWOT analysis of the South African quantity surveying profession, Ramdav and Harinarain (2020) identified FM as an opportunity for the quantity surveying profession. From Abbott's system of professions, FM might be a contested area within the built environment socio-technical system. Architects and other property professionals might also contend for the FM role. How CBE will adjudicate on who gets the FM role in South Africa will be of interest.

Currently, South African Facilities Management Association (SAFMA) is recognised by the South African Qualifications Authority (SAQA) as a professional body with the authority to accredit and

certify facilities professionals, practitioners and supervisors. Even though SAFMA identifies areas of work for FM, these areas of work are not legislated. Some roles of FM include project management, risk management, financial management, quality management and information management, which are arguably in the quantity surveying profession's domain (SAFMA, n.d).

Facilities management courses are offered as short courses in various institutions of higher learning in South Africa. The Cape Peninsula University of Technology is currently phasing out its Baccalaureus Technologiae (Btech) degree in FM and replacing it with an advanced diploma in FM (CPUT, n.d). The FM course is intended for persons in the construction management field (Ibid). This is another evidence of contestation regarding FM in South Africa. Which current built environment profession will eventually claim FM in future remains to be seen. FM might also develop into its own independent profession in future.

3.5.2.4.4 Recession

Even though the GFC of 2008 had a major effect on the construction sector in other countries, the influence of the 2008 GFC was not significant in South Africa. In fact, the years leading up to the FIFA 2010 World Cup in South Africa are regarded as the boom years in the South African construction sector (Madiba, 2019; Rossouw, 2013).

During the years leading up to the 2010 FIFA World Cup, the South African Government invested in major construction projects, such as the building of stadiums, roads, rail infrastructure and accommodation (Baloyi and Bekker, 2011; Briedenhann, 2011). As an indication of some of the costs involved, US$3 billion was spent on the Gautrain, a commuter rail system linking Johannesburg with the OR Tambo International Airport and the city of Pretoria. No official, final cost of stadiums available (Baloyi and Bekker, 2011). However, Table 3.5 shows estimated final costs of stadiums.

Table 3. 5 2010 World Cup stadiums budgeted cost versus estimated final cost (Baloyi and Bekker, 2011)

Stadium	Budgeted cost	Estimated final cost
FNB Stadium	R2.2 billiom	R3.7 billion
Ellis Park	R240 million	R253 million
Moses Mabida	R1.6 billion	R3.1 billion
Mbombela	R600 million	R1 billion
Green Point	R2.9 billion	R4 billion

Nelson Mandela Bay	R2.1 billion	Unknown
Peter Mokaba	R1.3 billion	Unknown
Royal Bafokeng	R360 million	R483 million
Mangaung	R245 million	R359 million
Loftus Versfeld	R122 million	R131 million

During recessions, however, quantity surveyors in South Africa, tend to reduce their fees to unsustainable levels to secure work (Ramdav and Harinarain, 2020; Smith, 2002). As clients become accustomed to paying lower fees, it becomes difficult to increase fees after the recession (Ibid). Recessions, therefore, tend to have a negative influence on the quantity surveying profession.

3.5.2.4.5 Public-private partnerships (PPPs) and private funds initiatives (PFIs)

When it came into power in 1994, the new democratic South African Government inherited a severe backlog in physical infrastructural development from the previous government. In 1997, the Department of Public Works estimated that the construction sector had to contribute at least fifty per cent (50%) to fixed-capital investments, in order for South Africa to meet its economic development target. As a result, the South African Government seeks partnerships with private parties to meet the demand (Gordham, 2013; Department of Public Works, 1997).

There were 21 PPP projects signed off as at February 2013, and 69 projects in preparation and registered, in terms of Regulation 16 of the National Treasury in South Africa (PPP Unit, 2015). The finding of the study by Llale (2015) on the role of quantity surveyors in PPP projects in South Africa concluded that, "… *although quantity surveyors possessed the relevant skills and competences required in a PPP project, their current involvement was limited.*" Quantity surveyors' role was limited to that of mainly providing the capital cost (Llale, 2015). In the UK, where the PPP market is much more mature as compared to South Africa, quantity surveyors' participation in PPPs is far greater (United Nations Economic Commission for Europe, 2008; Cartlidge, 2006).

Should the PPP market in South Africa mature as it did in the UK, South African quantity surveyors' involvement is likely to increase. However, will their role in PPPs offer a wider range of services or will it still be limited to the determination of capital cost? Will quantity surveyors' jurisdiction remain intact or will it be in a subordinated role?

3.5.3.4.6 A more profitable, efficient and competitive construction sector

The Competition Commission of South Africa recently found several construction companies guilty of bid rigging and collusion in the construction of the 2010 World Cup stadiums. Seven of the construction companies found guilty are amongst the top nine construction companies in South Africa and are listed in the Johannesburg Stock Exchange (JSE). These companies have since entered into a settlement agreement with the government (Rossouw, 2016; Competition Commission South Africa, 2011).

After the outcome of the investigation into the 2010 World Cup stadiums' collusion, the Competition Commission's Shan Ramburuth (2013) said, "*…embedding a competitive culture will be critical to bringing down the costs of future infrastructure investments and will incentivise firms towards innovation and efficiency in future projects.*" Competitiveness within the construction sector and the built environment professions is, thus, becoming a critical issue in South Africa.

The recommended tariff of professional fees issued by SACQSP and used by quantity surveyors for fee purposes has also recently come under heavy repression from the Competition Commission of South Africa. The Commission purports that the tariff of fees is anti-competitive and amounts to price fixing. The SACQSP has applied for an exemption to continue to publish the tariff of fees. The application is yet to be adjudicated. In addition, many quantity surveyors in South Africa have been offering huge discounts on the recommended fees in order to secure work. In the UK, fee scales have not been in use for almost three decades. While in other Commonwealth countries such as Canada, Hong Kong and Australia similar tariffs of fees are published and used by quantity surveyors for competitive tendering purposes (Prinsloo and Andersen, 2015).

The effects of the above-mentioned developments regarding competitiveness in the construction sector and the quantity surveying profession is likely to influence how the quantity surveying profession functions in future. Failure to respond in an appropriate manner may result in a loss of jurisdiction or subordination.

3.5.3.4.7 Globalisation

Technology has made the world a global village and created a 365 days a year/24 hours a day culture of work. E-commerce has virtually removed borders and made it possible for people in different countries to work together without a need to physically travel (Cartlidge, 2006). The implications of globalisation on the quantity surveying profession in South Africa has created both opportunities and threats to the profession. It has created opportunities for the profession to expand to other countries, to acquire international clients and partners. The potential threats include that the profession will not only have to compete with other professions within South Africa, but also with other global competitors.

Another example of a global factor that might have an influence on the South African quantity surveying profession is BRICS. The acronym 'BRICS' stands for Brazil, Russia, India, China and South Africa.

BRICS' objective is to increase multi-polarity in the world by challenging bias toward Western countries in the conduct of world affairs. Before South Africa became a member of this geo-political formation, it was known as 'BRIC'.

Brazil, Russia, India and China (BRIC) were identified by economist Jim O'Neill as countries with the potential to become the largest and most influential economies in the world by 2050. South Africa was included in the formation in 2011, first because its economy is the second largest in Africa; second, because of its rich mineral and natural resources; third, South Africa has a comparatively proper functioning financial, energy and transport sectors in comparison with other African countries; fourth, South Africa makes up 80% of the economic activities in the Southern African Development Community (SADC) and its economy is third in sub-Saharan Africa. Lastly, South Africa is leading in Africa in terms of infrastructure, financial institutions, and outward investment. Other BRICS member countries are also leaders in their respective regions. The co-operation of BRICS countries, especially in economic affairs is aimed at boosting their influence in world affairs (Sandrey et al., 2013).

BRICS has the potential to bring many economic benefits to South Africa, by opening South Africa to many global investors and partners in infrastructure development. Globalisation may increase or decrease the South African quantity surveying professions' jurisdiction. It will increase its jurisdiction, depending on its ability to be able to compete with its global challengers and to seize opportunities that globalisation brings. The converse is its jurisdiction will decrease should the profession fail to seize opportunities that globalisation brings and ward off global competition. How will the South African quantity surveying profession respond to global competition?

3.5.3.5 Governance

3.5.3.5.1 Government policy, legislation and regulation

Governance plays an important role in shaping the construction sector (WEF, 2016). Following the end of apartheid and the new democracy, the new South African Government embarked on major infrastructure projects to redress the imbalances of the past. Numerous laws have since been passed in an attempt to build a new South Africa. For instance, the PPP legislative framework came into effect in 1999 (National Treasury, 2009). An affirmation active law called the Black Economic Empowerment Act, currently amended and called the Broad-Based Black Economic Empowerment (BBBEE) Act, which aims to promote the economic development of Blacks, was passed after the dawn of the new South Africa (B-BBEE Commission, 2016; Von Steiger, 2018).

In the tender adjudication processes, including within the construction sector's tender adjudication process, the provision of the B-BBEE Act must be taken into account when awarding tenders for contractors or professional services. A scorecard on B-BBEE is used to determine points that must be

allocated to tenderers. A high score on B-BBEE increases the prospects of being awarded a tender (Von Steiger, 2018).

Whilst the wider adoption of PPPs as an alternative procurement method have the potential to positively influence the South African profession, it is debatable whether B-BBEE is a positive or a negative influence on the quantity surveying profession. Fronting and tokenism have rendered B-BBEE somewhat ineffective (Khatleli, 2009). Besides fronting and tokenism, BEE performance and implementation has not been effective (Öztürk and Jarbandhan, 2020). Government policy on the quantity surveying profession has thus been both positive and negative.

3.5.3.6 Other

3.5.3.6.1 Wild cards and major shocks

In 2008, ASAQS, having evolved from the South African Institute of Quantity Surveyors, celebrated 100 years of quantity surveying in South Africa (ASAQS, 2008). Since the profession was first introduced to South Africa in 1896, it has survived many challenges and continues to be in demand (DHA, 2014; Maritz and Sigle, 2016). This longevity is further evidence that the profession is able to adapt to the changes thrust upon it.

3.5.3.6.2 Corruption

An online survey study by Bowen et al. (2015) revealed that corruption within the South African construction sector and the built-environment profession was widespread. The most common form of corruption encountered included tender rigging (collusion), conflicts of interest, 'fronting' and 'kickbacks'. Contractors, sub-contractors and government officials were most likely to be involved in corrupt activities. Corruption was most likely to occur during tender evaluation and tendering phases of projects (Bowen et al., 2015).

The findings of another survey study by Rasmeni and Crafford (2016) on "*managing unethical conduct in the quantity surveying profession*," in South Africa revealed that quantity surveyors were generally ethical, except where their wellbeing was concerned. This means that quantity surveyors will act in an ethical manner as long as acting so does not negatively affect their livelihood (Rasmeni and Crafford, 2016).

The most common forms of unethical conduct within the quantity surveying profession are bribery, unfair conduct and fraud (Rasmeni and Crafford, 2016). Unfair conduct may be referred to as workplace harassment, such as sexual harassment, racial discrimination and workplace bullying (Rycroft, 2009). Codes of conduct from the quantity surveyors' regulatory bodies and voluntary associations, such as ASAQS and the RICS were insufficient in curbing unethical behaviour (Rasmeni and Crafford, 2016).

The younger generation within the profession, that is Gen-Yers (1977–1994) were less ethical than the older generations (Ibid). Baby Boomers (1945–1960) and Gen-Xers (1965–1976) were found to be relatively more ethical (Ibid).

The extent to which the unethical behaviour of quantity surveyors in South Africa has affected the trust of clients, and the associated impact on the profession, has not yet been established. Should unethical behaviour within the profession continue unabated, the future role of the quantity surveying profession in South Africa looks dim.

It is evident that the factors influencing construction sector elsewhere in the world are also influencing the construction sector in South Africa. Besides factors that have been mentioned in the prior discussion, other factors influencing the construction sector in South Africa include: the decline of the South African currency against the US dollar and the shortage of a reliable power supply (Isipho Sempilo, 2016). Windapo (2013) includes poverty, technology versus required skill to operate the technology, technology versus labour, unavailability of land for construction, a high rate of failure of construction companies, and an increase in building costs, as some of the challenges facing the construction sector in South Africa.

After looking at the factors that are influencing the construction sector and their implication on the quantity surveying profession, the next section discusses what literature claims will be the future of the professions, including the quantity surveying profession, given all these factors that are influencing on the profession.

3.6 The future of the professions

Susskind and Susskind (2017) predict that there are two possible futures for the professions. Technology will be the main factor driving these professions. In the first future, capable machines or systems will aid the professions in their work. This means the status core will remain, but with machines they will assist the professions to perform their tasks better. Capable machines or systems will dismantle the current professions in the second future. In the medium-term future, these two futures will run parallel, but in the long-term future the second future will be more dominant (Susskind and Susskind, 2017).

Brynjolfsson and Mcafee (2016) seem to concur with the assertion by Susskind and Susskind (2017). Even though Brynjolfsson and Mcafee's (2016) focus encompasses occupations in general, they argue that the future will be technology-based. Factors that will drive the shift in how work is carried out in future will be globalisation and demographics (Brynjolfsson and Mcafee , 2016) . Work will mainly be carried out through artificial intelligence (AI), robotics, genomic sequencing and 3D printing (Ibid).

Schwab (2017) also assents that how work will be carried out in future will be different. The Fourth Industrial Revolution will be the main factor that drives the change. Autonomous vehicles, 3D printing,

advanced robotics, new materials, the Internet of Things (IoT), sensors, blockchain and genetic sequencing are some of the technologies that will transform the future of work (Schwab, 2017). Schwab (2017), Brynjolfsson and Mcafee (2016), and Susskind and Susskind (2017) acknowledge that most Fourth Industrial Revolution's technology is still in its infancy and has yet to cause disruption in the current status quo. According to Schwab (2017), the tipping point for these technologies is predicted to happen in 2025.

A tipping point is, "*the point at which a series of small changes or incidents becomes significant enough to cause a larger, more important change*," (Lexico, 2020). Table 3.6 shows the tipping points that are expected to happen by the year 2025. For instance, by 2025, Schwab (2017) predicts that an AI machine will form part of a board of directors and that 30% of corporate audits will done by AI.

Table 3. 6 Tipping points expected to happen by 2025 (Schwab, 2017)

Estimated 10% of people that will be wearing clothes connected to the Internet	91.2%
About 90% of people that will have unlimited and free storage	91%
There will be 1 trillion sensors that will be connected to the Internet	89.2%
First robotic pharmacist in the US	86.5%
10% of reading glasses connected to the Internet	86.5%
80% of people with a digital presence on the Internet	84.4%
First 3D-printed car in production	84.1%
The first government to replace the census with the big-data source	82.9%
The first implantable mobile phone available commercially	81.7%
5% of consumer products printed in 3D	81.1%
90% of the population using smartphones	90.7%
90% of population with regular access to the Internet	78.8%
Driverless cars equalling 10% of all cars on US roads	78.2%
First 3D-printed liver transplant	76.4%
30% of corporate performed by AI	75.4%
Tax collected for the first time through blockchain by government	73.1%

Over 50% of Internet traffic to homes for appliances and devices	69.9%
Globally more trips via car sharing than in private cras	67.2%
First city with more than 50 000 people and no traffic lights	63.7%
10% of global gross domestic products stored on blockchain technology	57.9%
The first AI machine on a corporate board of directors	45.2%

3.6.1 Health professions

Many professions have to rethink their future in light of the Fourth Industrial Revolution. Desai (2018) claims that AI is already having an influence of obstetrics and gynaecology, particularly in the area of foetal heart monitoring and fertilisation. During labour, AI is used to assess cardiotocographs (CTG), that is, foetal heart and contractions of the uterus (Desai, 2018).

McGinty and Allen (2018) opine that AI may render the radiology profession obsolete. In comparison to radiologists, AI outperforms radiologists in a number of ways. The robotics that are currently in use are indefatigable and only require power and a software update to maintain. There are discussions within the radiology community in the US on how AI can be used to augment rather than replace radiologist in future.

3.6.2 Librarianship

Librarians' future is also threatened by AI. Wood and Evans (2018) claim that the biggest challenge that AI poses on the librarian profession is in machine learning, huge computing power and natural language processing. The findings of the survey study by Wood and Evans (2018), on the perceptions of librarians, revealed that librarians perceive AI as a future existential threat. Librarians are of the view that disruptive change within the profession is likely to occur in 30 years' time. According to Wood and Evans (2018), these perceptions of librarians are, however, not in sync with literature. Furthermore, these perceptions do not seem to stem from a sound basis. AI seems to be likened to computers. The perceptions seem to be that if computers did not replace librarians, AI will also not replace librarians (Wood and Evans, 2018).

3.6.3 Law profession

In the law profession, technology is systematising tasks and transforming how lawyers work (Susskind and Susskind, 2017). Tools such as ContractExpress and Exari can generate quality legal documents from interacting with users. The Internet has also made legal advice to be available online (Ibid). These and similar developments are leading law experts to believe that they could be "*replaced by advanced*

systems, or by less costly workers supported by technology or standard processes, or by lay people armed with online self-help tools," (Susskind, 2008 in Susskind and Susskind, 2017: 71).

3.6.4 Accounting profession

Technology has not spared the accounting profession from encroachment. Accountants have been cited as one of the professions most at risk of extinction due to technology (Addendorf, 2018). Accountants are usually involved in tax and auditing. The study by Frey and Osbourne (2017) on the future of employment identified the work of the tax profession as most vulnerable to technological encroachment. Only 1% of the work of tax professionals is safe from technology (Frey and Osbourne (2017).

Tax preparation software is challenging the need for tax professionals. For instance, in the USA in 2014, about 48 million people used tax preparation software to prepare their own tax returns, without the assistance of any tax professional. Although the auditing side of the accounting profession is currently not as threatened as the tax side, there is evidence to suggest that the status quo will not remain in future. The current regulatory framework governing auditing and the dominance of the Big Four auditing firms (Deloitte, KPMG, EY, and PwC) are arguably the reasons for its protection from challengers (Susskind and Susskind, 2017).

There is technology, particularly Big Data, posing a serious challenge to the current methods of auditing. Auditors usually use a sample of data to draw a conclusion about the reliability of the financial statements of an organisation. Big Data is able to deal with all the data instead of just a sample. In addition, Big Data is able to work with large data from different sources in different formats and without any formal structure (Susskind and Susskind, 2017).

Since clients depend on the opinion of auditors to make investment decisions, the biggest threat to the auditing firm may be in the area of trust. Financial scandals, such as what transpired at ENRON and similar, may be a death knell for the auditing profession. The accounting firm, Arthur Andersen LLP, approved ENRON's corporate reports, in spite of ENRON's questionable accounting practices. Following the ENRON scandal, Arthur Andersen LLP was dissolved (Ho and Wang, 2007; Li, 2010; Susskind and Susskind, 2017).

Scandals such as ENRON and Arthur Andersen LLP may cause a shift in society, from relying on professionals to alternatives perceived as more trustworthy and more ethical. Technology may be such an alternative. Given the issue of cyber crime and other moral issues related to technology, technology as an alternative to professionals may not be a perfect alternative but it is, nevertheless, a potential alternative (Susskind and Susskind, 2017).

3.6.5 Predictions about the future quantity surveying profession

This section discusses the predictions made in literature about the future of the quantity surveying profession. Luksha et al. (2015) predicted that amongst the white-collar jobs that would become obsolete by 2020 is accountancy, quantity surveying, lectureship and librarianship. White-collar jobs that would become obsolete by 2030 include legal advisory, notaries, pharmaceutical and real estate agencies (Luksha et al., 2015).

According to Luksha et al. (2015), accountants can be replaced by software. Apparently, there is software that is able to teach novices auditing and accounting basics. Luksha et al. (2015) predict that in future, intelligent software will perform quantity-surveying tasks. This is because that data that quantity surveyors process is becoming voluminous and human beings cannot process it quickly enough. They predict that in future quantity surveyors will be reduced to maintaining intelligent software and systems performing cost estimates (Luksha et al., 2015).

The accounting and quantity surveying professions are analogous in certain respects, hence, quantity surveyors are regarded as the "*construction accountants*" (Ashworth et al., 2013). Part of the work of both professions involves computing numeric data. It is argued that the computation of complex numeric data can be put in an algorithm and a computer system, which can process larger volumes and more complex data than any human being can handle (Acemoglu and Autor, 2011; Luksha et al., 2015).

The obsolescence of professions is described as a protracted process. First, there are novel experiments aimed at replacing humans with technologies. In the second phase of the process, these technologies become advanced and start replacing jobs. The final stage is when the use of technology becomes the norm even though there could be pockets of people still using past methods (Luksha et al., 2015). Figure 3.9 describes the process of the obsolescence of the profession.

There are divergent views within the quantity surveying profession about its future. The influence of BIM on the future of the quantity surveying profession has drawn different views. BIM proponents regard BIM as an enhancer to the profession (Beukes, 2014; Matipa et al., 2010; Wong et al., 2014; Wu et al., 2014). Others regard BIM as a possible substitute for the profession (Beukes, 2014; Olatunji et al., 2010). Given these divergent futures about the quantity surveying profession and the factors that are influencing the construction sector and the quantity surveying profession, what is the possible future of the quantity surveying profession? Is there one future for the quantity surveying profession?

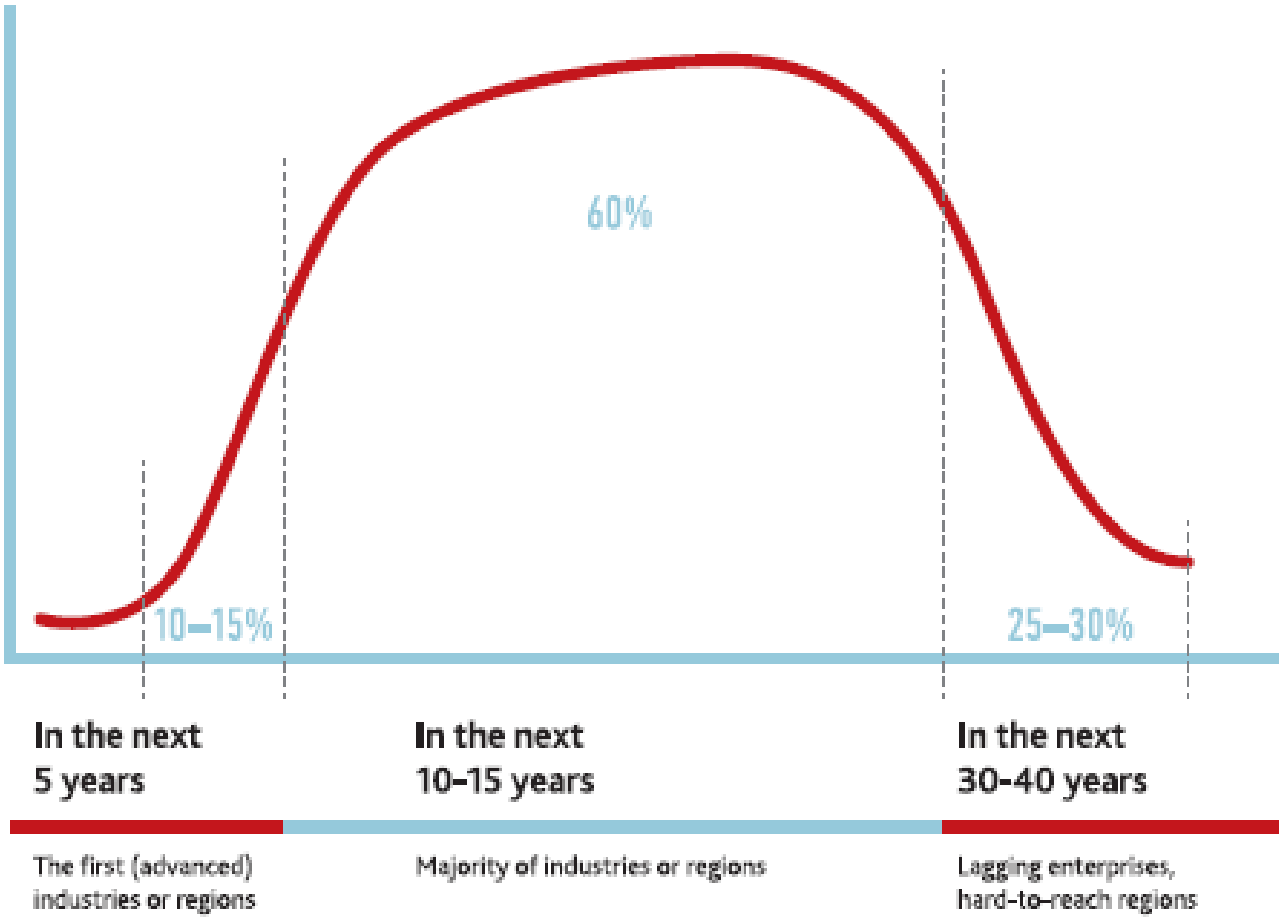


Figure 3. 9 The process of obsolescence in professions (Lushka et al., 2015)

3.7 Previous future scenarios of the South African quantity surveyor

In 1991, ASAQS published an article called, "*A scenario of the South African quantity surveying firm in the year 2005*." The article provided a scenario for the quantity surveyi
ng profession in eight themes, namely:

- Professional practice;
- Nature of work;
- Techniques;
- Manpower and education;
- Marketing;
- Communications and office systems developments;
- Insurance, group schemes, professional indemnity; and
- Viability.

The next section discusses the above-mentioned as per the 1991 ASAQS scenario of the QS profession in 2005.

3.7.1 Professional practice

ASAQS (1991) predicted that the profession would not go by the title, 'quantity surveying'. The profession would be dominated by multi-branch practices offering a wide range of services. Many of these practices will have international branches or at least be associated with international firms. Small- to medium-sized businesses will specialise in certain fields. There will also be individuals in practices who will also specialise (1991).

A cursory glance at the directory of the quantity-surveying firms published by ASAQS in 2008 and the ASAQS 2020 website reveal that the majority of firms use the title 'quantity surveyor'. Instead of quantity surveyor, a handful of firms use 'construction consultants', 'cost consultants', 'cost management consultants', 'property solutions', and 'cost engineers'.

The title 'quantity surveying', has been criticised for not capturing the work that quantity surveyors carry out accurately. It is also blamed for keeping the profession in obscurity. Proponents of the title 'quantity surveying' argue that a profession should not seek its place in society through its title but through its unique selling point (USP). They further argue that many other professions, such as the accounting and law professions, have evolved from providing basic accounting services or legal services to management consultancy and tax advisory services, although they have retained their titles. A counter-argument by those in support of changing the title, claim that the name change will assist in re-branding the profession (Ajalekoko, 2004; Ashworth et al., 2013).

"*Branding aims to establish a significant and differentiated presence in the market that attracts and retains loyal customers*," (The Business Dictionary, n.d). A good name that describes what a business provides is key in branding and to business success (Hall, 2013). Businesses that are poorly named and have to explain what they do are, therefore, in a disadvantageous position. From a cursory glance of the directory of the quantity-surveying firms published by ASAQS in 2008, as well as the current ASAQS website, the predictions made by ASAQS (1991) about the title change do not seem to have materialised. Will the current factors influencing the profession fundamentally change the role of quantity surveyors in society to justify a name change? This remains to be seen.

3.7.2 Nature of work

Technology would enable quantity surveyors to provide a wide range of services in construction cost management. The role of quantity surveyors will extend beyond final commissioning of building projects to managing operations and maintenance. Quantity surveyors would employ other professions

such as accountants, lawyers, industrial and public relations officers, personnel managers, etc. to augment their skills. The services quantity surveyors will provide will include:

- Cost control of all types of engineering works;
- Initiation of property developments;
- Package turnkey projects;
- Proposal call tenders;
- Mass housing and township developments;
- Town and regional planning;
- Valuations;
- Life-cycle costing;
- Taxation;
- Financing of projects;
- Property maintenance;
- Cost control in other fields, such as (shipbuilding, mining);
- Project management; and
- Insurance assessing (ASAQS, 1991:10).

Table 2.6 compares the traditional role and the current role of the quantity surveyor in South Africa revealed that the role of quantity surveyors in South Africa has involved to include some of the services predicted by ASAQS (1991). According to ASAQS (n.d.), the current role of quantity surveyors includes the following services, which were predicted by ASAQS (1991) turnkey projects, project management, property development advice, project management, property economics and quantity surveying services in respect of civil, mechanical, and electrical works. The role of quantity surveyors has not yet evolved, largely, to include mass housing and township developments, town and regional planning, valuations, life-cycle costing, taxation and financing of projects. Valuation falls under the ambit of valuers in South Africa and are regulated by SA Council for the Property Valuers Profession (SACPVP).

Even though not all the predictions regarding the services of the quantity surveyors by ASAQS (1991) materialised, it is evident that the quantity surveying profession is not static. Using systems theory, the profession is able to add to its jurisdiction. The ability of the profession to adapt to change is the profession's strength. Will the predictions of its doom, given the Fourth Industrial Revolution's technologies and factors currently influencing it, finally 'murder' the profession or will the profession survive? Hence the need for new scenarios for the quantity surveyors.

3.7.3 Techniques

ASAQS predicted that services of a quantity-surveying firm would be standardised and computerised. The Standard System of Measurement would be simplified. There would also be a regional cost data bank providing cost details and analysis of all projects. Indices used to calculate escalation would be available and updated monthly (ASAQS, 1991).

Bills of quantities would retain its status as a quantity surveyor's main tool of trade even though its production would be through more efficient multi-user computer systems. The improved production of bills of quantities would make it useful to all parties post tender stage. The use of Computer Aided Design (CAD) measuring would become the norm (ASAQS, 1991).

Rightly predicted by ASAQS (1991), bills of quantities are still the bread and butter of the quantity surveying profession. Quantity surveyors currently use different software to prepare bills of quantities. In comparison to manual preparation, these softwares have made the process quicker; however, not as quickly as BIM (Ashworth et al., 2013). Will BIM finally take away the role of bill preparation from quantity surveyors?

3.7.4 Manpower and education

Quantity surveying firms will constitute highly qualified, specialist and skilled quantity surveyors. Professionals such as accountants and lawyers would form part of the support system for quantity surveyors (ASAQS, 1991). Quantity surveyors do not currently employ accountants and lawyers. Instead, there are threats that accountants and lawyers might employ quantity surveyors in subsidiary positions (Ashworth et al., 2013). Is it possible for quantity surveyors to increase their positon in society to the extent that they will employ these professions? According to systems theory, it is possible. Given the quantity surveyors' current trajectory in relation to accountants and lawyers, it will not be an easy task to reverse it.

3.7.5 Marketing

Mass marketing of the profession through ASAQS and an individual firm's publicity would make the average person aware of the profession (ASAQS, 1991). Firms will conduct continuous market research to determine the ratings with clients, staff and rival firms. This is because the quantity surveying profession is regarded as an obscure profession. There is no data available to assess the profession's visibility in society.

3.7.6 Communications and office systems' developments

The influence of communication and computer technology will make quantity surveying firms unrecognisable (ASAQS, 1991). Technologies such as word processors, computers, printers,

microfilming machines, telephone and PABX, copiers, etc. would transform the quantity surveying profession beyond recognition (Ibid). ASAQS' (1991) predictions regarding communications were accurate. Current communication technologies have transformed communication within the built environment.

3.7.7 Insurance, group schemes, professional indemnity

Insurance, group schemes, and professional indemnity would, through ASAQS, be tailor-made in such a way that they will suit the needs of a transformed quantity surveying profession (ASAQS, 1991). No data is available to compare previous practices with current practices.

3.7.8 Viability

ASAQS predicted that by 2005 the quantity surveying would have become, "*an indispensable professional, economic and management consultancy firm in the property and various construction industries*" (ASAQS, 1991: 11). The quantity surveying professions would protect the contractual and financial needs of clients by providing essential and indispensable services using advanced technology and systems. Continuous research and development would keep the profession abreast with sector developments and assist the profession to increase its scope of services (ASAQS, 1991).

Quantity surveying firms will ensure their continuity by applying sound business and financial principles. It would as a result become a key profession within its sphere of activities, "*without which no client would embark on any project of consequence*," (ASAQS, 1991: 12).

Quantity surveyors have lived up to the predictions by ASAQS (1991), by increasing their role in society. In spite of its limitations, current technology and practices are safeguarding the role of the profession in society. Given current factors influencing the profession, will the status quo remain in future?

There are currently no other known future scenarios of the quantity surveying profession in South Africa, besides the scenario provided by ASAQS (1991). ASAQS (1991) provided only a single scenario. The scenario also looked only at the quantity-surveying firms. Individual quantity surveyors and the legislative framework governing the profession were ignored. One of the objectives of this study is to provide more than one scenario for the profession. The scenarios will cover the individual quantity surveyors, the firms, and the legislative framework governing the quantity surveyors. There are many factors influencing the profession, so it is likely that there is more than a future for the profession.

Another shortcoming of the scenario provided by ASAQS (1991) is that the methodology used to produce the scenario is not provided. In this study, the methods and process followed to develop the scenarios are provided. In this way, the logic of the scenario and plausibility can be critiqued.

3.9 Summary of the literature review

Chapter 3 discussed the factors influencing the quantity surveying profession and their possible implications on the quantity surveying professions. Comparisons between how these factors influence the profession in the six Commonwealth countries were also provided. The influence of these factors in developed countries are somewhat similar and how these factors influence the profession in developing countries is also somewhat similar.

The chapter also discussed literature predictions about the professions, including the quantity surveying profession. Other professions that are under threat of extinction to technology were also discussed, hence this study is used as a case study for other professions. While literature discusses threats and opportunities for the professions, literature does not provide future scenarios for the professions. The last published scenario for the quantity surveying profession in South Africa was conducted in 1991 and only one scenario was provided for the quantity surveying profession. Given the literature findings, it is therefore important to provide possible future scenarios for the profession. This is a gap the study wishes to fill and to which it hopes to contribute.

This is how the literature and research objectives covered in Chapters 2 and 3 were answered from the literature:

3.9.1 Objective One: Determine the current state of the quantity surveying profession

The current state of the quantity surveying profession was discussed. From the review of the literature, it is evident that the profession instituted based on the functionalist approach, that is, the traitist approach. Quantity surveyors are distinguished by the tasks they perform. Professional tasks, thus, give the quantity surveying profession some legitimacy in society. In South Africa, these tasks are legislated. There are possible threats, however, to some of the tasks that quantity surveyors perform. These threats might lead to changes in the tasks of the future quantity surveyor. The implications of changes to the tasks of the profession might threaten the professional status and legitimacy of the profession in society. If these tasks are replaced, will the profession still have a role to play in society? On what legitimate grounds can the profession claim its status in society? How will these changes affect the legislative framework governing the profession?

3.9.2 Objective Two: Identify socio-technological factors that are likely to influence the quantity surveying profession

and

3.9.3 Objective Three: Determine the potential influence of socio-technological factors on the current role of the quantity surveying profession

The socio-technical factors that Harty et al. (2007) identified as likely to influence the construction sector were used to analyse the influence of these factors on the quantity surveying profession. These factors include technology, the environment, the social (human), the economic, the legislative (governance) and factors, such as wild cards. As quantity surveyors operate within the construction sector's socio-technical system, the factors influencing the construction sector are likely to influence the quantity surveying profession. This assertion was supported by the evidence provided in the literature review. Possible implications of these factors on the current role of the quantity surveying profession were also discussed.

3.9.4 Objective Four: Identify the quantity surveying tasks that are at risk

Technology and BIM are one of the biggest threats to the tasks of quantity surveyors. Literature identified the quantities take-off, bills of quantities' preparation, cost estimation, cost planning, cost reporting, cost control, material procurement, payment application, value management and life-cycle costing as tasks that are at risk of being lost to technology.

3.9.5 Objective Five: Provide scenarios for the future quantity surveying profession

While there is consensus that the future of the professions will be different, there is no consensus on how the future professions will look. There are currently no known future scenarios for the quantity surveying profession. The one scenario for the quantity surveying profession provided in 1991 had a few shortcomings. One of the shortcomings of the scenario was that it only provided one scenario. Given the number of factors affecting the quantity surveying profession, it is possible that there is more than one possible future for the quantity surveying profession.

The preceeding discussion collectively provides evidence to support the assertion that the professions, including the quantity surveying profession, may be on the brink of a period of fundamental change. The implications of this change on the professions will no doubt be unprecedented. By providing future scenarios for the quantity surveying profession, this study will assist the professions and particularly the quantity surveying profession to consider its future and make informed decisions.

Geels' multi-level perspective (MLP) is used as a framework and a heuristic device in understanding socio-technical transitions in the socio-technical system of the quantity surveying profession. The MLP is augmented by the 5Ps model. The next chapter discusses the MLP and the 5Ps model.

Chapter 4: Theoretical Framework

4.1 Introduction

This chapter discusses the theoretical framework used to understand change in the socio-technical system of the quantity surveying profession. The multi-level perspective (MLP) is the theoretical framework and a heuristic device used to understand this change and to predict its future. This study is a futures study that uses grounded theory methods to collect and analyse the data.

The different ways of looking at change are firstly provided. Secondly, the MLP is explained. Thirdly, the justification for the use of the MLP as a theoretical framework and a heuristic device is explained. The last section provides the shortcomings of the MLP, responses to the MLP shortcomings and the mitigation of the MLP's shortcomings by augmenting it with the 5Ps model.

4.2 Ways of looking at change

Geels (2004) describes socio-technical changes as changes that include new technologies coupled with changes in markets, user practices, policy and cultural meaning. Socio-technical transitions are multi-dimensional phenomena and can therefore be studied from many perspectives (Geels, 2010). However, in comparison with other social science ontologies (refer to Table 4.1), the multi-level perspective provides a more comprehensive perspective in understanding the multi-dimensional complexity of transitions in socio-technical systems (Geels, 2010). Table 4.1 shows transitions as described by seven main social ontologies. Mahoney (2014) includes neo-Darwinian and cultural theory.

Table 4. 1 Transition as described in different ontologies (Geels, 2010: 504)

Ontology	Default orientation: change or stability	Explanation of transition
Rational choice	Stability (equilibrium) or incremental change	Difficult. Requires exogenous impulse (price changes) followed by gradual adjustment (of resource allocation)
Evolution	Dynamic stability (incremental change along lineages) and radical change (speciation, niches, competition)	Endogenous change (radical innovations) and/or exogenous changes in selection pressures
Structuralism	Stability	Difficult. Changing ideologies and belief systems often remain exogenous
Interpretivism/ Constructivism	Ongoing change and sense-making	Radical change through endogenous second-order learning

		processes (change in cognitive frames)
Functionalism (Systems theory)	Stability (system equilibrium)	Difficult. Requires exogenous shocks, followed by gradual adjustments
Conflict and Power Struggle	Stability (powerful actors suppress change), incremental change ('reform' to accommodate protests) and radical change ('overthrow' by challengers)	Endogenous struggles between incumbents and challengers
Relationism	Continuous process (change or reproduction)	Unclear. No distinction between radical or incremental change Focus on micro-processes and local projects

4.2.1 Rational choice

Rational choice theory "*is a micro-level theory*" (Mahoney, 2004: 462). "*Self-interested, utilitarian individuals*" cause socio-technical changes in rational choice theory (Geels, 2010: 505). The individual's instrumentality is what sets in motion events and occurrences (Mahoney, 2004). Individuals choose the best alternative, using a cost benefit analysis (Geels, 2010; Mahoney, 2004). Rational theory, however, does not take into account individual interests, potential rewards and choice options (Mahoney, 2004).

4.2.2. Evolution theory

Evolution theory can be divided into micro-evolution and macro-evolution (Geels, 2010). In micro-evolution, change occurs through a process of trial and error and behavioural learning (Ibid). Agents of change, such as individuals, firms and the market, in their problem-solving quest use trial and error in order to find solutions (Ibid). Change in macro-evolution conceptualises change as,"*…technological discontinuities, with new entrants struggling against incumbents,*" (Schumpeter, 1939 in Geels, 2010).

4.2.3 Structuralism

Agents of change in structuralism is beliefs, cultural categories, and symbolic sets that collective actors, such as individuals, organisations, and interest groups, hold (Geels, 2010). Geels (2010) describes these beliefs as "deep structures". Deep structures determine moral behaviour of the collective actors (Ibid). Change occurs when belief systems, public opinions and ideologies of the collective actors shift (Ibid). Structuralism is criticised for its emphasis on reification (Ibid).

4.2.4 Interpretivism/Constructivism

Change in interpretivism/constructivism is as a result of debates, conversations, negotiations and learning. Actors in interpretivism/constructivism are engaged in sense making (Wick, 1979 in Geels, 2010). Before making a decision or acting, actors need to make sense of the facts, circumstances and signals (Ibid).

4.2.5 Functionalism (Systems theory)

From a functionalist perspective, the agents of changes are the needs and goals of the social system (Geels, 2010; Mahoney, 2004). One of the main prerequisites of the social system is equilibrium (Mahoney, 2004). Actors in the social system will perform functions and tasks to meet the needs of the social system (Geels, 2010). Exogenous factors that result in system disequilibrium cause change in a functionalist perspective (Ibid). To achieve equilibrium, the system is forced to adjust goals (Ibid). Functionalism is a macro-level perspective and does not take into account micro-level dynamics in its explanation of change (Mahoney, 2004).

4.2.6 Conflict and power struggle

Conflict and power perspective explain change from a meso-level (Mahoney, 2004). Change agents are collective actors, such as social groups and organisations (Geels, 2010; Mahoney, 2004). These collective actors have conflicting interest (Geels, 2010). Change happens when the actors fight for the limited resources (Geels, 2010; Mahoney, 2004). To protect their interest, the dominant groups use their power to suppress the subordinate groups seeking change (Geels, 2010). Although useful in social science theory, the conflict and power perspective is underdeveloped (Mahoney, 2004).

4.2.7 Relationism (interactionism)

Relationism assumes that the individual actor's identity, interests and preference is continually affected by its interactions and relations with its social environment (Geels, 2010). These interactions are the agents of change (Ibid). Change is as a result of "*…alignment, enrolment, attachments, translation, co-construction and mutual constitution,*" (Geels, 2010: 502).

The next section discusses the MLP and provides justification for its choice as a framework for analysing change in socio-technical system.

4.2.8 Multi-level perspective (MLP)

4.2.8.1 The definition and history of the MLP

The MLP is defined as; "*… a middle-range theory that conceptualizes overall dynamic patterns in socio-technical transitions,*" (Geels, 2011: 26). The developers of the MLP perspective are scholars who wanted to bridge the gap between STS and evolutionary economics (Geels, 2005; Geels, 2005,

2004, 2002; Rip and Kemp, 1998; Scott, 1998). Thus, the MLP framework is made up of a combination of concepts drawn from evolutionary economics theory, science and technology studies theory, structuration theory and neo-institutional theory (Geels, 2011). The MLP's philosophical assumptions are based on the philosophical assumptions of these theories (Grin et al., 2010).

4.2.8.2 Philosophical assumptions of the MLP

Grin et al. (2010) claim the combination of theories to form an MLP Framework is possible as there is some philosophical semblance in the assumptions of the evolutionary economics, science and technology studies, structuration and neo-institutional theories. One of the assumptions in science and technology studies theory, for example, is that actors are creative and interpretive. These actors socially construct meaning and cognitive framework (Grin et al., 2010).

Similar to science and technology studies' theory, structuration theory assumes actors are knowledgeable and interpretive. Structuration theory, however, emphasizes structure and routine. Actors use the structure to draw their actions and practices from the structure. Structure, is therefore, used by actors as a guide. Actors have agency in structuration theory. Grin et al (2010) claim that it is possible to incorporate the principle of actor agency in evolution theory. Actors can be creative and interpretive instead of being blind-rule followers. This is evidence of the assumptions of the theories from which the MLP Framework draws similarities (Grin et al. 2010).

4.2.8.3 The analysis of socio-economic transitions in a multi-level perspective

The analysis of socio-economic transitions in a multi-level perspective is divided into three heuristic levels: niches, regimes and landscapes (Geels, 2005b; Smith et al., 2010). The micro-level consists of technological niches and it is at this level where radical change originates. In the quantity surveying socio-technical system, the actors in niches are made up of individual quantity surveyors, quantity surveying firms, entrepreneurs, researchers, etc.

The meso-level is made up of socio-technical regimes and the socio-technical landscape makes up the macro-level (Geels, 2005b). Socio-technical regimes consist of technology, policies, standards, norms, code of ethics, etc. Within the context of the quantity surveying profession, the socio-technical regimes refer to the regulatory framework and the institutions that regulate the profession, such as the Councils for the Built Environment (CBE), SACQSP, the Quantity Surveying Profession Act (No. 49 of 2000), user-practices, norms, standards, and suchlike.

The socio-technical landscape is the technology-exogenous environment's factors, such as the macro, socio-economic and political factors that are beyond the direct influence of the actors. Although the three levels are independent of each other, there may be elements of co-evolution. Change takes place

as a result of the interaction between the three levels. In the MLP, transition is as result of simultaneous processes at multiple dimensions and levels. Transition is therefore not as a result of a simple cause or driver (Geels, 2005b).

The relationship between the niches, regimes and landscape is referred to as a "*nested hierarchy*", where regimes are set within the landscapes and the niches within the regimes. Transitions takes place in four phases in a multi-level perspective framework. In the first phase, innovations emerge in the niches. The second phase occurs when there is technical specialisation of the new innovation in the small market niche and in the wider context. The third phase occurs when there is breakthrough in the new innovation. Breakthrough is usually characterised by wider application of the new innovation and competition with the incumbent regime. In the fourth phase, the new innovation replaces the old regime. The new regime may cause the socio-technical landscape to change. Transitions in the MLP are non-linear and unpredictable (Geels, 2005b). Figure 4.1 illustrates how transition takes place in an MLP framework.

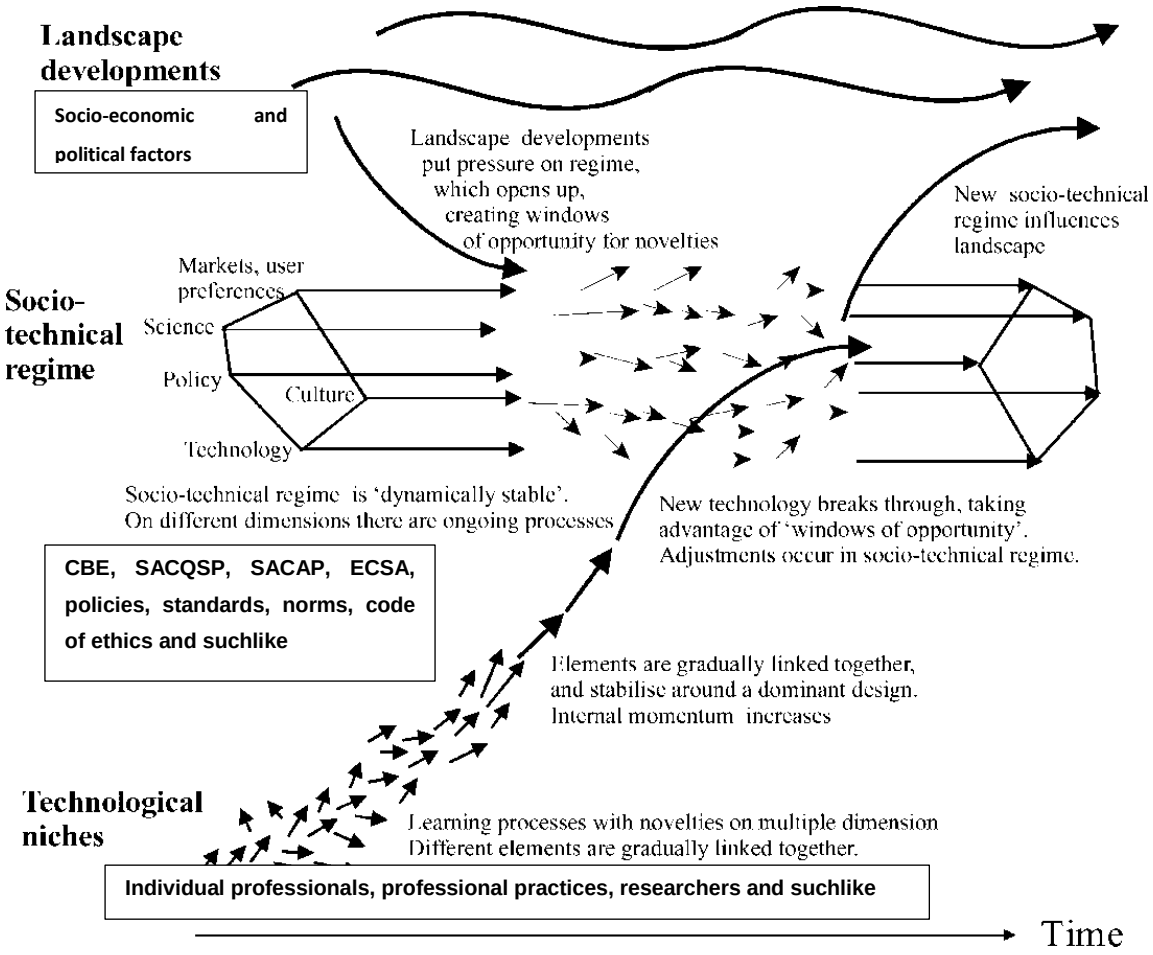


Figure 4. 1 Multi-level perspective (Geels, 2005)

4.2.8.4 Justification for the use of the MLP as a theoretical framework and heuristic device

The current changes taking place in the construction sector and the quantity surveying profession are unprecedented, uncertain and involve various factors and processes. The MLP recognises circular causality in transitions instead of simple causality, where there is only a single driver. Circular causality occurs when many processes of varying dimensions, at different interacting levels, cause transitions (Geels, 2011). Given the multi-dimensionality of the change, an MLP perspective framework is a more suitable theoretical framework and a heuristic device to use in understanding change within the socio-technical system of the quantity surveying profession.

Furthermore, predicting future changes in the socio-technical system of the quantity surveying profession using the MLP will be a contribution to the body of knowledge. The MLP is usually used to analyse historical changes in socio-technical changes (Geels, 2006, 2005b; Geels, 2006, 2005; Geels, 2011, 2002; Trist, 1981). MLP has only been used to predict futures in sustainability (Geels, 2020, 2011; Köhler et al., 2020).

4.2.8.5 Shortcomings of the MLP, responses to the MLP's shortcomings, and mitigation of the MLP's shortcomings

In this section, the shortcomings of the MLP, responses to the MLP shortcomings, and mitigation of the MLP's shortcomings are provided. Smith et al. (2010) and Geels (2011) provide shortcomings of the MLP Framework. Geels (2011) also provides responses to the shortcomings. How these shortcomings are mitigated, are provided in this study where possible.

Smith et al. (2010) include the relationships between the conceptual levels of the niche, regime and landscape, the interaction between plural regimes and niches, and the empirical operationalisation of concepts as the main criticisms of the MLP Framework. Geels (2011) claims the following as the main criticisms of the MLP Framework: "*(1) lack of agency, (2) operationalization of regimes, (3) bias towards bottom-up change models, (4) epistemology and explanatory style, (5) methodology, (6) socio-technical landscape as residual category, and (7) flat ontologies versus hierarchical levels*." (Geels, 2011: 24). Since Smith et al.'s (2010) criticisms are embedded with the seven criticisms mentioned by Geels (2011), the following discussion will focus on the seven criticisms, as stated by Geels (2011).

4.2.8.6 Shortcoming – lack of agency: response and mitigation

Smith et al. (2005) and Genus and Coles (2008) criticise MLP for its lack of agency. They argue that the MLP underplays the role of actor agency in transitions. Social groups bring about transitions in the MLP (Geels, 2011). In response to Geels' (2011) claims that although actor agency, such as in rational choice perspective, power struggles and cultural discursive, are not fully developed within the the MPL Framework, the MLP does include actor agency. Agency is included in the MLP through bounded

rationality and interpretive activities (Geels, 2011). Bounded rationality refers to activities, such as search activities, routines, and trial-and-error learning (Ibid).

In this study, the agency of actors to influence transition in a socio-technical system is included. Thus, the lack of agency is not a shortcoming in this study.

4.2.8.7 Shortcoming of operationalisation of regime: response and mitigation

Berkhout et al. (2004) argue that the MLP does not clearly demarcate the conceptual levels, which makes it a challenge to apply empirically. They offer an example that a regime in a socio-technical system could be at a primary level of supply or it could refer to an entire system. Another criticism of the conceptualisation of the regime is that at times it is referred to as rules, and at other times it is shorthand for a system (Markard and Truffer, 2008). Smith et al. (2010) criticise the presentation of socio-technical regimes as being too homogeneous or monolithic. Another criticism of the MLP is its focus on a single regime facing pressures from the niche innovations and landscape developments (Geels, 2011).

Geels (2011) responds thus to the demarcation criticism. The MLP is not prescriptive in how empirical topics should be delineated. The regime concept can be applied to broad or narrow topics. Before operationalising the MLP's levels, the analyst should first delineate the object of analysis (Geels, 2011).

In response to the regime as shorthand for a system, Geels (2011) responds by making a distinction between a regime and a system. A system refers to things that are tangible, such as infrastructure, regulations, public opinion, consumption pattern, market share and artefacts. A regime on the other hand refers to intangible things, such as beliefs, norms, standardised ways of doing things, routine, visions, heuristics, social expectations, and rules of thumbs. A regime should, therefore, be used as an analytical framework to understand underlying beliefs, values, visons, etc. of contributors to the system elements (Geels, 2011).

Responding to the criticism of the presentation of socio-technical regimes as being too homogeneous or monolithic, Geels (2011) claims that while there are shared rules and similarities within regimes, there are also variances, points of disagreements and internal conflicts.

In response to the criticism that the MLP focuses on a single regime facing pressures from the niche innovations and landscape developments, Geels (2011) agrees that it might be useful for further development of the MLP Framework to consider the positive and negative effects of multi-regime interactions.

In this study, the socio-technical regime refers to the legislative framework and the institutions that regulate the quantity surveying profession. The socio-technical regime also refers to policies, standards, norms, code of ethics and the like. In the analysis, however, beliefs, values, and the visions that underpin them will be discussed. The study, therefore, operationalises the socio-technical regime as tangible and intangible. Furthermore, only one regime is analysed for a more simplistic analysis. The study expounds on tensions and points of disagreements within a single regime.

4.2.8.8 Shortcoming of bias towards bottom-up change models: response and mitigation

Berkhout et al. (2004) criticise the MLP for not taking into account regime change that has been influenced by factors on the same level or those below the landscape level. In response to the bottom-up change models, and to demonstrate that these are not the only change model in the MLP, Geels and Schot (2007) provide four transition pathways for transitions in an STS. The four pathways are: transformation, reconfiguration, technological substitution, technological substitution, and de-alignment and realignment (Geels and Schot, 2007).

In a transformation pathway, niche innovations are not well developed (Geels and Schot, 2007). Change is, therefore, brought by pressure exerted by the landscape developments on the regime (Smith, 2007). Similar to the transformation pathway, change in the reconfiguration pathway is brought by pressure exerted by landscape developments. The difference, however, is that the niche innovations are somewhat developed in the reconfiguration pathway (Geels and Schot, 2007). This means that, while niche innovations do not have much influence on the regime in the transformation pathway, niches can cause some adjustment of the regime in the reconfiguration pathway, especially where they share a symbiotic relationship (Ibid).

There are two routes to transformation in a technological substitution pathway. The first route is where the pressure exerted by the landscape on the regime causes tensions in those regimes. These tensions make room for well-developed niches to replace the incumbent regime. In the second route, well-developed niches replace the regime without the pressure from landscape developments, due to factors such as investment in resources, consumer demand and similar (Geels and Schot, 2007) .

In the de-alignment and re-alignment pathway, the regime is disintegrated (de-aligned) by pressure exerted from landscape developments. This disintegration of the regime then causes multiple niche innovations to compete and co-exist within the space created by the disintegrated regime. The eventual niche innovation that prevails will cause the regime to re-align (Geels and Schot, 2007).

This study recognises that transitions in a socio-technical regime are not bottom-up only. The bias towards bottom-up change models is therefore not a shortcoming in this study.

4.2.8.9 Shortcomings of epistemology and explanatory style: response and mitigation

Genus and Coles (2008) argue that the MLP Framework should be used as heuristic device rather than a framework for analysing socio-technical transitions. Geels (2011) offers three responses to this criticism. First, an open framework such as the MLP, which asks questions about patterns and mechanisms, is suitable for investigating co-evolution dynamics rather than precise models. The MLP acts as a "heuristic device" rather than a "right answer slot machine" once the data is inserted. The analyst is guided to relevant questions and problems (Geels, 2011).

Second, Geels (2011) argues that as a middle-range theory, analysts using the MLP may consider augmenting the MLP's conceptualisation of a dynamic mechanism with auxiliary theories, such as evolutionary theory. Third, Geels and Schot (2010) prefer the choice of process theory to the variance theory. In variance theory, the change in a dependent variable is caused by an independent variable. In a process theory, changes are explained through a sequence of events, timing and conjunctures of event chains (Abbott, 2001; Langley, 2007; Pettigrew, 1997).

Geels and Schot (2010) further defend the choice of using narratives in process theory by claiming that narratives are best suited in explaining complex interactions between, "*…agency and changing contexts, time, event sequences, making moves in games, and changing identities*," (Geels, 2011: 36–35).

In this study, the MLP is used as both a theoretical framework and a heuristic device in understanding change within the quantity surveying profession. The limitations of the MLP as a middle-range theory are acknowledged in the analysis. Furthermore, the 5Ps model is used to augment the MLP.

4.2.8.10 Shortcomings of methodology: response and mitigation

The MLP is further criticised for using secondary data and narrative discussion in its case studies (Abell, 2004; Genus and Coles, 2008; Hall, 2003). Geels (2011) argues that not all the data in case studies is based on secondary data. Furthermore, where secondary data was used, no empirical mistakes were identified (Geels, 2011). The MLP faces a common process theory dilemma, where the ontology is complex but the methodology is underdeveloped (Ibid). Most MLP studies use single case studies to explain STS transitions (Ibid). In defence of the MLP methodology, Geels (2011) argues that transitions are a complex phenomena and should not be reduced to, "*…application of methodological procedures and will always contain elements of creative interpretation*," (Geels, 2011: 36).

In this study, primary data is collected through interviews, a workshop and a focus group. The narrative on the possible future scenarios of the quantity surveyors is drawn from the analysis of the primary data. The shortcoming of methodology is therefore overcome by the use of primary data instead of secondary data.

4.2.8.11 Shortcomings of socio-technical landscape as a residual category: response and mitigation

Geels (2011) concurs that the landscape level is conceptualised as a residual category or a "garbage can" that is susceptible to all kinds of contextual influences. To overcome this criticism, Geels (2011) offers three suggestions for the reformulation of the landscape level. First, the landscape can be conceptualised as more dynamic by incorporating 1) static factors or factors that change slowly, 2) rapid external shocks, and 3) trend-like long-term change such as demographic changes. Second, greater emphasis should also be paid to factors that stabilise the regime and not those that de-stabilise the regime. Third, focus should also be placed on reverse causality, that is, how transitions in the regime cause change in the landscape (Geels, 2011).

This study conceptualises the landscape level as a dynamic rather than a static concept, which can influence and be influenced. In conceptualising the landscape level this way, the shortcoming of socio-technical landscape as a residual category is mitigated.

4.2.8.12 Shortcomings of a hierarchical ontology: response and mitigation

Geels (2011) rebuts claims that the "micro-meso-macro" levels in the MLP Framework are hierarchical. MLP levels refer to the varying degrees of structuration of local practice, which are not hierarchical. Niches develop outside regimes (Geels, 2011). In the MLP, the landscape is conceptualised as an external context to the regimes and niches, rather than as a hierarchical layer (Ibid). Geels (2011) suggests that the concept of nested hierarchy should therefore be dropped from MLP. It is currently uncertain whether it has been dropped or not.

In spite of its criticism, the concept of nested hierarchy is used in this study. The institutionalisation and regulation of the quantity surveying profession in South Africa is within a nested hierarchy, and using the concept of nested hierarchy is useful in thinking about the possible futures of the quantity surveying profession in South Africa.

4.2.8.13 Other criticism of the MLP framework: response and mitigation

Another criticism of the MLP is that it has a limited ability in predicting the future (Köhler et al., 2020). As stated previously, the MLP framework has been used to predict the future in sustainability studies (Geels, 2020, 2011; Köhler et al., 2020). One of the research contributions to the body of knowledge of

this study is to expand the use of the MLP in predicting the future. The MLP Framework is used to predict possible futures for the quantity surveying profession.

4.3 The 5Ps model or theory

Given the shortcomings of the MLP, especially that of its inability to predict the future, Pryor et al.'s (2008) 5Ps model is used to augment the MLP somewhat. By combining the MLP and the 5Ps model, this study provides scenarios for the future quantity surveying profession. The premise of the 5Ps model is that "… *the most profitable change is reinvention of the future, not response to the present*," (Pryor et al., 2008:9). The 5Ps model is useful in testing survival and success of an organisation in the long term (Pryor et al., 2011).

The 5Ps model is regarded as an extension to organisational theories and was developed from the intergration of existing theories on organisation theory, strategic management, systems theory, process management and improvement, and leadership. Through the use of the 5Ps model, organisations can achieve both vertical and alignment in all the five strategic elements of the organisation (Pryor et al., 2011).

In this study, the 5Ps is used as a framework to determine the current and possible future state of the construction sector and quantity surveying profession. The 5Ps model is also a strategic management model that breaks organisations into five elements, that is, purpose, principles, processes, people and performance (refer to Figure 4.2). For any organisation to run efficiently and effectively, systems relating to purpose, principles, processes, people and performance must be in place and aligned to each other (Pryor et al., 2008).

Purpose in an organisation relates to vision, mission, values, goals, objectives and strategies. Principles relate to ethics, attitudes, philosophies and assumptions, shared core values, operating guidelines and norms. Processes refer to systems, procedures, communication, organisational structure, physical steps required to produce a good product or service. 'People' in the 5Ps model refer to stakeholders, process owners, individuals, clients, suppliers and teams. Performance in an organisation relates to things such as key performing indicators (KPIs), benchmarking, balanced scorecard and baselines (Pryor et al., 2008).

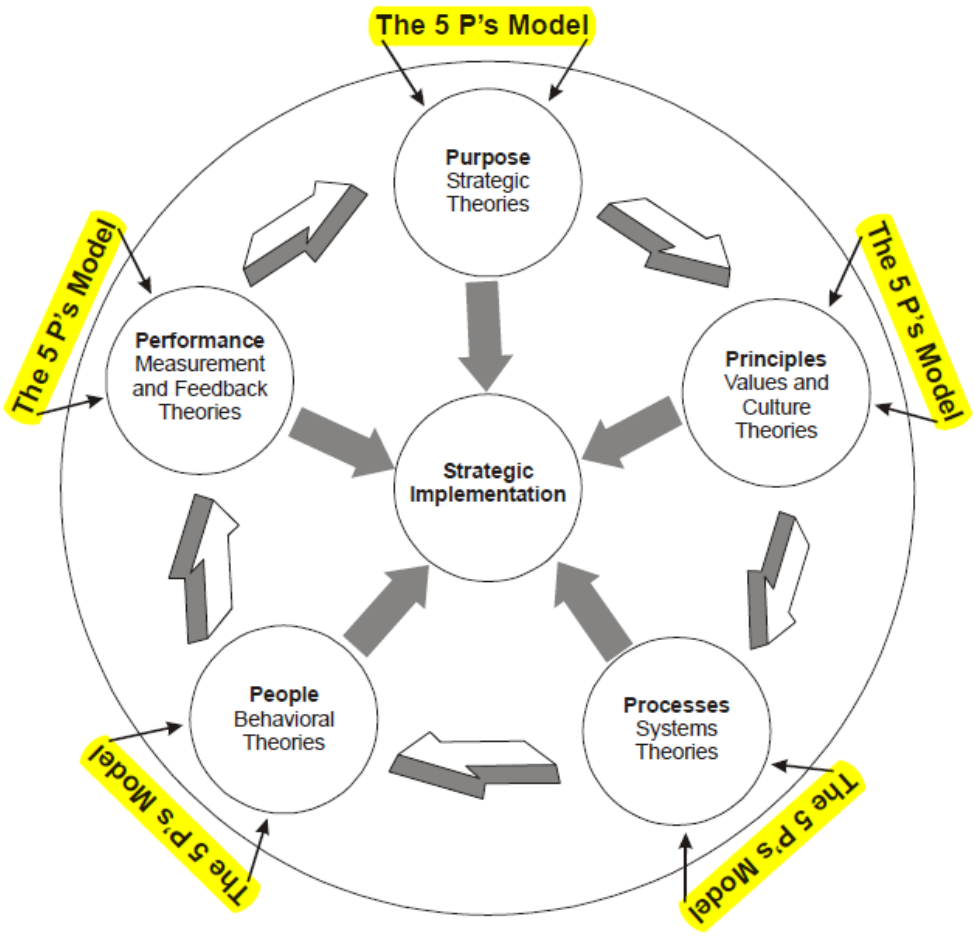


Figure 4. 2 5Ps model of strategy implementation (Pryor et al., 2007)

4.3.1 Justification for the use of the 5Ps model

The 5Ps model is chosen because of its ability to explain and predict future transformation in an organisation. When organisations are faced with factors that challenge the status quo, they can change, adapt or transform (Pryor et al., 2008). Change happens when an organisation moves from the current plateau towards a desired future state for improved efficiency and effectiveness (Cummings and Worley, 2005; George and Jones, 2002). Adaptation is the restoration of equilibrium by making alterations and modification to components of an organisation or system in response to changes in the external environment that has caused the imbalance (Cameron, 1984). Transformation is a radical and fundamental shift and reinvention of the organisation. In transformation, the 5 Ps of an organisation are continuously radically transformed and reinvented. A transformed organisation is capable of influencing the macro-environment (Pryor et al., 2008).

The literature review provided evidence of factors that have the potential to influence change within the construction sector and the quantity surveying profession. This change is arguably rapid, multifaceted

and multi-dimensional. It is likely that the influence of these on the construction sector and the quantity surveying profession might be a total transformation instead of change or adaptation. Hence, the 5Ps model was chosen over other change management theories or models to augment the MLP.

Other theories and models, such as action research theory (Collier, 1945; Lewin, 1946; French, 1969; Schein, 1980); Lewin's three-step model (Lewin, 1945; Lewin, 1951); Schein's extension of Lewin's change model (Schein, 1980); the Lippit, Watson and Westley model of planned change, model to a five-phase model (Lippit, Watson, and Westley 1958); Kotter's strategic eight-step model (Kotter, 1996); Mento, Jones and Dirmdofer's twelve-step model (Mento, Jones and Dirmdofer, 2002); Jick's ten-step model (Jick, 2003; Jick, 2001), and Shield' s five-step model (Shields, 1999), focus on planned change or adaptation rather than on transformation.

Most of the above-mentioned models were developed from Lewin's three-step model (Biech, 2007; Pryor, 2008). Lewin's three-step change model posits unfreezing the present, changing and then refreezing (Ibid). These models provide a step-by-step guide to changing an organisation (Ibid). They were deemed irrelevant to the study, as the quantity surveying profession is conceptualised as a system within a system and change as a system is complex. The 5Ps model is not only a strategic management model but also a systems model able to analyse change within a system.

4.3.2 Limitations of the 5Ps model

Two major limitations of the 5Ps model is that it fails to assess the factors that make up the model and how alignment is achieved (Pryor et al., 2007). Since the 5Ps model is used as supplementary to the MLP Framework, its limitations will somewhat be mitigated by the MLP Framework and vice versa.

4.4 Summary

This chapter discussed ways of looking at change. Change can be understood through the following lenses:

- Rational choice;
- Evolution;
- Structuralism;
- Interpretivism/constructivism;
- Functionalism (systems theory);
- Conflict and power struggle;
- Relationism;
- Neo-Darwinian;

- Cultural theory; and
- Multi-Level Perspective (MLP) (Geels, 2010; Mahoney, 2014).

The justification for using the MLP Framework, as a way of looking at change, was provided. In comparison to other ways of looking at change, and given the multiple factors currently influencing the quantity surveying profession, the MLP is more suited to understanding transitions in the quantity surveying profession's socio-technical system. This chapter also discussed the shortcomings of the MLP Framework. Responses to the shortcomings and how these shortcomings were mitigated in the study were provided including the use of 5Ps model to augment the MLP. The next chapter discusses the research methods of the study.

Chapter 5: Research Methodology

5.1 Introduction

The main aim of this section is to explain the rationale for the research design and methodology that were employed in the research. This research study is a futures research study that uses qualitative research methods. First, the definition of research is provided, then the different types of the research designs are discussed before futures studies are discussed.

Saunders et al.'s (2009) Onion Model was used as a framework for determining the research philosophy, the research approach, research strategy, the research choices, data collection, and data analysis methods. Figure 5.1 shows the process followed, from the outer layer (philosophical perspective) of the model, to arrive at the inner layer (the data collection and data analysis techniques).

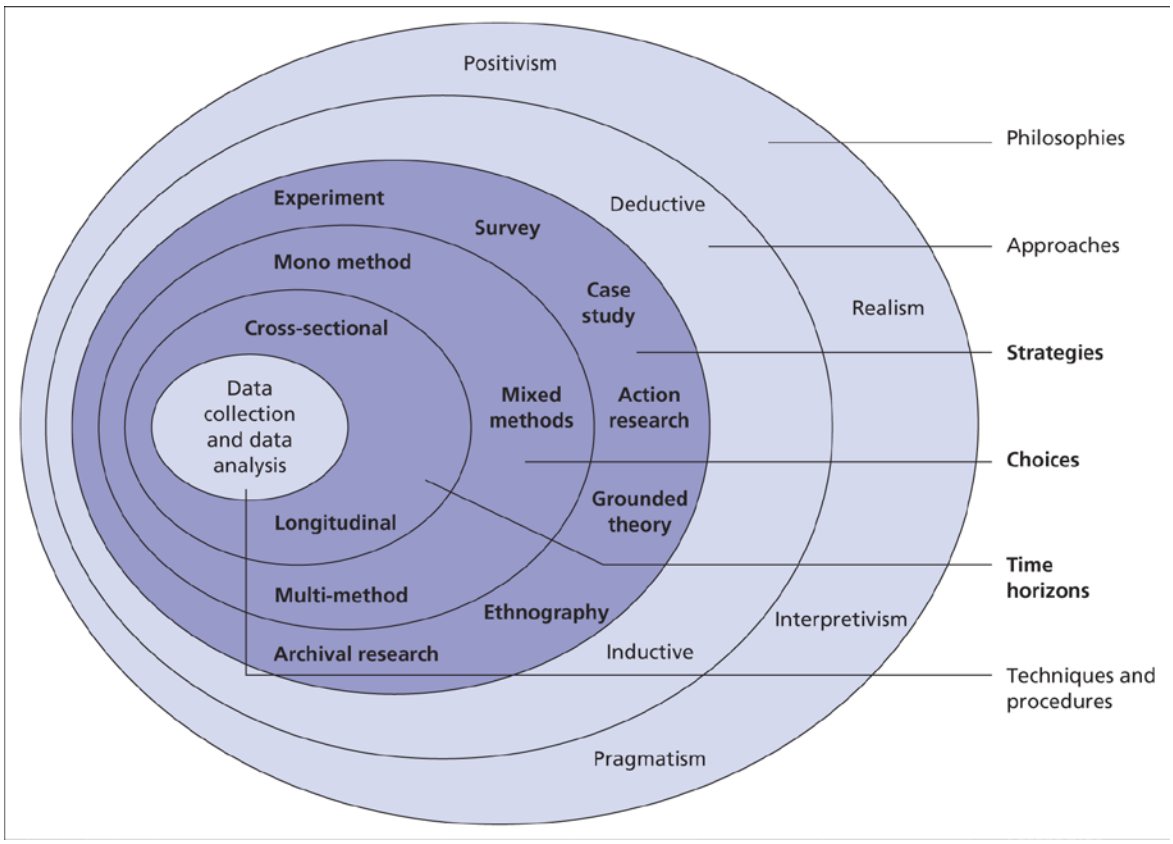


Figure 5. 1 Research Onion (Saunders et al., 2009)

5.2 Type of research

Research is defined, "… *as something that people undertake, in order to find out things in a systematic way, thereby increasing their knowledge*," (Saunders et al., 2009: 5). Research may be divided into two categories: basic or pure research and applied research. The main reason for undertaking applied research is usually to provide answers to specific questions, and its findings are of value to managers in organisations. Basic or pure research is usually undertaken to add to scientific knowledge and its findings are of value to the society in general (Blumberg, 2008; Saunders et al., 2016).

The proposed study falls under basic or pure research. The findings of the study will benefit wider society in general and add broad knowledge to the study of the quantity surveying profession.

5.2.1 Philosophical assumptions

From the research Onion Model, the first layer to peel in research is the research philosophy. The philosophy of the research is what guides how the research question will be answered. It determines the research approach, strategy, method, time horizons, techniques and procedures (Saunders et al., 2016).

Research philosophy can be divided into three broad categories: epistemology, ontology and axiology. Epistemology is concerned with what constitutes valid knowledge in a field of study. Ontology is

concerned with the nature of reality (Saunders et al., 2016). Axiology's main concern is value judgement, ethics and aesthetics (Rudestam and Newton, 2007; Saunders et al., 2016).

5.2.2 Epistemology of the study

Saunders et al. (2016) provides three epistemological positions: positivism, interpretivism and realism. Positivists are guided by the following four assumptions, they believe that:

- Phenomena in the social world can be verified by objective observation through a collection of objective data;
- Research is value-free, that is, the researcher conducting the research cannot influence the phenomena;
- The researcher is an objective analyst, or a "*disinterested scientist*" and
- The social world can be reduced to simple elements (O'Dwyer and Bernauer, 2013; Saunders et al., 2016).

Positivists use existing data to develop hypotheses, which are tested using highly structured methods. The results of the tests are usually quantified, and then statistically analysed. It is from these results that generalisations regarding the phenomenon are made. Theory regarding the phenomena is developed from these (Blumberg, 2008; Saunders et al., 2016).

In interpretivism, human beings are social actors who use their social lenses to interpret life. There are two traditions of interpretivism: phenomenology and symbolic interactionism (Saunders et al., 2016). Patton (2002:105), describes phenomenology as a, "…*study of how people describe things and experience them through their senses ... most basic philosophical assumption … is that we can only know what we experience by attending to perceptions and meanings*." Symbolic interactionism is not only concerned with meaning and interpretation but also with how humans share and create their interpretation and meaning of the social world around them (Merriam, 2009). Their worldview is continuously evolving (Saunders et al., 2016).

Realists believe that reality is beyond the human mind's comprehension. Like in positivism, knowledge is developed in a scientific manner. Data collection and data analysis are justified through the scientific approach. Realism may be divided into two categories: direct realism and critical realism. Direct realists believe that human experiences, or sensations through five of the senses, are a true reflection of the real world. Critical realists believe that humans do not see real objects, but rather representations of the real objects (Saunders et al., 2016).

5.2.3 Choice of the epistemology for the study and its justification

As discussed in the literature review, the envisaged changes in the quantity surveying profession are multi-dimensional and complex. They cannot be fully appreciated by reducing them to a formula. It is therefore for this reason that positivist and realist design approaches are not ideal for the study. The research approach followed in this study is therefore interpretivism, as the study is interested in understanding the changes in the quantity surveying profession, and what the changes mean for the profession (Merriam, 2009). An interpretivist approach therefore calls for a qualitative research design. The next section discusses the research approaches and choices of the study.

5.3 Research design and methods

5.3.1 Research design

The quantitative method and the qualitative method are the two most commonly used research methods. A mixed method is a combination of both the quantitative and qualitative methods. Both terms, 'quantitative' and 'qualitative', refer to the data collection techniques and the data-analysis procedures employed in each method (Saunders et al., 2016). Table 5.1 shows common differences between quantitative and quantitative methods.

Table 5. 1 The difference between quantitative and qualitative methods (Rudestam and Newton, 2015: 40)

Quantitative Method	**Qualitative Method**
Data expressed in numbers	Data expressed in words
Hypothetico-deductive	Inductive
Controlled research situations	Naturally occurring and contextual
Isolation of operationally defined variables	Holistic view of phenomenon
Seeks objectivity	Interested in subjectivity
Emphasis on prediction and explanation	Emphasis on description, exploration, search for meaning
Researcher directs, manipulates, controls.	Researcher participates and collaborates
Statistical analysis	Text analysis

5.3.1.1 Quantitative method

Quantitative methods are interested in investigating the relationships between variables (Saunders et al., 2016). The focus of quantitative methods is measuring the extent of a variation in variables; hence, the data is expressed in numbers (Kumar, 2014; Rudestam and Newton, 2015). Specific, well-structured, fixed and pre-determined methods are followed in the collection and analysis of data (Kumar, 2014). This allows for accuracy in measurement and classification, which is usually done using statistical and graphical techniques (Kumar, 2014; Saunders et al., 2016). The control measures employed in quantitative research studies allow for greater validity and reliability (Kumar, 2014; Saunders et al., 2016).

Since the methods used in the collection and analysing of data in quantitative research design are rigid and controlled, they can be replicated (Kumar, 2014). Quantitative research design studies seek objectivity; the researcher is therefore regarded as independent from the respondents (Rudestan and Newton, 2015; Saunders et al., 2016).

The development of theory in quantitative research design is through hypothetico-deductive approach. This means that data is used to test theory. Deductive approaches may incorporate inductive approach, where at the point of the study's findings, it may be inferred that the original theory is being tested (Bryman and Bell, 2014; Rudestam and Newton, 2015; Saunders et al., 2016). Figure 5.2 shows theory development in a deductive approach.

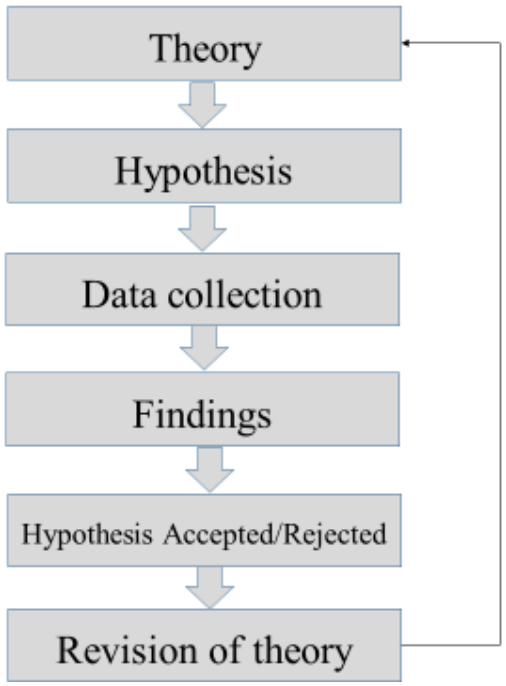


Figure 5. 2 Theory development in a deductive approach (Bryman and Bell, 2014)

Figure 5.2

5.3.1.1.1 Criticisms of quantitative research

Bryman and Bell (2014) provides four major criticisms of quantitative research:

- Quantitative researchers do not distinguish between people and the social world. People are not the same as the natural world. By classifying people as the natural world, quantitative methods omit aspects such as interpretation and self-reflection.

- The measurement process gives a false sense of precision and accuracy. Quantitative researchers make assumptions about concepts they are measuring and therefore their measurements are not real but are based on presumption. For example, not all respondents interpret questionnaires in the same way (Cicourel 1964 in Bryman and Bell, 2014).

- There is no connection between everyday life and research. The rigid processes followed in quantitative research mean the studies are divorced from the reality of everyday life.

- Social life is separate from the lives of people. In quantitative studies, the social world is reified and treated as an object.

5.3.1.2 Qualitative method

The focus of qualitative methods is in understanding and exploring meaning, beliefs, perceptions, values, attitudes and similar in people groups; that is the reason the data is expressed in words (Kumar, 2014; Rudestam and Newton, 2015). Unlike in quantitative methods, where clearly well-defined methods are followed in the collection and analysis of data, qualitative methods are flexible and evolving (Kumar, 2014). The unstructured nature of qualitative methods makes replication almost impossible (Kumar, 2014; Saunders et al., 2016).

Qualitative research designs are interested in subjectivity (Rudestam and Newton, 2015). The researcher is not independent from the participants, and there is a possibility of researcher bias (Kumar, 2014; Saunders et al., 2016). The development of theory in qualitative research design is through an inductive approach. This means that theory is developed through observation of empirical data (Rudestan and Newton, 2015; Saunders et al., 2016). Figure 5.3 shows theory development in an inductive approach.

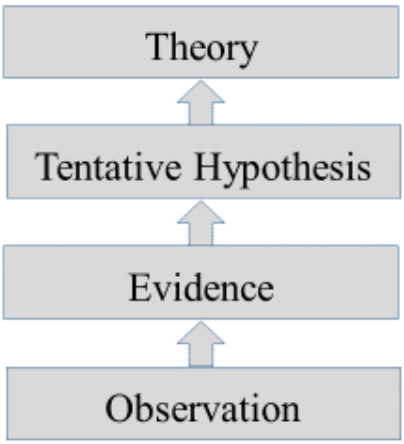


Figure 5. 3 Theory development in an inductive approach (Bryman and Bell, 2014)

5.3.1.2.1 Criticisms of qualitative research

The major criticisms of qualitative research include:

- It is very subjective. As the researcher in qualitative research participates in and collaborates with participants, the studies are criticised for being subjective. Researchers' own views have a bearing on the research.

- Qualitative research cannot be replicated. The unstructured and fixable nature of the studies makes replication almost impossible. Inter-relationships between the researcher and the participants play a part in the participants' responses to questions.

- The findings of qualitative studies cannot be generalised to apply to other settings. Findings of one of two cases used in qualitative studies cannot be generalised over populations; they can only be used to develop theory.

- It lacks transparency. Transparency refers to how participants were chosen, how data was analysed and how the conclusion was drawn.

5.3.1.3 Mixed methods

Kumar (2014) recommends the adoption of mixed methods to offset the limitations of quantitative and qualitative methods. Mixed methods are based on a critical realism philosophical approach, which

recognises both an objective world and subjective interpretation of that objective world (Saunders et al., 2016).

Theory in a mixed-method approach may follow a deductive, inductive or an abductive approach. In an abductive approach, existing theory is used in the generation of new theory or in the testing of theory. Data collection and data analysis in a mixed-method study design incorporates both quantitative and qualitative techniques. These techniques may be combined concurrently or sequentially, depending on the nature of the research (Saunders et al., 2016).

5.3.1.4 Justification for the choice of research design

As the interpretive nature of this study calls for a qualitative research design, the data collection procedures and data analysis used were qualitative. Interviews and focus groups were used to collect data. Both data sets were analysed through thematic analysis. This study is not only qualitative in nature, but is also a future study. The next section discusses futures studies.

5.4 Futures studies

According to Glenn (2009a:1), "*... the purpose of futures methodology is to systematically explore, create, and test both possible and desirable futures to improve decisions*." The intimation of this definition about futures studies is that these studies are not about making correct predictions, but they are about helping decision-makers to make informed decisions. There are at least 31 future studies' methodologies identified by Glenn (2009a). Table 5.2 provides a classification for future studies.

Table 5. 2 Taxonomy of futures research methods (Glenn, 2009)

Method	Quantitative	Qualitative	Normative	Exploratory
Agent Modeling		X		X
Causal Layered Analysis		X		X
Chaos and Non-Linear Systems	X			X
Cross-Impact Analysis	X			X
Decision Modeling	X			X
Delphi Techniques		X	X	X
Econometrics and Statistical Modeling	X			X
Environmental Scanning		X		X
Field Anomaly Relaxation		X		X
Futures Polygon	X	X	X	X
Futures Wheel		X	X	X
Genius Forecasting, Vision, and Intuition		X	X	X
Interactive Scenarios		X	X	X

Morphological Analysis		X	X	
Multiple Perspective		X	X	X
Participatory Methods		X	X	
Prediction Markets	X		X	
Relevance Trees		X	X	
Robust Decision-making	X			X
Scenarios	X	X	X	X
Science and Technology Roadmapping	X	X	X	X
Simulation-Gaming		X		X
State of the Future Index	X	X	X	X
Structural Analysis	X	X		X
Substitution Analysis				
Systems Modeling	X			X
Technological Sequence Analysis		X	X	
Text Mining		X	X	X
Trend Impact Analysis	X			X
Visioning		X	X	
Wild Cards	X	X		X

5.4.1 Normative versus exploratory forecasting

In futures studies, there are two types of forecasting, that is, normative forecasting and exploratory forecasting. Norms and values play an important part in normative forecasting. In exploratory forecasting, what is important is what is possible, and not what is desirable. Normative forecasting is concerned with the question of, "what is a desirable future?", while exploratory forecasting is concerned with, "… what future is possible?" (Glenn, 2009a).

5.4.2 Quantitative and qualitative futures' studies

Futures studies methods may follow quantitative or qualitative methods. The difference between the two methods is that quantitative methods rely on numerical data, mathematical calculations, measuring instruments and equations to make forecasts about the future while qualitative methods rely on hypothesis, intuition, invention and judgement.

5.4.3 Assumptions of futures studies

Which method to follow in forecasting the future depends on the assumptions about the future. There are a few basic assumptions about the future in futures research methods. These assumptions provide a basis for the generation of possible futures and how the future can be viewed. One view is that the future is predictable and can be controlled. This means that the knowledge of the present and the past can be

used to calculate the future outcome. In this predictive view of the future, statistical trend extrapolation is often used to predict the future (Glenn, 2009a; Kosow and Gaßner, 2008).

The second view is that the future is evolutive. From an evolutive perspective, the path to the future is chaotic, random and uncontrolled. Emergent strategies and intuition are used in developing future scenarios. Another view of the future is that the future is malleable. The malleable perspective adopts the view that the future is not predictable nor is the path to the future chaotic and uncontrollable. From a malleable perspective, the future can be controlled through intentional manipulation. In a malleable perspective, the future can be shaped by the implementation of certain strategies and actions. What is common among these three future perspectives is that they all provide a single future (Kosow and Gaßner, 2008).

The funnel model of the future on the other hand produces more than one future. There are many possible futures in the funnel model. The possibility of many futures is realised by the interplay of the number of factors currently affecting events. Scenario planning uses the funnel model in generating future scenarios. The premise of the funnel model is that gazing into the future from today's perspective, allows the possibility for many futures (Kosow and Gaßner, 2008). Figure 5.4 shows a graphical representation of the funnel model.

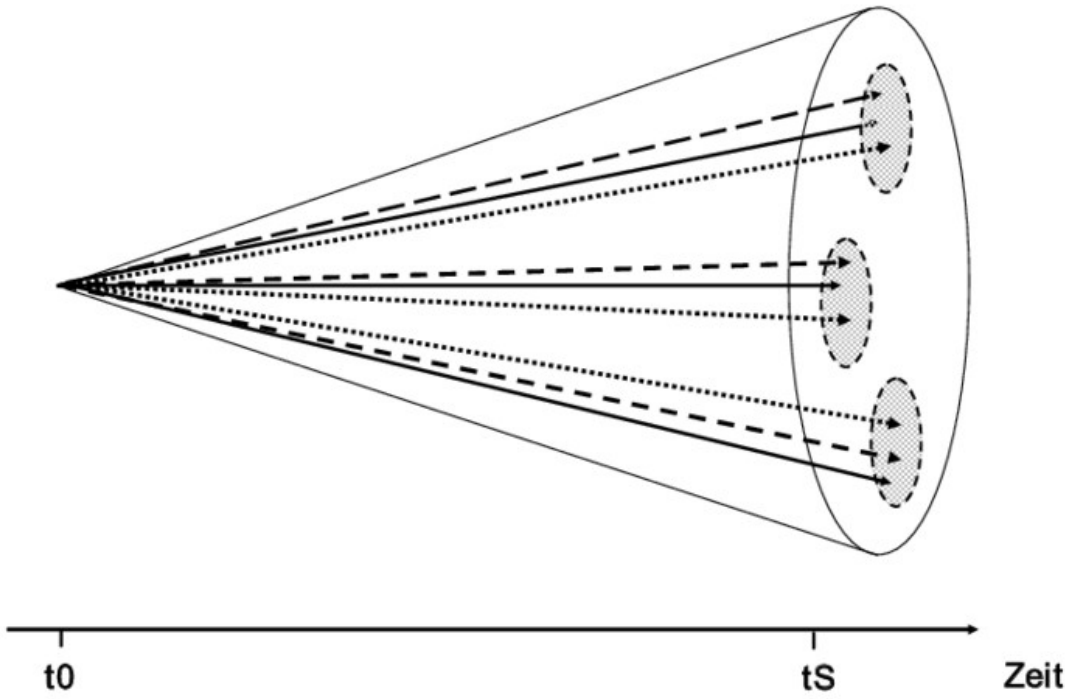


Figure 5. 4 Funnel of possible futures (IZT in Kosow and Gaßner, 2008)

5.4.4 Types of futures' studies

This section provides a synopsis of futures studies.

5.4.4.1 Environmental scanning

Environmental scanning aims to gain early warnings about the future in order to have enough time to prepare for the future. All futures studies include environmental scanning in some form or the other. There are various ways environmental scanning is used to scan the future. In determining the significance of the developments such as trends, future events and issues, experts' panels, database literature review, Google alerts, Internet website, hard-copy literature review, essays by experts, key person tracking and monitoring of key conferencing, are all used (Gordon and Glenn, 2009).

5.4.4.2 Text mining

Text mining is similar to environmental scanning. While environmental scanning is concerned with providing information about various environments, text mining is concerned with intelligent information regarding science and technology. Intelligence (as in the Central Intelligence Agency (CIA)) is of great importance in managing technology successfully (Porter 2009).

In text mining, useful intelligence from electronic text sources is extracted to identify portended future developments, time series for trend extrapolation, and possible future successful technology application (Porter, 2009).

5.4.4.3 Delphi method

The Delphi method can be described as a controlled debate between experts. In futures studies, the Delphi method is used to forecast future developments, the benefit of some future condition, and the ways of achieving or avoiding a future condition. The premise of the Delphi method is that experts in the field are more likely to provide the correct answers for questions in their area of expertise than non-experts (Gordon, 2009a).

After a careful selection of experts to participate in a Delphi method, a sequential set of questionnaires are then sent to experts. There can be three to four rounds of questionnaires, including feedback sent to experts until consensus is reached. One of the strengths of the Delphi method is that issues that require judgement can be investigated objectively. Some of the criticisms of the Delphi method include the fact that it is difficult and lengthy to conduct (Gordon, 2009a).

5.4.4.4 Real Time Delphi

Real Time Delphi uses the Delphi method's techniques; however, it is quicker and less costly to conduct than the original Delphi method. This is because it uses online tools to reduce time taken between the sequential questionnaires. Participation can happen simultaneously (Gordon, 2009b).

5.4.4.5 The Futures Wheel

The Futures Wheel is described as structured brainstorming. It allows participants to think and question the future in an organised way (Glenn, 2009b). Futures Wheel is used mainly to:

- Think about the possible impacts of current trends or future trends on the future;
- Generate forecasts in alternative scenarios;
- Indicate interrelationships;
- Assist in coordinating group participants into a workshop to participate in a brainstorming exercise and to consider the future; and
- Avoid surprises in future (Glenn, 2009b).

Participants in Futures Wheel are asked to state their opinions about the implications of a certain situation taking place in future. Futures Wheel is an easy and less expensive futures method to use in futures studies. One other benefit of Futures Wheel is that it can be used in simple cases and in advanced cases. Its disadvantages are that it can produce conflicting impacts and the results can also merely represent the collective judgement of participants (Glenn, 2009b).

5.4.4.6 Futures Polygon

Future Polygon is a complementary method to the Futures Wheel method (Pacinelli, 2009a). From the results of the Futures Wheel, Futures Polygon is used to provide indications about the probabilities of impact scenarios generated occurring, and to provide an evaluation of a realistic temporal horizon of when they are likely to happen (Ibid). It uses Delphi techniques and some calculations to achieve its objectives (Ibid). Future Polygon is criticised for including subjective evaluations from Delphi, as these are incompatible with Bayesian principles (Nair and Sarin, 1979; Moskowitz, Sarin, 1983 in Pacinelli, 2009a).

5.4.4.7 Trend Impact Analysis

In Trend Impact Analysis (TIA), perceptions about the implications of future events on extrapolations are represented in a time series. TIA assumes extrapolations are free from surprises. Thus, in developing a TIA, events, including their probabilities and impacts that would cause surprises, are identified. These events may be political, economic, social, technological, environmental and similar (Gordon, 2009c).

Since the TIA method extrapolates historical data into the future to make forecasts, it is criticised for not taking into account unprecedented future events. A TIA forecast might, therefore, produce forecasts that are surprise-free, which is unlikely in real life (Gordon, 2009c).

5.4.4.8 Cross impact analysis

The cross-impact method is described as "…*an analytical approach to the probabilities of an item in a forecasted set*," (Gordon, 2009d: 4). Cross-impact refers to how events and developments interrelate. The premise of the cross impact is that events leave a mark after they occurr. One event can cause a chain reaction of other events because of their interrelationships (Gordon, 2009d).

To do a cross-impact analysis, first, events that are to be included in the study are identified through a literature review and interviewing relevant experts. Second, the probability of each event occurring in future is then estimated. The estimation of the probability of the events occurring in future is done by experts or through questionnaires, interviews and group meetings. Third, conditional probabilities are estimated based on the interrelationship of events and developments. Researchers and participants have to determine the probability of an event occurring as a result of another taking place. One of the criticisms of the cross-impact analysis is that it relies heavily on causality. If the unexpected results are produced, researchers are inclined to re-examine their methods (Gordon, 2009d).

5.4.4.9 Wild cards

Wild cards are high-impact surprises with a low likelihood of occurrence, but which have global implications that can alter how people live. These implications can also be life threatening. Another characteristic of wild cards is that they do not give the system time to adjust to the shock, because they happen so quickly (Petersen et al, 2009).

Wild card methods involve, first, the identification of wild cards that are likely to happen in future. The identification process can be done through brainstorming, expert interviews, surveys and science fiction. After identifying possible wild cards, they are narrowed down according to their importance to the stakeholders. The third step is to determine the probability of these wild cards from happening, by looking at precursors. Lastly, options on how to deal with wild cards are then generated (Petersen et al., 2009).

The strength of the wild card method is that it identifies blindspots regarding future outcomes. One of its weaknesses is that it produces a large number of diverse wild cards, which require different ways of monitoring, and this can only be achieved through technology (Petersen et al., 2009).

5.4.4.10 Structural analysis and actors' strategy

Structural analysis and actors' strategy are types of impact matrices. In futures studies, the aim of impact matrices is to investigate systems and their dynamics. The impact matrices are usually applied in scenarios. Firstly, the system under study is analysed using structural analysis. It is at this first stage that important variables are identified. Second, major future developments and key future questions are identified using the actors' strategy to gain insight of the change in certain variables and explore possible future changes. In the last stage, exploratory scenarios are developed based on key questions (Arcade et al., 2009).

The structural analysis is a useful tool for identifying variables that are key to the evolution of the system. Its advantages however, are that it involves a large number of resources, expertise and sound logistics to implement. As with other methods that require group participation, the results can be biased towards the dominant participants' perspective (Arcade et al., 2009).

5.4.4.11 Systems perspectives

Systems perspective is a multi-disciplinary futures approach, which aims at "*...defining and solving complex, high-variety, dynamic, continuous, and interactive problems*," (Leonard and Beer, 2009: 1). The premise of a systems approach is the inter-connectedness of everything. Systems are nested within larger systems, often not because of hierarchy but because of logic or completeness (Leonard and Beer, 2009).

In forecasting the future using the systems perspective, a purpose for the exercise is first established. Second, the system and its boundaries are defined. This identification process is usually quantitative in nature. The third phase is the data-gathering phase. In this phase, the system is tested to determine its usefulness in testing its alternative scenarios and in predicting the future behaviour of the system. The fourth phase involves final testing, and revision to take into account environmental factors that might affect the system (Leonard and Beer, 2009).

While the systems perspective is useful in looking at the big picture, its major limitation is its reliance on equations and computer programmes to generate answers. Although accurate, these answers may prove unreliable with further probing. Qualitative methods allow for further probing of answers (Leonard and Beer, 2009).

5.4.4.12 Decision modelling

Decision modelling attempts to mimic real behaviour of actors in decision-making, based on certain criteria for success (The Futures Group International, 2009a). This technique is based on the utility

theory (Ibid). In futures studies, the decision modelling method follows the following criteria to forecast the future:

1. Identification of the decision criteria that will be used as the basis for judging different alternatives;
2. Each criteria is given a weight of importance;
3. The extent of how each alternative fits each criteria is estimated; and
4. A matrix is developed based on steps one to three (Ibid).

Decision modelling is useful in identifying the important aspects of decision-making of actors, its weakness is that identifying the criteria of what is important might be inaccurate. What is important does not always remain constant; it changes with time and situations (The Futures Group International, 2009b).

5.4.4.13 Substitution analysis

Substitution analysis is "*…a mathematical technique used to project the rate of market adoption of technically superior new technologies*," (Technology Futures Inc, 2008 in Gordon, 2009e). The technique used in substitution analysis is based on the assumption that new technologies usually follow a 'Logistics Curve' pattern. The 'Logistics Curve' is a type of S-Curve. Some of the weaknesses of the substitution analysis method includes the assumption that current factors will also be involved in future and for only considering one item as a substitute for the other. In reality, it is possible to have many substitutes and history does not always repeat itself (Gordon, 2009e).

5.4.4.14 Statistical modelling

Statistically modelling futures method includes all models that use numbers and mathematics to forecast the future. Similar to other quantitative methods, the statistical modelling method extrapolates historical data into the future. The assumption that present conditions will remain the same in future is unrealistic (Pacinelli, 2009b).

5.4.4.15 Technology Sequence Analysis

Technology Sequence Analysis (TSA) is used to forecast the time by when a technology-dependent system is likely to be available. To forecast, the TSA uses statistics and estimates. Some of the weaknesses of the TSA method is that it is costly and takes time, dedication and diligence. For analysis, the TSA requires certain software that may require training in order to use (Gordon, 2009f).

5.4.4.16 Morphological analysis

In the morphological analysis method, internal relationships of non-quantifiable socio-technical problem complexes are structured and investigated. To use morphological analysis method, parameter space and variables are defined. Morphological analysis can be used in scenario planning and in risk analysis. The disadvantages of morphological analysis is that it is time-consuming. It can take up to 10 full group-workshop days to develop morphological models (Ritchey, 2009).

5.4.4.17 Relevance tree

A relevance tree is an analytic technique, where a broad topic is sub-divided into sub-topics until it reaches the lowest level of disaggregation. A relevance tree is usually used to define important relationships and to investigate problems comprehensively. The relationships are often depicted in a hierarchical structure (The Futures Group International, 2009b).

One of the weaknesses of a relevance tree is that the excessive number of possibilities can be too cumbersome for analysis. Another weakness is the possibility of human error in the development of the relevance tree (The Futures Group International, 2009b).

5.4.4.18 Scenarios or scenario planning

Scenario planning was used in this study to suggest possible futures for the quantity surveying profession in South Africa. A scenario is defined as, "*…a story with plausible cause and effect links that connects a future condition with the present while illustrating key decisions, events, and consequences throughout the narrative*," (Glenn and The Futures Group International, 2009: 2). Another definition of scenarios is, "*Scenarios are descriptions of journeys to possible futures. They reflect different assumptions about how current trends will unfold, how critical uncertainties will play out and what new factors will come into play*," UNEP (2002: 320 in Kosow and Gabner 2008).

Scenarios aim to alter perceptions about the future through the observation of relevant key factors (Kosow and Gaßner, 2008). There are three characteristics regarding scenarios:

- A scenario draws attention to demarcated segments of reality and is therefore not a clear prediction about the future (Kosow and Gaßner, 2008).

- Scenarios are based on a construct of certain key factors, that is, whether they are deemed important or irrelevant in scenarios. In scenario planning, key factors and events are set in a context of interrelationships based on certain assumptions within a specific time frame. Thus,

scenarios can be reconstructed many times depending on assumptions made, and the interplay of the key factors analysed (Kosow and Gaßner, 2008).

- Scenarios are based on assumptions about the outlook of the future. They are therefore a hypothetical construct of possible futures. Knowledge gained in the present and the past is used to develop scenarios (Kosow and Gaßner, 2008).

5.4.4.19 Interactive scenario

Interactive scenario allows people to make changes to scenarios that have previously been prepared. The interactive scenario method uses cross impact analysis and a computer to determine and analyse the probability of each event. Currently, the method is not well developed and can only be used in simple and well-structured scenarios (Gordon, 2009g).

5.4.4.20 Robust decision-making

Robust decision-making (RDM) is described as a theoretical framework for decision-making that systematically uses a number of plausible future forecasts (Lempert and Collins 2007; Lempert et al., 2003). The RDM method is an iterative and a quantitative method that assists decision-makers and analysts in identifying robust short-term actions that are needed to reach the desired outcome in future (Lempert et al., 2009).

In the interactive process, participants use computer programs to suggest robust strategies for a number of plausible futures. Using a combination of simulation models and extrapolation of data, computer programs then challenge the performance of these suggested robust futures, by exposing their shortcomings. A weakness in the RDM method is that it requires a large amount of investment in developing simulation models suitable for the scenario ensembles (Lempert et al., 2009).

5.4.4.21 Participatory methods

Participatory methods are futures method that use public and/or professional communities' participation, such as opinion polling and focus groups, to identify possible futures, issues and goals. Wikipedia, collaborative software, websites and chat rooms are a few examples of the use of public participation in obtaining public opinion. Public participation can also be face to face. Most future forecasts developed through public participation tend to be normative rather than analytic. Normative forecasts are good in identifying common aspirations and strategies for achieving those goals, but are poor in making specific plans. In participatory processes, it is possible for the process to be manipulated for self-interest and for creating division between participants and non-participants (Glenn, 2009c).

5.4.4.22 Simulation and games

Simulation and games are useful in gaining insight into different aspects of the future. By using experimentation, possible futures can be explored without incurring the cost of errors as one does in real life. The difference between simulation and games is thatsimulations explore all relevant ideas, regardless of their absurdity or eccentricity. Games test the ability of existing structures, procedures and policies to cope with possible future changes, through communication and enhanced learning. Unlike dry simulations, rich ideas can be generated in gaming, as games are able to appeal to people's feelings. Simulation and gaming are only useful if the reality they choose to mimic is as close to reality as possible. Another limitation of simulation and gaming is that the adoption of virtual reality is still in its early stages (Rausch and Catanzaro, 2009).

5.4.4.23 Genius forecasting, intuition and vision

Genius forecasting describes the process that geniuses use to reach conclusions about the future. Geniuses are described as experts in their field of expertise, who usually make correct predictions about issues in their field of expertise. Intuition means looking within oneself to gain insight. A sound intuition is often developed over time through a combination of many factors, such as rationalisation, heuristics, mental model methods, assumptions and sources. In futures studies, vision describes a future condition and not a desired future. Visionaries often see what others cannot (Glenn, 2009d).

Genius forecasting, intuition and vision are subjective methods of forecasting and visioning the future, which rely on Albert Einstein's notion that "…*imagination is more important than knowledge*". The biggest criticism of the use of genius forecasting, intuition, and vision as methods of forecasting the future, is their subjectivity. These methods rely too heavily on expert knowledge, which might be relied upon in science and chemistry, but is unreliable in the social sciences (Glenn, 2009d).

5.4.4.24 Prediction markets

In prediction markets, the market prices predict a future event. The prediction market is based on the hypothesis that the markets are efficient. Predictive markets are a form of betting, where participants trade in contracts linked to payoffs, based on the occurrence of a future event. Prices yielded by this trading are indicative of market aggregate forecast. One of the drawbacks of predictive markets is that where stakes are high, the results may be manipulated (Wolfers et al., 2009).

5.4.4.25 Visioning

A vision is described as "…*a statement or image of the future we are committed to creating*," (Bezold et al., 2009: 5). Visions compel stakeholders to take measures to make the vision a reality. Trends and scenarios are futures methods that forecast futures systematically. Visions, on the other hand, inspire

future possibilities from the heart. The main questions that visions wish to answer relate to purpose, meaning and direction. The success of visions lie in the buy-in of stakeholders. There are claims that success does not depend on a compelling vision but on a good strategy (Bezold et al., 2009).

5.4.4.26 Science and technology roadmapping

There are three types of science and technology roadmapping methods. The product technology roadmap is used to provide actions that can be taken from the current product to a future product. An emerging technology roadmap is used to show the evolution of an emerging technology. Emerging technology also shows how resources can be used to interfere with the evolution of emerging technology. An issue-oriented roadmap shows how the use of technology can be one of the steps to reaching a solution or in raising an issue. Roadmapping is useful in aligning R&D with the allocation of resources. One of its weaknesses, however, is that it requires sound expertise to carry out (Gordon, 2009h).

5.4.4.27 Field Anomaly Relaxation

Field Anomaly Relaxation (FAR) is based on the social field theory that emphasizes the notion of the interactions of people and events in fields in which they live. In FAR, all imaginable patterns of interactions in social fields are explored. Patterns that are inconsistent with the gestalt assessment of internal coherence are ignored. FAR relies on intuition, logic and imagination to develop scenarios. The use of intuition, logic and imagination to forecast, is regarded as FAR's weakness (Coyle, 2009).

5.4.4.28 Agent-based modelling

Agent-based modelling (ABM) is a futures method that models a system as a collection of agents capable of making autonomous decisions. Each agent makes a decision based on a set of rules, after assessing a situation. Computers are used to create agents and to enable interaction between agents. Agents may represent markets or any phenomenon in real life. By using simulation and changing rules, how agents will react under different conditions in real life can be observed. ABM is criticised for failing to produce any credible forecasts that could be useful to forecasters and planners (Gordon, 2009i).

5.4.4.29 Chaos

Chaos is a futures method that seeks to identify underlying order in disorderly situations. The premise of the chaos method is that there is an orderly structure in systems that appear disorderly. This orderly structure of a chaotic system can be described and expressed mathematically. Chaos in futures study are useful in demonstrating that orderly systems may be operating in a regime that could become chaotic in future. Disorderly systems on the other hand, may possess some underlying order that make

predictions about their future behaviour possible. The weakness of the chaos is that it requires advanced mathematical analysis, a skill that many forecasters may not possess (Gordon, 2009j).

5.4.4.30 Multiple perspectives

The multiple perspective uses three perspectives to forecast the future. In the technical perspective, issues are simplified through abstraction, idealisation and separation from the real world. Technical perspective is concerned with problem solving. The organisational perspective's worldview is through the lens of social groups, society and institutions. In the organisational perspective, optimisation is least important. Process, actions and stability are more important that products and problem solving. Personal perspective looks at how an individual can influence a system. What is important in the personal perspective is power, prestige and influence (Linstone, 2009).

Since the technical perspective uses observations, analysis, data and models to forecast the future, its forecasts are probable. The organisational perspective uses consensus, bargaining and compromise to produce preferable forecasts. Personal perspective uses intuition, heuristics and experience to produce possible forecasts. The strength of the multiple perspective is that it looks at the future through all three perspectives. The multiple perspective is not, however, all comprehensive, hence the suggestion that the religious and oriental perspective should also be included (Linstone, 2009).

5.4.4.31 Causal layered analysis

Causal layered analysis (CLA) is a theoretical method that creates an environment conducive for forecasting alternative futures. This futures method is useful in developing inclusive long-term policy. CLA analysis shifts between these four levels of analysis, litany (such as trends), social causes, discourse and metaphor to aid policy-makers in developing inclusive policies. By including CLA in futures' workshops, participants' conventional ways of framing issues can be stretched beyond its boundaries. The limitation of the CLA method is that it does not predict the future but rather aids in analysis. This analysis, however, may lead to problems with over analysis and over thinking, rather than in policy development (Inayatullah, 2009).

5.4.4.32 State of the Future Index (SOFI) method

State of the Future Index (SOFI) is an index used to determine the changing state of the future. The state of the future, good or bad, is determined quantitatively using statistical methods based on key indicators and forecast. One of the drawbacks of SOFI is that it reduces the future into a single number, which can be misleading, as there are many factors at play in determining the future (Gordon, 2009k).

5.4.5 Summary of futures' studies methods

The foregoing synopsis on futures' studies demonstrates that there are many ways to forecast the future. The method used will depend on the aim of the study. Futures' studies' methods may be combined in their application. For example, to identify trends, the Delphi technique, text scanning, and group participatory techniques can be used in environmental scanning (Glenn and Gordon, 2009). Scenarios can incorporate the use of TIA to identify events that can alter historical trends (Ibid).

5.4.6 Criticism of futures' studies

Even though there is some contestation that futures' studies are not a science (as they lack the rigour associated with scientific studies) (Glenn, 2009a), futures' studies rely on human cultural knowledge, and empirical knowledge generated in other disciplines (Kuosa, 2011). In addition, futures studies follows basic scientific rules of research such as "… *open debate, objectivity, self-correction, possibility to falsification, iteration and accumulation of knowledge*," (Kuosa, 2011: 331). To respond to the criticism that futures' studies are not a science, this study follows grounded theory principles in its data collection and data analysis. In the data analysis, thematic and narrative analysis are also used.

5.4.7 Examples of the application of futures' studies

An example of futures' studies used in planning are the fifteen global challenges produced by The Millennium Project. The Millennium Project is an independent non-profit global participatory futures' research think tank of a group of futurists, made up of scholars, business planners, and policy-makers, from around the world (The Millennium Project, 2009a). Fifteen global challenges were identified to provide a framework for determining the prospects of humanity (The Millennium Project, 2009b).

Various public and private organisations have used futures' studies to plan for their future. In 1993, the United Nations University used the Delphi technique to investigate how population growth and the environment could be affected by future events and policies in the next 25 years (Gordon, 2009a). The Futures' Wheel was used to produce, "*South Africa's Western Cape of Provincial Foresight Coordinator Futures Wheel Report*," (Glenn, 2009b). The Futures Group used the TIA in its studies for the Federal Aviation Administration in the US (Gordon, 2009c). The CIA was used in the early 1990s to investigate the future of the European automobile industry and how innovation could assist in improving the quality of the logs in the softwood lumber industry in Canada (Gordon, 2009d). These are just a few examples of the application of futures' studies' methods by various organisations. The next section provides justification for the use of scenario planning in this study.

5.4.8 Justification for the use of scenario planning

In scenario planning, the future is not singular but plural (Cronjé, 2017). Change in a socio-technical system is complex, emergent, non-deterministic and path dependent (Mohr, 1982; Van de Ven and

Huber, 1990; Van de Ven et al., 1999; Agar, 2004 in Lyytinen and Newman, 2008). It is for this reason that a single forecast for the future quantity surveyor will not be of much benefit to the quantity surveying profession in preparing it sufficiently for its future.

The literature review revealed that there are many factors influencing the socio-technical system of the quantity surveying profession. The many factors currently influencing the socio-technical system of the quantity surveyor underpins the assumption that the future of the quantity surveying profession is not a singular concept but a plural concept. Hence, scenario planning is the most appropriate future methodology for the study. The type of scenarios generated are exploratory in nature as the study seeks to investigate possible futures for the quantity surveying profession.

Aaltonen (in Glenn, 2009a) classifies the 31 future methodologies into four categories (refer to Figure 5.5). Future methods that seek to understand the system include methods used to understand the system from outside the system, and methods that participate in the system. The future methods that are utilised to control a system include those that attempts to remove ambiguity to those that include or adapt to ambiguity. Therefore, according to Aaltonen (in Glenn, 2009a), scenario planning falls under the future methodology that analyses a system from the outside, and one that can both remove or allow for ambiguity. It is important that the socio-technical system is analysed in a "value free" manner, if it is to be of any value to the quantity surveying profession. Hence the choice of scenarios.

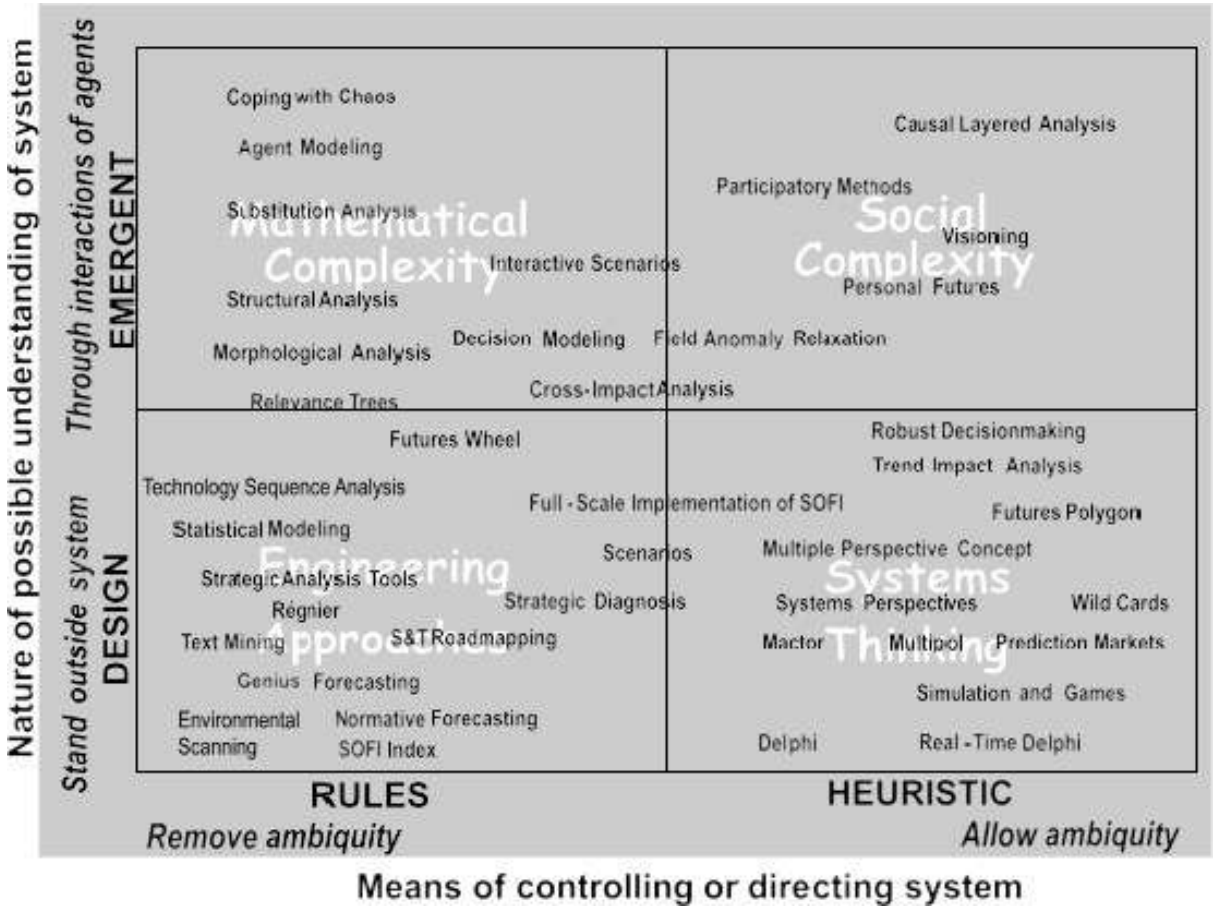


Figure 5. 5 The evaluation and organisation of Futures Research Methodology – Version 3.0 (Glenn 2009a)

According to Glenn and The Futures Group International (2009), one of the reasons scenarios are beneficial is that they can assist stakeholders in preparing for future risks and in identifying new opportunities. In spite of the threat of socio-technical changes to the position of the quantity surveying profession, there might also be new opportunities for the profession as a result of the socio-technical changes. These opportunities need to be identified. Hence, scenario planning was used in this study.

Through scenario planning, both exogenous and endogenous variables and influential forces (or which could potentially influence), an organisation or a profession can be taken into account (Chermack, 2004). By considering the many factors facing the quantity surveying profession, robust and useful scenarios can be generated.

This study copies from other studies that have used scenarios to assist organisations and economic sectors in society to prepare for their future. Harty et al. (2007) used scenario planning in their study of the future of construction in the UK. In 2008, a team of South Africans from different spheres of society developed future scenarios for South Africa in 2020 (Cilliers, 2014). These scenarios are called "*The Dinokeng scenarios: Walk apart, Walk behind and Walk together*". Prior to that, a similar exercise was

undertaken in 1991/1992 (Ibid). Twenty-two distinguished South Africans were brought together to develop stories about the future of South Africa between 1992–2002 (Beery et al., n.d.). These were called the Mont Fleur scenarios (Ibid).

5.4.9 Procedure followed in developing scenarios

There are five scenario generation techniques: scenarios based on trend extrapolation, formalised scenario techniques, morphological analysis, intuitive logics and normative-narrative scenarios (Kosow and Gaßner, 2008). All the five techniques follow a five-step methodology to identify possible futures (Cronje, 2017; Kosow and Gaßner, 2008).

According to Cronje (2017), the methodology entails the following steps:

1. Identification of the needs of the client within a specified time;
2. Identification of every economic, social and political factor that might influence a specific client's needs (or questions);
3. Grouping of socio-economic and political trends into groups of related trends;
4. Ranking trends based on their likelihood of impacting the questions at hand and its associated uncertainty using a two-axes graph; and
5. Identification of sudden shifts in trends by plotting the trend of the highest impact against the trend of the greatest uncertainty.

The process of scenario building described by Cronje (2017) is somewhat similar to the one described by Kosow and Gaßner (2008). Both steps 1 and 2 are similar. Steps 3 to 5 differ slightly. Kosow and Gaßner (2008) describe steps 3 to 5 thus;

Step 3: Analysis of key factors;
Step 4: Scenario generation; and
Step 5: Transfer scenarios (where necessary).

The next section discusses how this five-step process is followed in the five-scenario generation techniques. Since steps 1 and 5 are common for all five techniques in Kosow and Gaßner's (2008) scenario generation process, only steps 2–4 are discussed.

5.4.10 Scenarios based on trend extrapolation

Scenarios based on trend extrapolation identify key factors by trend observation and trend analysis. The analysis of trends is usually carried out through a time series analysis and statistical trend extrapolation. Scenarios based on trend extrapolation usually produce a single forecast of the future, that is, the most

probable scenario or business as usual (BAU) scenarios. They assume that the future can be predicted (Kosow and Gaßner, 2008).

The advantages of scenarios based on trend extrapolation are that they use data and calculations that can be verified. One of the biggest disadvantages of scenarios based on trend extrapolation is that they only provide one scenario; one future forecast. This can be interpreted as the only future that can be expected (Kosow and Gaßner, 2008).

5.4.11 Formalised scenario techniques

Key factor identification in formalised scenario techniques is through identification and characterisation, such as impact analysis. Once key factors have been identified, they are analysed and bundled together through consistency analysis or cross impact analysis. From the number of bundled key factor characterisations, stories about possible futures are created (Kosow and Gaßner, 2008).

The advantage of the formalised scenario technique is that factors are analysed in a systematised manner that is sufficiently transparent for scrutiny. Formalised scenario techniques' disadvantages include that they only take into account a limited number of factors. Another disadvantage is that the intuitive and normative elements are ignored in the process (Kosow and Gaßner, 2008).

5.4.12 Morphological analysis

Key factors identification and their analysis is done using Fritz Zwicky's morphologic box. The components and interrelationships of key factors are recorded in Fritz Zwicky's morphologic box. Table 5.3 shows a typical morphological box. Various combinations of these factors make a morphological space. Various combinations that develop are then selected using systematised or intuitive techniques to create scenarios about the future. The advantage of morphological techniques is that they allow for a great level of analysis and synthesis. Similar to the formalised scenarios, only a limited number of factors are taken into account (Kosow and Gaßner, 2008).

Table 5. 3 The morphologic box (Ritchey, 3007: 3 in Kosow and Gaßner, 2008)

Components (factors):	**Hypotheses (profile curves)**			
	1	2	3	4
Factor A	A1	A2	A3	A4
Factor B	B1	B2	B3	B4
Factor C	C1	C2	C3	C4
Factor D	D1	D2	D3	D4

5.4.13 Intuitive logics

In the intuitive logics techniques, key factors are identified and analysed according to their unpredictability and degree of impact, through both raw data and the intuition of experts in the field. After key factors are identified, they are then arranged according to the PESTEL framework, before being analysed on their unpredictability and degree of impact. This process of identification and analysis reveals relationships of key factors and their interactions with each other. A manageable number of scenarios are then generated based on the relationships and interactions of key factors, hence the scenario generation process follows scenario logic. Scenarios generated using the intuitive logic technique have three characteristics: interesting descriptive titles, captivating storylines and a line item explaining the possible future direction of the key factors identified (Kosow and Gaßner, 2008).

The advantage of the intuitive logic techniques is its inclusion of both implicit and explicit knowledge in the process. Another advantage is that there are no restrictions on the number of factors that can be taken into account. A big disadvantage of this technique, however, is that it is dependent on the selected experts and the process cannot be easily scrutinised (Kosow and Gaßner, 2008).

5.4.14 Normative-narrative scenarios

Normative-narrative scenario techniques identify key factors through collective collation and ordering of relevant factors. The analysis of key factors and scenario generation is done through scenario workshops, which often include experts and non-experts. Key factors are evaluated based on the desired future and condensed into consistent scenarios. Narrative scenarios are usually narrated using fictitious persons or institutions. The advantages of normative-narrative scenarios is that they involve a large number of participants of diverse backgrounds. In addition, there is no restriction on the number of factors to be considered (Kosow and Gaßner, 2008).

5.4.15 Procedure followed in developing scenarios

This study followed Kosow and Gaßner's (2008) scenario generation process, as it is the most relevant to the study. Another reason is that the researcher received training in the method. Instead of following one scenario generation technique, this study combined certain aspects of the three scenario generation techniques, in order to generate scenarios.

From the intuitive logics, the gut feelings of experts was used to identify key factors and for narrating the story of the scenarios. Impact analysis, a technique from the formalised scenario technique, was used to analyse the key factors. Normative-narrative scenarios techniques, such as a workshop with experts and non-experts, was also used in analysing key factors. Combining scenario generation techniques was done to mitigate the weaknesses of each technique.

The next section explains how this study followed steps 1 to 4 of the scenario generating process. Step 5 of the scenario process is communicating the outcome of the scenario-planning process and the scenarios to clients or the relevant stakeholders. Since this study is a basic research undertaken for academic purposes, step 5 was not necessary.

Step 1: Identification of the needs of the client within a specified time

Step 1 of identifying the client's needs in the scenario planning process in this study is the aim of the study. The aim of this study is to identify possible future scenarios for the quantity surveying profession in South Africa. This aim is based on the research assumptions that the quantity surveying profession not only desires to exist in future, but that the profession wishes to retain its professional status. Step 1 in the process of scenario planning in the context of this study can be summarised thus; the aim of the scenario planning exercise in this study is to suggest future scenarios for the quantity surveying profession in South Africa in the next five to 20 years.

Step 2: Identification of key factors

Step 2 in the scenario planning process involves identifying factors that might influence the clients' need. Identification of factors can follow a quantitative or a qualitative approach. This study followed a qualitative approach to identify key factors influencing the profession. The literature review and interviews with 23 experts were used to identify key factors that are likely to influence the current role of the quantity surveying profession.

An expert is "*a person with a high level of knowledge or skill relating to a particular subject or activity*"(Cambridge Dictionary, n.d.). This study uses the 10 000 hours rule to determine if someone is an expert. According to the 10 000 hour rule, it takes 10 000 hours of deliberate practice to become an experts in any field (Hill, 2013). The 10 000 hours converts to 10 years of experience (Ibid). An expert is therefore anyone with 10 years' experience in a field.

The reason for using experts is that the opinions of experts carry more weight than the opinions of non-experts (Dalkey et al, 1970; Helmer et al., 1959). Using the PESTEL framework, the 23 experts in the built-environment socio-technical system and the quantity surveying profession identified the factors influencing the built-environment and quantity surveying profession.

The majority of experts interviewed in this study are prominent members of the built-environment professions in South Africa. The inclusion of their opinion in the study was also based on a self-rating tool that was part of the research instrument. Experts used the self-rating tool to rate themselves on their

knowledge of the construction sector and the quantity surveying profession. Dalkey et al. (1970) recommend the use of a self-rating method to identify experts in a field of study.

The experts who participated in the study had to rate their knowledge of the South African construction sector and the quantity surveying profession on a scale of 1 to 5, where 1 was very low and 5 was very high. Participants who rated themselves above 3 were regarded as experts. This is because the sample of the selected participants was from people in the built-environment who had at least five years' working experience. It can therefore be assumed that an average rating of any participant in the study is higher than an average from the general society.

Steps 3: Analysis of key factors and ranking

To analyse key factors, a workshop and focus groups were used. Participants of the focus groups used impact analysis techniques to rank the key factors. From the interviews, a number of factors influencing the construction sector and the quantity surveying profession emerged. Participants in focus groups used the impact analysis matrix to show the relationships between these factors (refer to Table 5.4).

Table 5. 4 Impact analysis matrix (Adapted from Blasche, 2006: 74 in Kosow and Gaßner, 2008)

Impact On Of	Factor A	Factor B	Factor C	Factor D	**Active Sum**
Factor A					
Factor B					
Factor C					
Factor D					
Passive Sum					

The impact analysis matrix analyses the relationship between factors by asking the question, "*To what extent does a direct relationship take effect between these factors?*" (cf. Wilms 2006b, 51 in Kosow and Gaßner, 2008). In this study, the question was phrased thus; "*To what extent does a particular factor influence another factor*?" (Kosow and Gaßner, 2008: 51). The influence of one factor over another was measured by using the scale of 0 = No influence; 1 = Weak relationship; 2 = Medium relationship; 3 = Strong relationship (Kosow and Gaßner, 2008).

Before the matrix was used, the number of factors were reduced by discussion and consensus to a reasonable number. Working with many factors can be overwhelming (The Futures Group International, 2009c). Six to eight factors were deemed sufficient for the purpose of analysis in this study. In the workshop, key factors were reduced to six factors, and in the focus group they were reduced to eight factors.

The rows of the impact analysis matrix represent the Active Sum (AS). The AS denotes how that factor influences other factors. The column sum or the Passive Sum (PS) denotes how the factor is influenced by other factors. Factors with a high active sum and passive sum are called critical or dynamic factors. These critical factors have either the greatest impact and/or pose the greatest uncertainty to the phenomenon under study (Cronje, 2017). Only two critical factors are plotted on a two-axes graph (refer to Figure 5.6). Figure 5.6 represents four possible futures. In the context of this study, they represent the four possible futures of the quantity surveying profession.

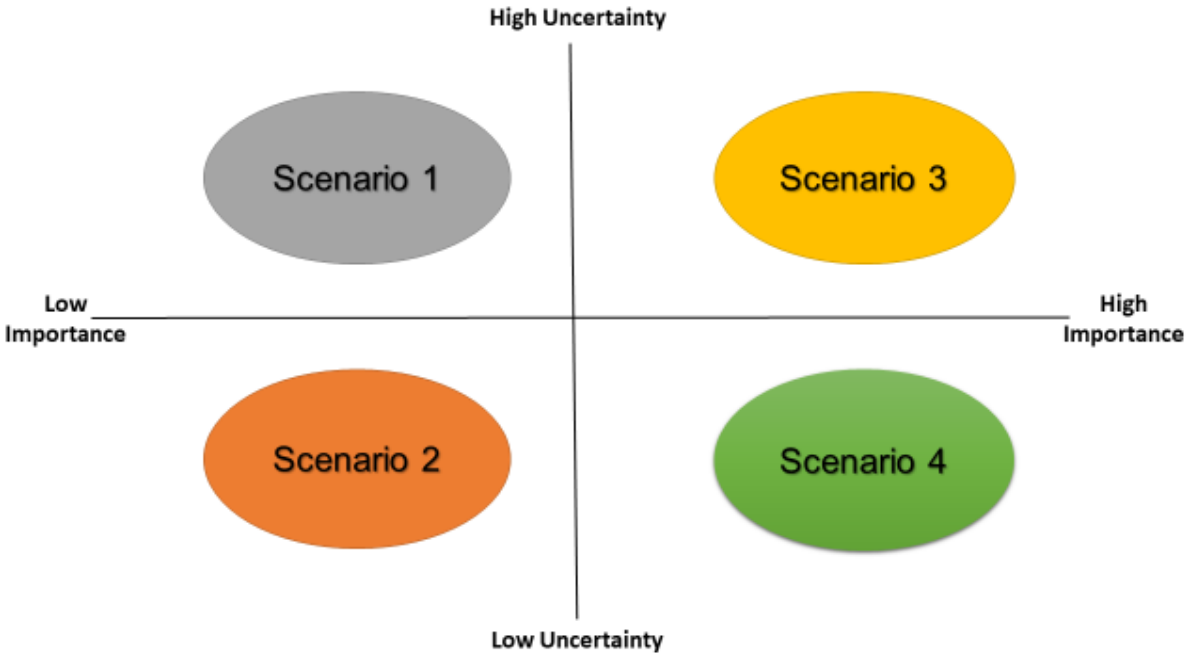


Figure 5. 6 Two-axes scenario-planning graph (Adapted from Cronje, 2017)

Step 4: Scenario generation

In step 4, scenarios are generated through story writing. The future of the quantity surveying profession represented in each quadrant in Figure 5.6 is narrated in the form of a story (Cronje, 2017). Stories about the possible future of the quantity surveying profession are written based on how the other factors analysed in step 3 are likely to influence the quantity surveying profession in future. The researcher used the data from the workshop and the focus group to write future scenarios for the quantity surveying profession.

The quality of the scenario generated is judged by the same rules applied in research generally (Kosow and Gaßner, 2008). In addition, Kosow and Gaßner (2008) claim that scenarios are judged according to the following certain rules or tests. These tests were applied to the scenarios generated in this study.

Test of plausibility. The scenario generated must logically be possible in future. This is regardless of its probability or desirability. In addition, the path to the future must also be feasible.

All four scenarios were based on the data collected from interviews, workshops and the focus group. The path to the future is based on current factors affecting the quantity surveying profession and the opinions of experts about the future. By looking at how past events have led to the current state of the profession, the same logic was followed. Scenarios were based on the principle of "from the known to the unknown".

Test of consistency. In scenarios, the consistency referred to is that between the paths to the futures and images of the futures. Paths to the future, and the images of the futures may not contradict each other. A similar format was followed in generating the scenarios in this study. Geels' MLP Framework was used to explain the profession at the macro, meso and micro levels. Pryor et al.'s (2008) 5Ps model was used to discuss the state of the different levels. Contradictions were eliminated by following the same pattern and logic in narration.

Test of comprehensibility and traceability. Future scenarios presented must be sufficiently detailed and traceable. Comprehensibility and traceability were achieved by supporting claims with reasons for such claims. Claims were based on experts' current views about the profession.

Test of distinctness. Each scenario generated must be distinguishable from other scenarios. Therefore, it must be possible for scenarios to be compared to each other. In this study, each scenario has a unique name. Conditions causing the events in each scenario are stated. A graphical representation of each scenario is also provided to simplify comparisons.

Test of transparency. Assumptions made in the generation of the scenarios must be clearly stated. This is to improve their validity and legitimacy. The study states assumptions about the future in 2040 from the outset. These assumptions are based on the evidence from literature and data collected from interviews, workshops and focus groups.

Test for the degree of integration. Scenarios must take into account the vertical integration and horizontal integration of factors. Vertical integration refers to the causal relationships between the macro factors such as political, economic, social, environmental, technological and legal. Horizontal integrations refer to the interrelationships between different sectors and themes.

How macro conditions are affecting the future of each scenario are stated from the study's onset. Relationships between the quantity surveying profession, other built-environment and other actors are explained throughout the narration of the scenarios.

Test of quality of reception. Scenarios must not be written in an incromprehensible manner, where they are torturous to read. In this study, academic jargon is substituted withy simple language when writing scenarios.

Test of participants. Participants in scenario development process determine the outcome of the scenarios. Scenarios will have different inclinations depending on whether participants were scientists/consultants, stakeholders or affected persons.

Scenarios in this study were developed by the researcher. It is possible that there might be some researcher bias in the development of the scenarios, even though it was somewhat mitigated by greater reliance on the evidence from literature and interviews, workshops and focus groups.

Test of time and effort. The time and effort taken to generate a scenario determines their degree of comprehensibility and integration.

Scenarios generated in this study followed an extensive literature review, 23 face-to-face interviews with experts, a workshop, a focus group and data analysis.

Kosow and Gaßner (2008) claim that plausibility and consistency are the litmus test for evaluating the credibility of scenarios. In spite of the foregoing, according to Tapinos (2013), there is no absolute process in developing scenarios. Variations in the development of scenarios is added to the development of the field (Tapinos, 2013). The next section discusses the qualitative data collection and data analysis that were followed in this study.

5.5 Data collection

From Saunders et al. (2009) research Onion, various quantitative and qualitative strategies can be used to collect and analyse data. Since the study lends itself as a qualitative study, only qualitative approaches are discussed.

There are different types of qualitative research: 1) phenomenological research, 2) ethnographic inquiry, 3) grounded theory, 4) narrative research, 5) case study, 6) critical qualitative strategy, and 7) archival research (Merriam, 2009; Rudestam and Newton, 2015; Saunders et al., 2009). In a qualitative research strategy, the researcher is the primary research instrument and data is usually collected through 1) individual interviews, 2) focus-group interviews, 3) observations, 4) action research, and 5) documents (Merriam, 2009). Each strategy and data collection procedure has its own strengths and weaknesses.

5.5.1 Types of qualitative research

4.5.1.1 Phenomenological research

Phenomenology is concerned with people's conscious experience of their life world. It usually deals with people's intense experiences, such as love, anger, betrayal and such (Merriam, 2009). A major advantage of phenomenology is that the data is collected in a manner that makes it compelling data (Lewis-Hickmann, 2015). The major disadvantage is that of the issue of the researcher's bias. The researcher's beliefs and values may affect the reliability and validity of the data (Creswell, 2014; Janesick, 2011; Patton, 2002).

4.5.1.2 Ethnographic inquiry

Ethnographic strategy includes anthropological descriptions, naturalistic research, field research, and participant observations. In ethnography, a phenomenon is studied within the context in which it exists through observing patterns of behaviour, customs and lifestyles. Data collection is through participants observation over a prolonged period of time (Rudestam and Newton, 2015; Saunders et al., 2009).

A major advantage of ethnography is that a phenomenon can be comprehended in a particular context through the lens of the subjects involved. Its main disadvantage is that it is a lengthy process, as it is conducted over a prolonged period of time (Saunders et al., 2009).

4.5.1.3 Grounded theory

Grounded-theory strategy is concerned with theory building through a combination of the inductive and deductive approaches. Data collection is done without having any theory. It is from the data collected that theory is then developed (Saunders et al., 2009). It is useful in explaining and predicting behaviour (Goulding, 2002).

Explaining and predicting behaviour is the main advantage of the grounded-theory strategy (Goulding, 2002). Researcher-induced bias is one of the disadvantages of this strategy. It is difficult to detect and to prevent researcher bias. In addition, the reliability and validity of data is difficult to assess, given the subjective nature of the data. Because of the qualitative nature of the results, their presentation to practitioners might make them "non-user friendly" (Davison, 1998).

4.5.1.4 Narrative research

Narrative research is concerned with personal experiences of the person who has lived them (Chase in Rudestam and Newton, 2015). In a narrative research, study stories are used as data. Stories of experiences are classified into different categories, such as biography, life history, oral history, autoethnography, and autobiographies. The text in the data collected in narrative research is analysed for the meaning it has for the author. Narrative research is informed by the philosophy of hermeneutics, which is the study of written texts. However, narrative analysis goes beyond written text to include in-depth interview transcripts, life-history narratives, historical memoirs, and creative non-fiction (Merriam, 2009).

A major advantage of narrative research is that it adds people's personal experiences in the research, thereby enhancing the understanding of a field (Dunbar-Hall, 2009). Its main disadvantage is that it is, "… not appropriate for studies of large numbers of nameless and *faceless subjects*," (Reissman, 2005).

4.5.1.5 Case study

Yin (2014: 16) defines a case study in two parts, the one-part definition of a case study is, "…*a case study investigates a contemporary phenomenon (the case), in its real-world context, especially when the boundaries between [the] phenomenon and [the] context may not be clearly evident*," (Yin, 2014). The second part of the definition is:

"*A case-study inquiry:*

copes with the technically distinctive situation in which there would be many more variables of interest than data points; and where one result
relies on multiple sources of evidence, with the data needing to converge in a triangulation fashion; and as another result
benefits from the prior development of theoretical propositions to guide the data collection and analysis," (Yin, 2014).

A case-study strategy is often useful in explanatory and exploratory research, as it provides answers to the 'why', the 'what', and the 'how' research questions. Case study data collection is from multiple sources, such as interviews, questionnaires, observation and archival documents (Saunders et al., 2009, Yin, 2014).

The advantage of the case study strategy is that it allows a phenomenon to be studied within its real-life context. It also provides explanations of how multiple variables affect the phenomenon. Other advantages of a case study strategy are that it can be used to test theory and in producing new theory sources. A major disadvantage of the case study is that it is often regarded as being a non-scientific method as it lacks the rigour associated with "scientific research" (Saunders et al., 2009).

4.5.1.6 Critical qualitative study

The goal of critical qualitative study is to, "…*critique and challenge, to transform and empower*" (Merriam, 2009: 34). It focuses more on context than on individuals. For example, in the quantity surveying profession, the context where they operate includes the professional system, the culture and the institutions in the construction industry and society at large, which shape its functions and practices (Merriam 2009). Critical qualitative theory is concerned with issues such as oppression, domination and power (Mertens, 2009 in Creswell, 2014).

An example of a critical qualitative study is participatory research (PAR) (Merriam, 2009). In PAR, participants are actively involved in the collection, analysis of data, and on the decision of the action to be taken as a result of the findings. The main advantage of critical qualitative study is that, "… *critical theorists use critical reflection on social reality to take action for change by radically calling into question the cultures that they study*," (Baum et al., 2004). The main disadvantages are that PAR does not have a set end date. The process of investigation is through a reflective cycle that continues until the problem is resolved. Thus, the cycle may continue "forever" (Walter, 2009).

4.5.1.7 Archival research

Data collection in archival research is through recent or historical administrative records (Bryman, 1989; Saunders et al., 2009).

The main advantage of archival research it is able to provide explanations on the past, and on any changes that have occurred over time. Its disadvantage is that since it depends on archival records and documents, it may not be able to answer the research questions, as the data collected is limited by the archival records, the nature of the records, and the documents obtained. There might also be restrictions to accessing the records, due to confidentiality (Saunders et al., 2009).

5.5.2 Justification for qualitative data collection strategy

From the above brief descriptions, on the types of qualitative research strategies, the most suitable strategy for the study is the grounded theory design, as it is good for explaining and predicting behaviour (Goulding, 2002). Merriam (2009) claims that grounded theory is useful in explaining the process of change. The quantity surveying profession is being influenced by numerous factors that have the

potential to change it. By using grounded theory design this potential change will be better explained. This in turn will assist in predicting the future development of the profession.

Phenomenology is not relevant for the study as it usually deals with people's intense experiences, which are outside the scope of the study. Ethnography is more suitable for anthropological studies. As narrative research is concerned with personal experiences of the person who has lived them, it is not suitable for the study. Some of the change envisaged have yet to be experienced by the quantity surveying profession in South Africa, but is important to study these changes in order to predict the behaviour (or role) of the quantity surveying profession in future.

Although issues of professions' "market" dominance form part of the study somewhat, they are not the only core issues studied. Thus, a critical qualitative study is insufficient in explaining and understanding what influence socio-technological changes will have on the future role of a quantity surveyor. Archival research's reliance on administrative records for its data collection makes it unsuitable for the study, as some of the factors are not confined to specific organisations or institutions, and thus information from archival records may be limited, thus leading to the research question being inadequately answered. The choice to adopt grounded theory over a case study design to collect and analyse data was due to this study's interest in not only understanding behaviour, but also in predicting behaviour, which grounded theory is able to do.

5.5.3 Data collection: grounded theory techniques

Merriam (2009) states that data collection in grounded theory may come from interviews, observations and a wide variety of documentary sources. Observation in research refers to a systemic observation of the behaviour of participants through recording, description, analysis and interpretation (Saunders et al., 2016). It was not relevant to use observation in this study. Data was collected through a literature study, interviews, workshops and focus groups.

According to Saunders et al.'s (2016) research Onion, there are three research choices for data collection and analysis. There is the mono-method, where one research strategy is selected to collect data and analyse data (Saunders et al., 2016). Another choice is mixed-method, where a combination of qualitative data collection and data analysis techniques are combined with quantitative data collection and data analysis techniques (Ibid). The third choice is called the multi-method (Ibid).

Multi-method, "*…refers [to] those combinations where more than one data collection technique is used with associated analysis techniques, but this is restricted within either a quantitative or qualitative world view,*" (Tashakkori and Teddlie, 2003 in Saunders et al., 2009). In this study, multi-method was

used to collect data. A literature study, interviews, workshops and focus groups are qualitative research techniques that were used to collect data.

5.5.4 Justification for the use of multi-method

Multi-methods are ideal for an exploratory study. The study is exploratory in nature, as it explores what the future of quantity surveying profession will be like. The guiding principles for exploratory studies are a literature study, interviews with experts in the field, and focus-groups interviews (Saunders et al., 2016).

5.5.5 Data collection technique: interviews

Once the choice of method is made, the last layer or pillar to 'peel off' from Saunders et al.'s (2016) research Onion is the data collection and data analysis techniques and procedures. Firstly, data collection through interviews is discussed, and then data collected through a workshop and a focus group is explained later in this chapter.

Semi-structured interviews were conducted with a purposively selected sample of participants. Rudestam and Newton (2015) recommend that in grounded theory, participants for the interview be chosen on the basis of their, "... *experiential relevance*". Hence the use of experts in the interviews.

A semi-structured interview usually consists of a list of questions and topics that must be covered in the interview. An interview guide rather an interview schedule is used. The order of questions and the manner of questioning may differ from one participant to the other. One of the benefits of a semi-structured interview is that it provides more insight to the topic under study. However, its disadvantage is that it introduces bias (Saunders et al., 2016).

The use of semi-structured interviews instead of structured or unstructured interviews in this study was guided by the aim of the research study. A structured interview uses an interview schedule to solicit information from participants (Kumar, 2014). Participants are asked the same questions in the same order and wording (Ibid). One of the advantages of structured interviews is that data is provided in a uniform manner and can be compared (Ibid). The limitation of structured interviews is that they only take into account the 'what' and the 'how' questions (Saunders et al., 2016). Structured interviews ignore the 'why' questions (Ibid), which this study is interested in exploring.

Unlike in a structured interview, where the style of questioning is formal, the style of questioning in an unstructured interview is informal (Bryman et al., 2014; Saunders et al., 2016; Kumar, 2014). There is contestation as to whether the use of an interview guide is necessary in an unstructured interview. Bryman et al. (2014) advocate for the use of an interview guide while Kumar (2014), Merriam (2009) and Saunders et al. (2016) do not. The researcher only needs to have a list of topic or themes that they

need to cover in the interview (Saunders et al., 2016). Questions to participants may not be the same for each interview (Bryman et al., 2014; Kumar 2014; Saunders et al., 2016).

In an unstructured interview, the researcher may ask any questions that may arise during the interview. This freedom in the structure and content of questions is an advantage of unstructured interviews. A major disadvantage of unstructured interviews is the large data they produce, which makes analysis difficult. Unstructured interviews are also criticised for being too subjective and therefore unscientific (Bryman et al., 2014; Kumar 2014; Saunders et al., 2016).

4.5.5.1 Justification for the use of semi-structured interviews

By using a combination of structured interview and unstructured interview techniques, the interviews conducted in this study ensured flexibility, but had some structure to ensure that the relevant themes are covered. The interviews were conducted using an interview guide. Questions were however, not asked in the same way or same order. The researcher was able to ask further questions where necessary. In some instances, it was not necessary to ask experts in the construction sector questions related to the quantity surveying profession or vice versa.

Saunders et al. (2016) recommends the use of semi-structured interviews where, first, the number of questions to be answered is large; second, where the questions are open-ended or complex, and last, where it is necessary to change the order of the questions. All these three instances recommended by Saunders et al. (2016) were the case in this study, hence semi-structured interviews were used.

The literature review revealed that the number of issues to be covered is large. Second, this study is not only interested in the ‘what’ or ‘how’ questions, but also in the ‘why’. Last, it was necessary to change the order of the questions depending on the area of expertise of the expert interviewed and the time available for the interview.

Interviews can be conducted face to face or by telephone, or by any other electronic media (Kumar, 2014). In this study, face-to-face interviews were used to collect data. The next section provides the reasons for the use of face-to-face interviews over other means of interviews.

4.5.5.2 Justification for the use of face-to-face interviews

The 23 interviews conducted in this study were all face to face. The interviews were held between May 2020 and December 2020. Face-to-face interviews were preferred to other types of interviews, because of the larger number of questions and the complexity of the questions. Telephone interviews are unlikely to proceed beyond 20–25 minutes (Frey, 2004 in Bryman et al., 2014). The average time for the interview in this study was 85 minutes. The quality of face-to-face interviews is much higher than the quality of electronic media or telephone interviews (Bryman et al., 2014), hence their use in this study.

4.5.5.3 Shortcomings of interviews and mitigation of the shortcomings

The biggest shortcoming of the use of interviews is bias. Different types of bias can be introduced, such as biased sample, interviewee bias and interviewer bias. A biased sample occurs when the selected participants do not truly reflect the population (Bryman et al., 2014). An interviewee bias occurs when the interviewee conceals some information or falsely represents themselves (Saunders et al., 2016). Bias by the interviewer can be caused by the interviewer's conduct, behaviour or appearance (Ibid).

Bryman et al. (2014) recommends that bias should be reduced to a minimum, as it is almost impossible to remove bias altogether in practice. The sample of 23 participants was regarded sufficient for the purpose of the study. For a semi-structured interview, a sample size of 5–25 for a homogeneous population and 12–30 for a non-heterogeneous population, is deemed sufficient (Saunders et al., 2016).

In this study, the experts that were interviewed were made up of two semi-retired quantity surveyors, 11 practising quantity surveyors (QS), five architects, two civil engineers, one researcher, one construction project manager (CPM) and one property and facilities manager (FM). Some experts had more than one role in the construction sector. What is reflected is their most dominant role. It would have been ideal to interview an evenly distributed sample; however, those interviewed were those that agreed to participate.

The use of multi-method in this study is also an attempt to deal with bias that may have been introduced in the interviews. It is a form of triangulation. Triangulation allows for a phenomenon to be observed from various vantage points (Saunders et al., 2016). It improves the quality of the research by providing additional knowledge (Flick, 2011).

4.5.5.4 Interviews: data-collection procedure and sampling methods

Participants in the face-to-face interviews were solicited through the researcher's network in the construction sector. This type of sampling is called non-probability sampling. In non-probability sampling, participants are chosen with a specific purpose in mind (Saunders et al., 2016). One of the participants recommended one participant to be included in the interviews, and the recommended participant was subsequently interviewed. All participants were chosen and included based on their expertise in quantity surveying and the construction sector.

Upon receiving ethical clearance from the University of the Witwatersrand's Ethical Committee, a list of potential participants was drawn up based on their relevance to the study. A copy of the ethical clearance certificate is attached in the annexure section.

Email invitations were sent to potential participants. A letter explaining the aim and objectives of the study accompanied the email invitation. Issues related to confidentiality, anonymity and voluntary participation were also covered in the letter. Attached with the letter was a consent form that each

participant had to sign before both the interview and the recording of the interview. Before the commencement of interviews, the aim and objectives of the study, including the content of the study, were further explained to participants. A copy of the letter sent to participants, including the consent form, is attached in the annexure section.

4.5.5.4.1 Interviews: data collection instrument

The researcher administered all the face-to face interviews using an interview guide. A poor interview guide can adversely affect the quality of data collected (Kumar, 2014), hence principles of this study followed recommendations by various scholars in formulating the interview guide. The interview guide was divided into the following sections:

- Section 1: Background information;
- Section 2: Level of knowledge of the construction sector and the quantity surveying profession;
- Section 3: Construction sector questions; and
- Section 4: Quantity surveying questions.

Bryman et al. (2014) recommends questions in long interview guides to be grouped together, hence the grouping of the questions. The order of questions followed the principle of asking general questions first followed by asking specific questions, recommended by Bryman et al. (2014) and Merriam (2009). The interview guide comprised open-ended questions and closed questions. Open-ended questions allow participants to answer questions in their own way while closed questions provide the participants alternative answers from which to choose (Saunders et al., 2016). A copy of the interview guide is attached in the annexure section.

Even though the interview guide was not followed religiously, it was important to include closed questions in the interviews. For example, the literature revealed quantity-surveying tasks that are at risk of extinction. Participants were asked to choose which ones they thought were at risk. This allowed for their responses to be compared to the literature claims. Open-ended questions are important in a qualitative study as they allow for the 'why' questions to be answered, hence their inclusion.

4.5.5.4.2 Interviews: data capturing instruments

Data was captured through note taking and a mobile phone. The mobile phone was used as a recording device. A combination of recording and note taking has a few advantages. Note taking is useful in maintaining concentration and formulating probing questions (Saunders et al., 2016). Recording provides accurate and unbiased record of the interview (Ibid). Another advantage of recording is that it makes direct quotations possible (Ibid). In this study, note taking was used minimally to allow the researcher to be fully engaged with the interview.

Transcribing data from semi-structured interviews can be time consuming (Bryman et al., 2014; Saunders et al., 2016). Given the large amount of data collected from 23 interviews and the time constraints (as this is a cross-sectional study), transcription software was used to assist in transcribing the audio recording. The software used to transcribe the interview recording is called "*Transcribe*". This software allows for auto-transcription of the recording; however, the transcription was not accurate and had errors that the researcher corrected.

Interviewing and transcription was carried out concurrently, as recommended by Saunders et al. (2016) and Bryman et al. (2014) between the period May 2019 and November 2019. Through this simultaneous process of interviews and transcribing, certain themes and patterns emerged. Some of the themes and patterns that emerged were used in subsequent interviews and also in workshops and the focus group. It was not possible, however, to transcribe the recordings immediately after each interview as recommended (Saunders et al, 2016). About half of the interviews were transcribed in the period December 2019 to January 2020.

5.5.6 Data collection technique: workshop

In this study, the scenario workshop was used to reduce and to analyse key factors identified in the literature review and the interviews. Even though the use of workshops in the scenario planning process is widespread, they are still under-researched. Scenario planning workshops aim to assist key decision makers to consider a number of plausible futures and to identify and select a strategy for the future (Franco et al., 2013). In a scenario-planning workshop the following takes place, key factors are generated and reduced to a workable number; secondly, themes are elaborated, and lastly scenarios are generated (Ibid).

Participants in a scenario workshop include a facilitator and workshop participants. The personality styles of workshop participants play a critical role in determining the outcome of the scenario planning process. The more cognitively diverse the group of participants is, the better the outcome. Cognitive style refers to the way people think, perceive and process information (Franco et al., 2013).

4.5.6.1 Justification for the use of a scenario workshop

A number of scenario planning studies use workshops to generate scenarios or to aid the process of scenario generation (Derbyshire, 2016; Franco et al., 2013; Glenn and the Futures Group International, 2009; Kosow and Gaßner, 2008; Pattinson and Sood, 2010; Tapinos, 2013). In generating future scenarios for a British multi-national firm, Tapinios (2013) conducted five workshops. The first two workshops were used to prepare for the main scenario-planning workshop, and the two other workshops were used for debriefing (Ibid).

The two preparatory scenario workshops were held with top management in order to set the aims and outcomes of the main scenario planning. The purpose of the main scenario planning workshop was to foster a discussion about possible futures and to improve the strategic foresight of top management. For reflexivity and reflection purposes, two debriefing workshops were held; firstly, with industry experts and lastly with the managing director and the director of the human resource development (Tapinios, 2013).

In creating the three futures for South Africa through the scenario planning process, the Dinokeng scenario planning team first conducted in-depth interviews with 35 various societal leaders. These societal leaders were the same who were invited to participate in the workshop. Thereafter three three-day workshops were held, and lastly a fourth workshop was held (Reos Institute, 2013).

In the first workshop, the emerging themes from the interviews were reviewed. The second workshop involved inputs from experts from key sectors of society. This input from experts assisted in refining key trends and challenges. The third and fourth workshops were used to generate scenarios for South Africa (Dinokeng Scenarios, n.d).

The Dinokeng and Tapinios (2013) scenario workshops are provided as evidence of the widespread use of workshops in the scenario-generation process. Hence, the use of a workshop in this study. From the two examples provided on the use of scenario workshops, is that scenario workshops may be used for different purposes.

Scenario workshops may also be lengthy or shortened, as in Tapinios (2013), where one-day workshops were held instead of three-day, full-day workshops (as in the case of Dinokeng). Shortened scenario planning workshops can take between four and six hours (Glenn and the Futures Group International, 2009). As this study is a cross-sectional study, with a set duration, a shortened workshop was used. The next section discusses the workshop procedure followed in this study.

4.5.6.2 Workshop: data-collection procedure and sampling methods

Participants of the workshop were part of the delegates of the 2019 SACQSP International Research held on the 16th and 17th of September 2019 in Johannesburg, South Africa. Once again, non-probability sampling was used. Records from the SACQSP show that the majority of the delegates were quantity surveyors. Table 5.5 shows the record of the delegates.

Table 5. 5 Delegates of the 2019 SACQSP International Conference (SACSP, 2020)

		Number

	Category	
1)	Candidate Quantity Surveyor	48
2)	Professional Quantity Surveyor	103
3)	Students	40
4)	Community/Administration	23
5)	Not classified	2

Table 5.5 shows that the majority of the conference delegates were quantity surveyors. Of the delegates who are classified as community or administration, 11 were from universities, four were from ASAQS or SACQSP, three were from a construction supplier, one from a construction company, five from private quantity surveying firm, one from a Government department, and one delegate was not classified. Of all the delegates, only five were from outside South Africa.

With permission from SACQSP and the conference organisers, 39 delegates participated in the scenario workshop that was facilitated by the researcher. Before participating in the workshop, the researcher explained the purpose and objectives of the study to the delegates. Participants were also requested to sign a consent form before participating in the workshop. Table 5.6 shows the economic sector of the participants.

Table 5. 6 Economic sector of participants

	Economic sector	Number
1)	Private professional firm	23
2)	Construction sector – supplier	2
3)	Public	4
4)	Academic	6
5)	Parastatal	3
6)	Construction – regulatory body	1

Participants from private, professional firms were mainly from quantity surveying firms. Two firms represented by participants offered both quantity surveying professional services and project management services. Two participants from the construction sector are quantity surveyors from a global supplier of building and engineering equipment. From government departments, there were four participants. The academic sector participants included students and academic staff. Three participants were from a state-owned, public service provider. One participant was from a regulatory body in the construction sector. Even though the conference was an international conference, all the scenario workshop participants are based in South Africa.

The following are the steps followed in the reduction and analysis of the key factors:

Step 1: The researcher explained the aim of the study and the workshop to participants. A brief background of the study, including key factors and emerging themes from the interviews were also explained.

Step 2: Participants were divided into small groups of five to six to ensure effective participation of each participant. The small groupings were random. Participants elected to form small groups with the participants seated next to them; this was partly because of the venue setting. The venue seating was small and the seating was arranged classroom style. Organisers of the conference could not secure a large enough venue for round tables. Sitting in a circle is more effective in facilitating discussions than sitting in a classroom style discussion (Yale Poorvu CTL, n.d). In spite of this limitation, participants were able to rearrange the chairs to allow for a more circular seating arrangement during discussions.

Step 3: Through group discussion and consensus, participants were able to reduce the 39 key factors identified through interviews into six factors.

Step 4: Using the impact analysis matrix, participants analysed the six key factors identified.

Step 5: Each group presented its results. From the results of the analysis, two factors that had the highest active and passive scores from all the groups emerged.

4.5.6.3 Workshop: data collection and data capturing instrument

Following a presentation of the key factors identified in interviews, through robust discussion, key factors were reduced to six factors. Participants used an impact analysis table to analyse the six key factors. Data was captured through note taking and an audio recorder. Each group had a scribe.

5.5.7 Data collection technique: focus group

In addition to a scenario workshop, a focus group was also used to reduce and analyse key factors identified in the literature review and the interviews. A focus group is a group interview where four to 12 participants, who share similar characteristics for triangulation purposes relevant to the study, are interviewed in a group setting (National Science Foundation, 2002; Saunders et al., 2016). Focus groups are ideal for examining an issue thoroughly and in identifying problems, questions or significant issues (McMillan et al., 2016).

5.5.7.1 Justification for the use of a focus group

Firstly, the use of a focus group in addition to the workshop in this study was for triangulation purposes. Although the interviews revealed many factors that are currently influencing the construction sector and the quantity surveying profession, it was deemed necessary to reduce and analyse the key factors through robust debate. This is in line with Saunders et al.'s (2016) claim that in focus groups, the interactions between group members may generate shared meanings about a topic.

5.5.7.2 Focus group: data-collection procedure and sampling methods

Through non-probability sampling methods, 11 participants took part in the focus group held on the 24th of October 2019. Four participants were part of those interviewed. Similar to the Dinokeng scenarios, participants from interviews were invited to be part of the focus group, but many were unable to attend. Bryman et al. (2014) recommend over-recruiting to overcome the challenge of possible low turnout. Other participants who were not interviewed were also invited to mitigate for the possible low turnout. A copy of the letter sent to participants (including the consent form) are attached in the annexure section. Participants were mainly invited through email. Table 5.7 shows the professional groups the participants represented.

Table 5. 7 Professional group of participants

	Professional Group	Number
1)	Quantity surveyors	5
2)	Construction manager	1
3)	Architects	3
4)	Academic	1
5)	Civil engineer	1

All quantity surveyors who participated in the focus group were from private practices, except for one, who was also an academic. Only one quantity surveyor had also been interviewed. All three architects who participated in the focus groups were also interview participants. The construction manager, academic and civil engineer had not been interviewed previously. The researcher facilitated the focus group. There were two scribes to take notes.

The following are the steps followed in the reduction and analysis of the key factors:

Step 1: Similar to the workshop. The research aims, objectives, key factors and emerging themes from the interviews were explained to participants at the start of the meeting.

Step 2: Participants were divided into pairs. As in the workshops, the pairing of the groups was random. All participants sat at one round table and elected to pair with participants seated next to them. Pairing ensured that all participants could have their voice heard without being dominated by one dominant voice.

Step 3: After discussion and consensus amongst the pairs, key factors from interviews were reduced to eight factors.

Step 4: Each pair explained their reasons for choosing the key factors they have chosen. The researcher engaged the group to discuss why the pairs chose those factors as the most important.

Step 5: The impact analysis matrix was used to analyse the identified eight key factors.

Step 6: After each pair presented its results, two factors that had the highest active and passive scores from all the pairs were identified.

5.5.7.3 Focus group: data collection and data capturing instrument

The key factors were reduced and analysed through discussion and the use of an impact analysis table. An audio recorder was used to record the discussions. The two scribes captured the discussions by note taking.

5.5.7.4 Shortcomings of workshops, focus groups, and mitigation of the shortcomings

The biggest disadvantage of group interviews, such as workshops and focus groups, is that some group members may dominate the discussion, while others are inhibited from participating (Blumberg et al., 2008; Saunders et al., 2016). To overcome this shortcoming, the participants were divided into smaller groups in the workshop and into pairs in the focus groups to encourage participation of all who took part. At the end of the discussion for each session, groups and pairs reported on the outcomes of the discussions. This enabled participants from other groups to comment on those discussions, thus the benefits of the group interview, such as challenging other participants' views, was not lost (Saunders et al., 2016).

5.6 Data analysis procedures

In a qualitative research, the data analysis process is mainly inductive and comparative. Data analysis is, "… *a process of making sense out of the data*," (Merriam, 2009:175) or "… *a process used to answer your research question*," (Merriam, 2009: 176). The answers to the research questions are called categories, themes, or findings (Merriam, 2009).

Qualitative data usually involves the analysis of the data through conceptualisation and the use of narratives to explain the relationships. The data is usually summarised, categorised and structured (Saunders et al., 2009). From general ideas, themes or concepts, generalisations are made (Neuman, 2014).

Ratcliff (2004) identifies a few qualitative data-analysis techniques: typology, taxonomy, constant comparisons (grounded theory), analytical induction, logical analysis or matrix analysis, quasi-statistics, event analysis or micro-analysis, metaphorical analysis, domain analysis, hermeneutical analysis, discourse analysis, semiotics, content analysis, phenomenology/heuristic analysis and narrative analysis). The next section looks at some qualitative data analysis techniques.

5.6.1 Data analysis techniques

5.6.1.1 Typology

In typology, the relationship between two or more variables is shown in the form of diagrams, such as flow charts, grids, causal chains or networks (Merriam, 2005). By comparing elements within these diagrammatic classifications, possible hypotheses and explanations can be made (Ibid). Typology is used often in market research (AQR, n.d). One of the limitations of typology is that it relies on the assumption that people have the same stable identities, attitudes and consumption patterns, which is not necessarily the case (Ibid).

5.6.1.2 Taxonomy

In taxonomy, multifaceted complex phenomena is classified according to conceptual domains and dimensions (Patton, 2002). Taxonomy is useful in comparing diverse and complex phenomenon (Sofaer, 1999). One of the limitations of a taxonomic analysis is that it only provides an approximation of the phenomena under study as there no complete taxonomy (Williams, n.d).

5.6.1.3 Constant comparisons (grounded theory)

Grounded theory analysis is a systematic method of collecting and analysing data in order to construct theory from the data. The processes involved in grounded theory begin with inductive data, and involves the iterative action of going back and forth between data collection and data analysis as themes emerge. One major criticism of grounded theory is that its ability to produce theory is questionable. It is argued that grounded theory may produce concept rather than theory (Bryman, 2012; Charmaz, 2014).

5.6.1.4 Analytical induction

Analytical induction is the deductive approach of analysis, which begins with the formulation of a tentative hypothesis of the phenomenon under study. Second, an instance is purposefully selected to see if it fits the hypothesis. If the instance does not fit the hypothesis, the hypothesis is then reformulated.

If after reformulation of the hypothesis, the instance fits the hypothesis, then other instances are chosen to test the hypothesis. Cases that seem not to fit the hypothesis are selected, if they do not fit the hypothesis, the hypothesis is reformulated until there are no negative cases or all cases are covered. While analytical analysis is commended for its rigour, it is criticised for failing to provide a number of cases required, before there are no negative cases and the hypothetical explanation can be confirmed (Bryman, 2012; Merriam, 2009).

5.6.1.5 Logical analysis or matrix analysis

In logical analysis or matrix analysis, data is arranged and categorised in the form of diagrams, tables, flow charts and similar, to depict causes and processes in a graphical, pictorial or tabular manner. Logical analysis or matrix analysis is useful in developing hypothesis and in making comparisons (Brighthub, 2011). Logical analysis or matrix anlaysis might become cumbersome for complex relationships with many variables.

5.6.1.6 Quasi-statistics

Quasi-statistics incorporate the use of numbers in qualitative data analysis by making counts from qualitative data. Words such as 'some', 'most', 'usually' and similar are used to make non-precise counts. Within a qualitative framework, counts made in this way are regarded as numeric data. Quasi-statistics is useful in evaluating internal generalisation. Using numbers to analyse qualitative data, however, can lead to unappropriate conclusions (Glen, 2009; Maxwell, 2010).

5.6.1.7 Event analysis

In event analysis (EA), data collection and analysis is limited to an event of interest without taking the event outside of its social and environmental contexts. Multiple perspectives of a event within a complex setting can be obtained. Thus EA is helpful in providing explanations of complicated events. The techniques of event analysis are, however, still evolving. There are are no known tools or criteria for performing the analysis (Happ et al., 2004).

5.6.1.8 Semiotics

Semiotics is called a science of signs. In semiotics, symbolic systems are systematically analysed through assumptions and concepts. Semiotic systems' examples include music, etiquette, road signs and mathematics. Data, in whatever form, is treated as text. Signs represent various things in people's minds. One advantage of semiotics is that its analysis goes beyond face value. A disadvantage of semiotics analysis is, however, its arbritariness in analysis, which is often associated with other qualitative data analysis, such as thematic analysis and content analysis. The linking of a sign to an expression and content is a social phenomenon and is subjective (Bryman et al., 2014; Bryman, 2012; Manning et al., 2008).

5.6.1.9 Content analysis

In content analysis, data is analytically coded and categorised for quantitative data analysis. Data is collected and analysed in a step-by-step process. The content analysis process involves sampling, the development of the analytical categories, definition of the unit of analysis, coding and data analysis. Content anlaysis is often regarded as an objective method of analysis, as its coding and sampling procedures can be set out in such a way that they can be replicated. One of the disadvantages of content analysis is that its strength is dependent on the documents under analysis. Credibility, aunthenticity and representation of the document come into question in content analysis. Another disadvantage is that content analysis does not answer the why question (Saunders et al., 2016; Bryman, 2012).

5.6.1.10 Phenomenology/heuristic analysis

Phenomenological analysis seeks to determine the essence of a phenomenon through different techniques such as epoché, bracketing, phenomenological reduction, horizontalisation, imaginative variation and similar. In epoche, the researcher suspends all biases, viewpoints and prejudices they may have about a phenomenon under study. By suspending or bracketing judgements, a phenomenon can be viewed for what it really is. Phenomenological reduction involves a continuous process of revisiting the essence of the experience in order to comprehend its inner structure or meaning. In horizontalisation, data is laid out and assigned equal weight of importance before it is arranged into clusters or themes. Data is viewed from different perspectives in imaginative variation. Heuristic analysis is another type of phenomenological analysis, where the researcher includes their own experience as part of the data (Merriam, 2009).

The disadvantage of the phenomenology/heuristic analysis, is that the reseracher's involvement in the study may make the researcher lose focus of what they are studying and make it difficult to draw the boundaries of their participation in the study. Another drawback of phenomenology is that it may result in tunnel vision of the phenomena of the study, as data is collected from participants who are part of the social scene (Bryman, 2012).

5.6.1.11 Narrative analysis

Narrative analysis is concerned with how people experience the world (Merriam, 2009). How people experience the world is through stories (Ibid). Data is collected and analysed in such a way as to avoid fragmentation of the data (Saunders et al., 2016). There are different types of narrative analysis. There is narrative analysis that focuses on how the stories are reported and those that emphasize content and structure (Bryman, 2012). Narrative analysis is commonly used in life history research (Ibid).

5.6.1.12 Discourse analysis

Discourse analysis is another form of narrative analysis. In discourse analysis, the emphasis of analysis is on the language used to convey the story. How the story is narrated is also taken into account in discourse analysis. The intonation, pitch and the pauses of the story teller are considered in the data analysis process. Discourse anlaysis is criticised for allowing the inclusion of extraneous factors emanating from the conversation in the analysis (Bryman, 2012; Merriam, 2009).

5.6.1.13 Thematic analysis

In thematic analysis, data is grouped according to the main themes and sub-themes, based on a recurring or dominant idea from the data. Thematic analysis is criticised for its emphasis on the repetition of words to create themes and also its lack of specific procedures. In spite of this criticism, thematic analysis can be applied in a systematic review of qualtitative research, grounded theory, narrative analysis, critical discourse analysis and qualitative content analysis (Bryman, 2012).

5.6.2 Qualitative data analysis: grounded theory, thematic analysis and narrative analysis techniques

A combination of three data analysis techniques was employed in the analysis of the data in this study. Grounded theory or constant comparison was combined with narrative and thematic analysis. These three techniques were the most relevant data analysis techniques for the study. It was important to continually compare data from interviews, workshops and focus groups to see if there were any common themes. Recurring themes and ideas were grouped together. Narrative analysis was preferred as experts answered questions through their own lived experience.

The process of data analysis ran parallel with data collection, as is usually the case in qualitative research (Lawrence and Tar, 2013). Interviews, transcription and analysis ran parallel for the majority of the data collection process in this study. What transpired in interviews was incorporated in subsequent interviews, a workshop and a focus group. Figure 5.7 shows a graphic presentation of the data analysis procedure followed in the study.

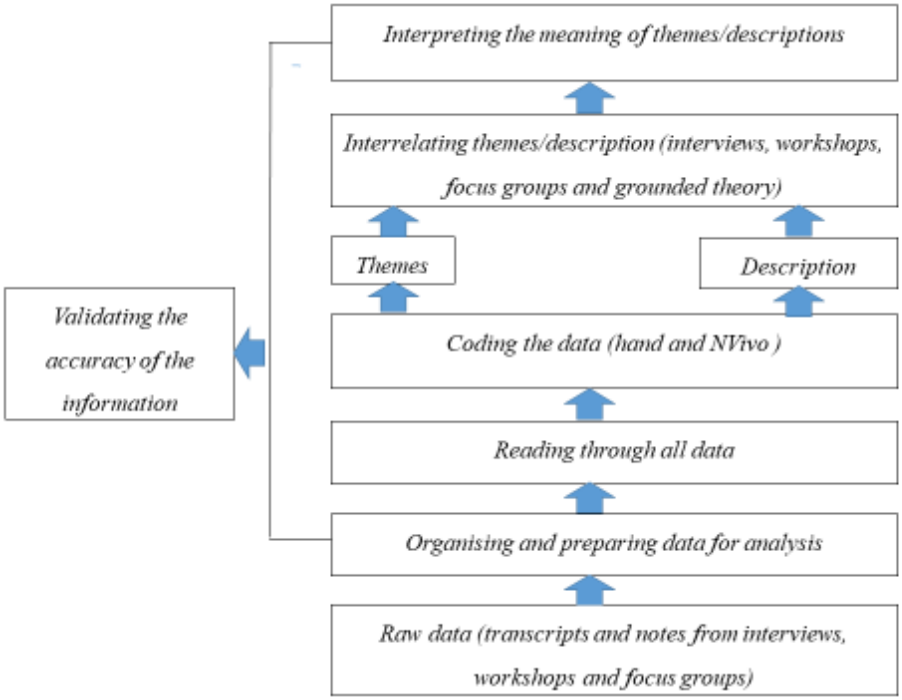


Figure 5. 7 Data analysis for qualitative research adapted from Creswell (2014)

As per Figure 5.7, the following steps were followed in the data analysis (Creswell, 2014):

- Step 1: The data collected from the interviews was transcribed and sorted into different into different categories.
- Step 2: Read through the data in order to get the overall meaning of the data collected. Key themes that emerged from interviews were organised and used in the workshop and focus group.
- Step 3: Data was coded by hand and through the analysis software program, QSR NVivo 11. The software allows for the collection, organisation and analysis of the content from interviews, focus groups and web pages (Rudestam and Newton, 2015). The reason for combining QSR NVivo 11 and hand coding is that qualitative data techniques are generally time-consuming and laborious, thus the program assisted in saving time (Schutt, 2001).

  Coding is described as the, "…*process of organizing the data by bracketing chunks (or text or image segments) and writing a word representing a category in the margins*," (Rossman and Rallis, 2012 in Creswell, 2014: 197–198). The data collected was organised into categories, labelled with an *in vivo* term. An *in vivo* term is the precise language of the participants.

  Exact quotations are the strength of qualitative data hence they were used to support the interpretation of the data in this study. Guest et al. (2012: 272), state that, "…*undoubtedly, the most important practice in reporting on qualitative research is providing quotes. Quotes are*

the primary form of evidence to support an author's interpretation of the raw data. They show the reader that the findings presented are based on what participants have said…"

- Step 4: From the coding, a number of descriptions and themes for analysis were generated. These themes formed the basis for the study's findings and were developed into scenarios for the future role of the quantity surveying profession in South Africa.

- Step 5: The descriptions and themes are organised in the research report according to the research objectives. It is from these themes that future scenarios are developed.

- Step 6: In this final step of the analysis, the results were interpreted to discover lessons learned from the study.

5.6.2.1 The process of coding and developing themes

This section describes the process for coding and developing themes in this study. The study followed a 'grounded theory' method of coding and developing themes, which relies on intuitive analysis rather than frequency of words or phrases used, as is the case with content data analysis (Easterby-Smith et al., 1991). Grounded theory' techniques were preferred over content analysis, as the interviews were face to face and semi-structured.

Face-to-face interviews allow researchers to observe the participants' facial expressions, posture, gestures, body language, etc. in answering questions during the interviews (Saunders et al., 2016). These, in addition the tone of voice and choice of words, assist reseachers to discern other meanings from the data collected during interviews, hence the grounded theory method was chosen. Another reason grounded theory techniques were preferred is in a semi-structured interviews, the questions were not asked in the same manner or order. Data analysis in grounded theory is unstructured , that is, structure emerges from the analysis of the data, which is ideal for semi-structured interviews.

The coding of the data first began by hand, before transferring it to NVivo, at the point where it was deemed useful to do so. Data with similar meaning or descriptions was highlighted and categorised on paper. It was then arranged into categories by first using initial codes based on the research objectives. These codes were refined and adjusted into themes.

Figure 5.8 provides a graphic illustration of how themes emerged from the process of coding and developing themes. For instance, where participants were asked about their perceptions about the future of the quantity surveying profession, three codes became apparent. The codes that developed were positive, negative and neutral. These were noted. In NVivo, three nodes were created with the three

titles. Praticipants' responses were then coded in those nodes, in NVivo. Themes best capturing the participants' meanings were developed with the aid of the dictionary or words from the participants.

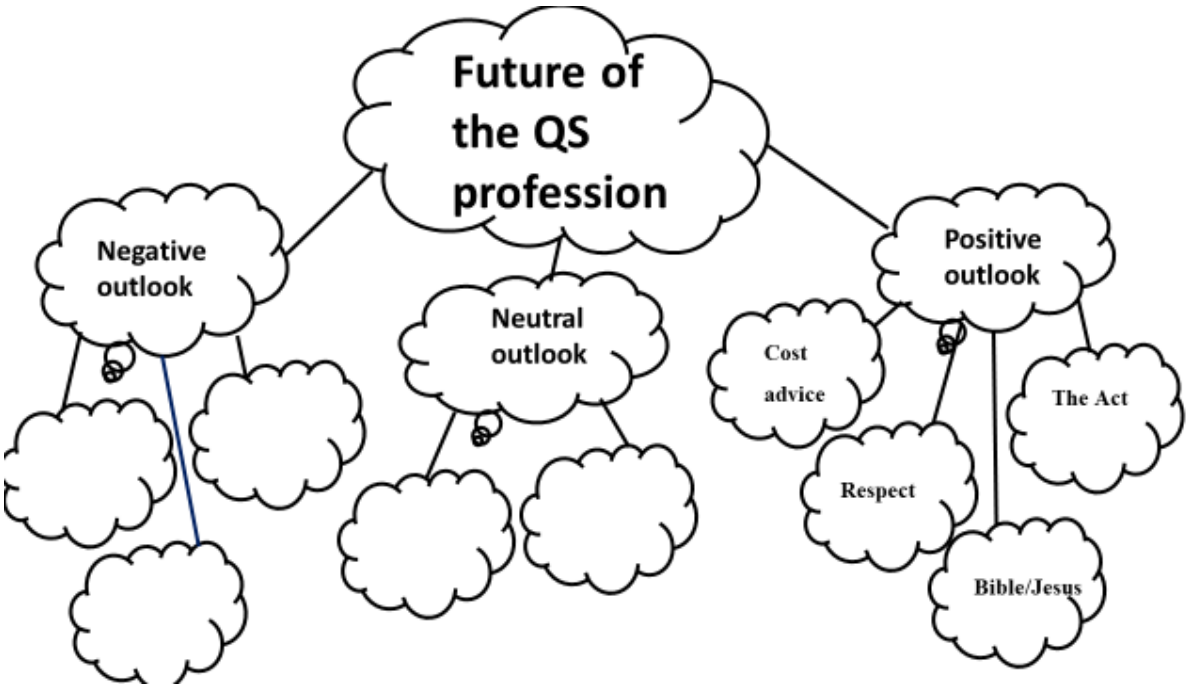


Figure 5. 8 The process for developing codes and themes

5.6.3 Quantitative data analysis: self-ranking and impact analysis matrix

The use of the self-ranking tables and the impact analysis matrix to analyse key factors influencing the construction sector and the quantity surveying profession resulted in the generation of quantitative data. This quantitative data was analysed using an Excel spreadsheet. As is usually the case with quantitative data, the findings are presented using tables (Saunders et al., 2016).

5.7 Strategies for validating data and testing reliability

Validity in qualitative research means that, "…*the researcher checks for the accuracy of the finding by employing certain procedure*," and, "…*qualitative reliability indicates that the researcher's approach is consistent across different projects*," (Gibbs, 2007 in Creswell, 2014: 201–202). There are multiple validity strategies to strengthen the accuracy of the findings. Creswell (2014) identifies eight validity strategies:

1. Triangulation;

2. The use of member checking to determine the accuracy of the qualitative findings, through taking the final report or specific descriptions or themes back to participants for determining accuracy;
3. Conveying the findings by using rich and thick descriptions;
4. Clarification of the researcher's bias, such as their background, gender, culture and such like;
5. Presenting contradictory evidence that challenges the themes. This evidence will make the report more credible, realistic and more valid, as real life is full of different perspectives that do not necessarily converge;
6. Spending extended time in the field to develop an in-depth understanding the phenomenon under study;
7. Using a peer debriefer to review and question the study, so that the study is generally acceptable to other people rather than the researcher only; and
8. Using an independent external editor to provide an objective evaluation of the whole project.

In this study, triangulation was used to validate the data. After identifying key factors influencing the quantity surveying profession, the workshop and focus group were used to 'validate' the data collected from the literature and interviews, and to assist in developing possible scenarios for the quantity surveying profession. The use of the multi-method was used both to test the reliability and the validly of the data collected.

There are also different procedures for reliability that Creswell (2014) recommends:

1. checking transcripts for errors;
2. continuously checking data against the codes to ensure that there is no deviation from the code definitions and meanings;
3. using an independent person to cross-check codes to see, "…*whether two or more coders agree on codes used for the same passages in the text*," (Creswell, 2014: 203).

In this study, transcripts from interviews, which were automatically transcribed through Transcribe Software, were checked for errors by the researcher. To correct the errors, the researcher edited the transcription through listening to the recording and re-transcribing. Thus, the transcripts were continuously checked throughout the re-transcribing process. The process for validating and testing reliability used in the study was deemed sufficient, as it covered at least two of the recommendations by Creswell (2014).

5.8 Ethical issues

As stated in Chapter 1, ethical clearance was obtained before collecting data. Ethical compliance was maintained throughout the data collection and data analysis process. Data during interviews, workshops

and interviews was captured through note taking and audio recording. Prior to recording, consent was required from all partcipants. No objections for recording the interviews, workshop and focus group discussion were raised. Recordings were then transferred to a password-protected computer, with identifying features removed. The software used to assist in transcription clears the recordings from its servers immediately after completing the transcription and thus confidentiality and anonymity is still maintained to a degree.

5.9 Summary of research methods

In this chapter, the choice of research design was explained. A qualitative approach was chosen, as it is the most suitable research design to address the objectives of the study. The data collection and data analysis procedures are aimed at addressing the objectives of the study (see section 1.6, and refer to Tables 1.1).

Table 5. 8 Research objectives versus data collection procedures

Research Objectives	**Research Methods**
Determine the current state of the quantity surveying profession.	Literature, interviews, workshops and focus group.
Identify socio-technological factors that are likely to influence the current quantity surveying profession.	Literature, interviews, workshops and focus group.
Determine the potential influence of socio-technological factors on the current role of the quantity surveying profession.	Literature, interviews, workshops and focus group.
Identify the quantity surveying tasks at risk.	Literature, interviews, workshops and focus group.
Provide scenarios for the future quantity surveying profession.	Literature, interviews, workshops and focus group.

The study is not only a qualitative study but also a futures study. From the futures' studies' methods, scenario planning is the best and most suitable method for the study. There is more than one future for the quantity surveying profession, hence the use of scenario planning in forecasting the future of the quantity surveying profession.

The next chapter provides findings and discussions from the interviews, workshop and focus group.

Chapter 6: Findings and Discussion

6.1 Introduction

Chapter 5 discussed the research design adopted for this study and its shortcomings. In this chapter, the findings of the interviews, workshop and focus groups are discussed with reference to the MLP Framework, the 5Ps model, the research questions, the research objectives, and the literature review.

6.2 Interview findings and discussions

6.2.1 Background information

Background information of the participants is important in establishing whether they can be regarded as experts in their field, and whether they have the necessary requirements to answer the interview questions. Gordon (2009a) claims that predictions made by experts in their field of expertise are likely to be more true than those made by non-experts.

6.2.1.1 Professional activity

Participants were asked to indicate the current professional activity in which they are involved, and the previous professional activity in which they were involved. Table 6.1 shows the current professional activity and previous professional activity of participants. Combined experience refers to the sum of years in both the professionals' current and previous professions. Participants are labelled according to the order in which they were interviewed.

Table 6. 1 Professional activity of participants

	Current Profession	Previous Professional Activity	Combined Experience
P1	Quantity Surveyor	Not Applicable	42 years
P2	Engineer	Not Applicable	47 years
P3	Quantity Surveyor	Not Applicable	32 years
P4	Architect	Construction Manager	29 years
P5	Architect	Not Applicable	25 years
P6	Quantity Surveyor	Not Applicable	26 years
P7	Engineer	Not specified	18 years
P8	Quantity Surveyor	Not Applicable	15 years
P9	Quantity Surveyor	Not Applicable	30 years
P10	Architect	Not Applicable	32 years
P11	Quantity Surveyor	Not Applicable	22 years
P12	Quantity Surveyor	Not Applicable	22 years
P13	Quantity Surveyor	Not Applicable	19 years
P14	Quantity Surveyor	Property Development	30 years
P15	Quantity Surveyor	Not Applicable	15 years
P16	Quantity Surveyor	Construction manager	40 years
P17	Developers	Not Applicable	23 years
P18	Quantity Surveyor	Not Applicable	44 years
P19	Architect	Not Applicable	23 years
P20	Developers	Construction Project Management	24 years
P21	Quantity Surveyor	Financial service provider	22 years

P22	Architect	Construction Project Management	31 years
P23	Researcher	Architecture	27 years

Based on the 10 000 hour rule (see 5.4.15), all participants can be regarded as experts, as all of them have experience in their respective fields of over 10 years. Most of the participants had more than one area of expertise within the construction sector. For instance, participant P12 is both a professionally registered quantity surveyor and a professionally registered project manager. P7 is a professionally registered engineer, a contractor and a property developer. P9, P15 and P16 are professionally registered quantity surveyors and academics. P19 is an architect and a property developer. P10 is an architect and a law expert within the built-environment. Participants who had experience in more than one profession, were asked which one was most dominant in their current state, and the answer they gave was the one that was recorded as the current profession. Dominant meant the profession they regarded as their main expertise.

Even though P3 is a professionally registered quantity surveyor, their main experience is in the engineering sector. Where previous professional activity is not applicable on Table 6.1, this denotes that participates have always practised their current profession. There were participants who began their professional careers in a profession different to their current profession. For example, P14 is a quantity surveyor who started their career in property development. P7 is an engineer who started their career in banking. It is not clear what role they fulfilled in the banking sector. The combined experience, therefore, does not include the banking experience but only their built-environment experience. The combined experience of P23 includes both current and previous experience, as the participant is involved in the built-environment research, and their previous experience is in architecture.

6.2.1.2 Current and previous economic sector of participants

Eighteen of the participants work for private professional firms. Two participants work for public institutions (P22, P11). One participant works for a research institution that can be classified as a parastatal (P23). P1 and P18 are semi-retired quantity surveyors, and both are actively involved in their profession, especially in the assessment of candidate quantity surveyors. For participants such as P9, P15 and P16, who are professionally registered quantity surveyors and academics, they are classified (as in the private professional firm), as they spent most of their time in private practice rather than in the academic sector. P7 is an engineer who runs their own engineering construction firm.

Finding out both the current and previous economic sectors was not only important in confirming that the participants meet the requirements of the study, but also in determining the perspective through which they will be answering questions. Refer to Tables 6.2 and 6.3.

Table 6. 2 Current economic sector of participants

Current economic sector	Participants	No.
Private, professional firm	P3, P9, P14, P6, P7, P20, P2, P4, P12, P15, P21,P5, P17, P8, P13, P10, P16, P19	18
Construction	P7	1
Public	P22, P11	2
Academic	P9, P15, P16	3
Retired and self-employed	P1, P18	2
Parastatal	P23	1

Table 6. 3 Previous economic sector of participants

Current economic sector	Participants	No.
Private, professional firm	P23, P1, P22, P11	4
Construction	P4, P15, P16, P18	4
Public	P7, P20, P12, P8, P19	5
Academic	P23	1
Finance or banking	P6, P7, P21	3
Professional body	P1	1

6.2.1.3 Age group of participants

One of the criteria for participation in the interview was that experts must be over 25 years' old. Psychologists claim that people over the age of 25 tend to be more self-aware than those who are younger (Warren, 2005). They have crystallised intelligence. Crystallised intelligence, which is learned knowledge and experience over a lifetime (Horn and Cattell, 1966). People tend to gain crystallised intelligence and wisdom with age (Grossmann et al., 2013).

Psychologists claim that people under the age of 25 may not be fully matured (Warren, 2005). Given that this study required experts' opinion, it was deemed important that participants not only have the right experience and education, but are also mature. Maturity would also give their opinions credibility.

6.2.1.4 Educational background of participants

Ten of the participants have a Master's degree. P11 and P10 have more than one Master's degree. Twelve have Honours degrees, and one has a bachelor's degree. P13 has a postgraduate diploma in engineering. Knowledge may be gained through experience and learning. Establishing the participants' level of knowledge was important in confirming the claim that they can be regarded as experts in their field of expertise. All participants have a built-environment degree except for P17. P17 has a bachelor's degree in economics, but has always worked in the property sector. Table 6.4 shows participants' highest qualifications.

Table 6. 4 Highest level of educational qualification of participants

Level of qualification	Participants	No.
Diploma	None	0
Bachelor's Degree	P17	1
Honours	P3, P14, P6, P20, P1, P22, P5, P8, P13, P16, P18, P19	12
Master's	P9, P7, 23, P12, P2, P4, P15, P21, P10, P11	10
PhD	None	0
Other (please specify)	None	0

6.2.1.5 Professional affiliation of participants

All participants indicated that they were all members of professional bodies. Table 6.5 indicates the various professional affiliations to which participants belong within CBE recognised bodies. One of the tenets of professionalism is affiliation to a professional body (Susskind and Susskind, 2017). It was deemed important to determine if participants were familiar with the concept of professionalism. Their understanding of professionalism was important in answering questions related to the legislative framework governing the professions in South Africa.

Table 6. 5 Professional affiliations of participants

CBE professionally recognised bodies	Participants	No.
SACQSP	P3, P9, P6, P14, P1, P12, P15, P21, P8, P13, P16, P11	12
SACAP	P23, P4, P5, P10, P19	5
ECSA	P7, P2	2
SACPVP	None	0
SACPCMP	P12, P20	2

P21 is not a member of the SACQSP but is a fellow of the RICS and a member of the ASAQS. P10 is not a member of SACAP, but is a member of South African Institute of Architects (SAIA), the Gauteng Institute of Architects (GIA) and the Gauteng Infrastructure Financing Agency (GIFA). P17 is a member of SAFMA and is a member of South African Property Owners' Association (SAPOA). All participants with the exception of P18 held membership with other voluntary bodies, such as ASAQS. Besides an affiliation with CBE professionally recognised bodies, a few participants were either currently affiliated or previously affiliated with international professional bodies.

P2 is a member the American Society of Civil Engineers (ASCE), the Institute of Civil Engineers, S.A.F.M.A, the South African Institute of Civil Engineers (SAICE), Institute of Civil Engineers UK. P11 is also a member of the RICS and the Association for the Advancement of Cost Engineering International (AACEI). P2 is a member of the RICS and SAPOA. P6, P12, P15, P13, P16 are also

members of the RICS. P8 used to be a member of the RICS. This demonstrates that a few participants are not only familiar with the legislative framework governing the South Africa's built-environment professions, but are also familiar with international developments regarding the regulation of professions. This was useful in looking at possible paths the professions might follow given international trends.

6.2.1.6 Summary of background information

From the background information provided, all participants meet the criteria for consideration as experts. All participants have experience in the property or the construction sector. Their experience exceeds 10 years. All participants have an affiliation to professional bodies. This means that they ought to understand the legislative framework regulating the built-environment professionals.

6.2.2 Level of knowledge of the construction sector and the quantity surveying profession

In this section, participants were asked these questions to gauge their level of knowledge of the South African sector and the quantity surveying profession. Participants used a self-rating tool to rate their knowledge.

6.2.2.1 Experience of working in the South African construction sector

All participants indicated that they have all worked in the construction sector in South Africa. The study looks at the quantity surveying profession within the South African construction sector, thus participants needed to have experience working in the South African construction sector. There were only a handful with international experience.

P3, P9, P2 and P18 have also worked in the UK. P1 has also done some work in Australia, Namibia and Botswana. P2 has also worked in Australia, Botswana, Lesotho and Uganda. P5 has done some work in Uganda. P6 indicated that they have international experience without providing details of the countries from which they have gained international experience. In spite of this international experience, all participants with international experience stated that most of their work experience was gained from South Africa. Although international experience was not deemed important for this study, participants with international experience provided insight those without international experience did not have.

6.2.2.2 Experts' own rating of their knowledge of the construction sector and the quantity surveying profession

As participants are regarded as experts, these two questions were aimed at assessing their level of knowledge of the construction sector and the quantity surveying profession. Tables 6.6 and 6.7 show

how the participants rated themselves in terms of their level of knowledge of the construction sector and the quantity surveying profession.

Most participants rated themselves above average in their level of knowledge of the construction sector and the quantity surveying profession. P7, P23, P18, P19 rated themselves as average in their knowledge of the quantity surveying profession. P7, P23 and P19 are not quantity surveyors. P18 is a semi-retired quantity surveyor who worked as a contractor's quantity surveyor for most of their lives. Their ranking may be because they do not have experience working within the quantity surveying professional field.

P20 and P17 scored themselves low in their knowledge of the quantity surveying field. Both participants are in the property sector. Their experience is in property management and facilities management. Although P20 has a degree in quantity surveying, they have never worked as a quantity surveyor in their career. Most of P20's experience is more in construction project management than it is in property. Their low self-rating of their knowledge of the quantity surveying profession may be based on a lack of personal experience in the quantity surveying professional field.

P17 and P16 rated their knowledge of the construction sector as average. As P16 is in property management, the low self-rating may be attributed to a lack of experiential knowledge within the construction sector. P16 is a quantity surveyor who was once involved in the construction sector but experienced business failure. Their low self-rating might be because of that business failure.

Table 6. 6 Participants' knowledge of the construction sector

Scale	Knowledge of construction sector	Participants	No.
1	Very low	None	0
2	Low	None	0
3	Average	P17, P7	2
4	High	P9, P14, P20, P1, P2, P4, P15, P21, P8, P18	10
5	Very high	P3, P6, P7, P23, P12, P22, P5, P13, P10, P11, P19	11

Table 6. 7 Participants' knowledge of the quantity surveying profession

Scale	Knowledge of construction sector	Participants	No.
1	Very low	None	0
2	Low	P20, P17	2
3	Average	P7, P23, P18, P19	4
4	High	P9, P14, P1, P22, P4, P15, P21, P5, P8, P13	10

5	Very high	P3, P6, P12, P13, P10, P16, P11	7

6.2.2.3 Summary of experts' knowledge of the construction sector and the quantity surveying profession

It is evident from the self-rating scores of the participants that the majority of the participants rate their knowledge of the construction sector, and the quantity surveying profession, as above average. This means that their opinion on the construction sector and the quantity surveying profession have some merit. Opinions of participants with low or average ratings were not ignored, because their knowledge of the quantity surveying profession and the construction sector is above the knowledge of the average person. In addition, all participants with low or average ratings have had experiences of working with a quantity surveyor or any one of the built environment professionals, hence their opinions were included.

6.2.3 Data analysis of the construction sector and the quantity surveying questions

6.2.3.1 Sequence of questions

Questions were divided into three broad categories, that is, the present, the future and the past. According to McNamara (n.d), it is easier for participants to answer questions about the present than it is to ask questions about the future or the past; hence, the questions were arranged in that order. Another reason for dividing the questions into these time periods was to determine if there were factors influencing the construction sector and the quantity surveying profession that could be regarded as trends. The *Oxford Dictionary* defines a trend as a, "*general direction in which something is developing or changing*." In the next sections, the questions were asked with reference to the present period and the responses received are discussed.

6.2.3.2 Objective One: Determine the current state of the quantity surveying profession

6.2.3.2.1 The current state of the construction sector

In line with objective one of the study, questions with reference to the present period were intended to determine the current state of the construction sector from the experts' perspective. The reasons for these questions were based on the premise that what happens in the construction sector will affect the quantity surveying profession. The quantity surveying profession is a system within a system of the construction sector.

Given that the interviews were semi-structured and not all questions in the interview guide were asked, or asked in the same way, the 5Ps model was deemed suitable for use in the overall analysis of the state of the current construction sector. For the South African construction sector to be in a healthy state, it has to pass the test of the 5Ps model.

6.2.3.2.1.1 Construction sector: purpose

The construction sector's general purpose is to provide adequate infrastructure and accommodation for the proper functioning of society and the economy. Value creation in society or the economy takes place within buildings or constructed assets (WEF, 2016). If the sector fails in its purpose, then societies and economies will be adversely affected, and the converse is also true. If it serves its purpose then societies and economies will be positively affected.

Negative outlook

Most experts have a negative view of the current state of the construction sector. A few participants were asked to describe the current state of the construction sector in their own words and these were some of the responses: "*desperate*" (P2), "*depressed*" P19, "*one word is, it is battling*" (P18), "*It is battling … I think it's in a recession*" (P5), "*…bad, disaster, terrible … It is the worst it has ever been. It's bad*" (P9), "*…it's an absolute mess to say it in simple terms*" (P10), "*…it's the worst animal you want to be in at this point in time*." (P11), "*… the construction sector has problems"* (P1), "*…the construction sector has actually lost its credibility*," (P12), "*…it's like taxi industry*" (P14). The taxi industry in South Africa is regarded as an industry that is a law unto itself. It is chaotic and the government has not been effective in regulating it.

Politics and the economy were cited as the main reasons for the negative view of the sector, "*I think it's in a recession. There is not a lot of building going on. It's the state of the economy*" *(P5)*, "*…the construction sector has problems because I think [of] the economic conditions that have been laid down and are currently in place by the government, [it] does not reassure investors that their funds are safe*" (P1), "*… obviously politically, economically … I think the big driving thing is we've had 10 years of no growth*." (P9), "*…the construction sector has been affected by the political problems*" (P12), "*…there's heavy politics around it*" (P11),"*… depressed … because of the current state of the economy ... I think the other factor is the level of corruption that is taking place*" (P19).

At the time of the interviews (May 2019 –December 2019), the South African construction sector was experiencing a slump in production (Khumalo, 2020; StatsSA, 2019). Experts attributed this economic recession to poor governance, inefficiencies within the public sector and corruption (P14, P7, P23, P20, P1, P12, P2, P15, P17, P13, P19, P11). P1 summarised views shared by other experts succinctly, "*Government is a major developer of infrastructure. And if they don't have the competency or capability to bring these projects bankable to the market then there's no projects in the construction industry. It [Government] doesn't have work. So why? Because they haven't got money and because they haven't got the competency to be able to do it. You can put on that … corruption and whatever it does. It just doesn't help. I mean, you know, billions being siphoned off in the wrong place. And the other thing is*

that while you've got CIDB putting in place structures, other people are working behind the scenes to get incompetent people to do the job."

Similar to literature findings, corruption seems endemic within the construction sector in South Africa and partly to blame for the state of the current construction sector (Bowen et al., 2015). More views on corruption include, "*…So there's corruption despite all of those amazing principles in the public sector and then of course in the private sector*" (P23), "*…there's [a] corruption issue in the industry* " (P7), " *…look it's competition, corruption and so on*" (P14), "*…the big issue we have is the corruption*." As developing countries are more likely to be corrupt than developed countries, high levels of corruption within the construction sector are not surprising (Owusu et al., 2020a; Yap et al., 2020).

P20's negative views of the construction sector were based on the slow adoption of technology within the sector. In addition to an Honours degree in quantity surveying, P20 has a degree in IT. Their views might be influenced by their knowledge of technology. They described the construction sectors as, "*… slow. It is still … I wouldn't say quite modern, it is still conservative. I would say it is conservative in that… there is not a lot of 'wowing' technological methods in the way the construction is done*." (P20).

Although the slow adoption of technology within the construction sector is worldwide (Farmer, 2016; WEF, 2016), it is more pronounced in a developing country such as South Africa. Wider adoption of technology in South Africa might lead to potential job losses (Frey and Osborne, 2017). In a country where unemployment is at 27.5% (StatsSA, 2018a), job losses are undesirable. This might be another reason for the slow adoption of technology within the South African construction sector.

Positive and neutral outlook

Not all experts viewed the construction sector in a negative light. For instance, P17 has a somewhat positive view of the sector. P17 described the construction sector as, "*…very active. There are lots of developments that are happening around the country throughout the country from your residential to commercial to industrial to retail. Yeah, it's very active.*" P3's view was neutral. They described the construction sector as "*interesting*" because, "*everything in the world comes down to money*."

As someone who not only manages developments, but who also develops property, P17's views may be attributed to the current level of activity within their own practices. P3's view, as a quantity surveyor in the engineering field, may also be attributed to current activities within the mining sector in which they are involved, where much larger investments are made, in comparison to the construction sector. Money may be described as king.

In spite of the many current challenges faced by the construction sector, a few experts regard the current state of the construction sector fit for its purpose (P20, P22, and P15). Reasons provided for why the construction sector is regarded as 'fit for purpose' varied. The regulatory framework that still governs the sector is one of the reasons that is making the industry relevant. According to P20 "…*because of the conservativeness, it's still [fit for purpose], the rules are still there*."

Fit for purpose

In spite of the negative views experts hold regarding the construction sector, a few claim that the sector is fit for its purpose (P7, P20, P23, P5 and P17). Reasons provided for this assertion vary. The fact that the construction sector is still able to contribute to the economy is the reason why the sector is still fit for its purpose, "…*it is fit for purpose because it contributes to the economy*," (P7). This sentiment was shared by P17.

P22 is of the view that technological advancement is one of the reasons why the construction sector is still fit for its purpose. "…*We have seen, especially in the private sector … where it is a more revolutionised sector in terms of building, implementation of new methodology of construction and technologies [is more advanced]… That [part of the] sector of construction such as roads, dams and stuff like that, compared with other countries in this area, say Africa, is quite a competitive sector*."

The views of P20, of a strong regulatory framework, and P10's views on advances in technology (P22) were also shared by (P4). P4 went further, in placing the South African construction sector on par with the international construction sector, "… *if you just compare it with other African countries, they don't even do proper construction methods … there's not really a strong construction sector but in South Africa at least is fine. It is useful. The construction is running at the international and professional level.*" It is important to note that P4 started their professional career in the Democratic Republic of Congo (DRC). Their comparison of the South African construction sector may be attributed to experiential knowledge.

The construction is fit for purpose because it is able to deliver big projects. This is according to P15, "…*I think that the capacity is there but then for bigger projects, let's say, like your Medupi and whatever something bigger [we don't have capacity]. Yeah we are able to understand things and refine our approach to practice and application. But then because those level of power stations are not built daily, even in developed countries, and that's where the bigger project usually the so-called mega projects, [are] usually a bigger issue*."

Medupi Power Station and Kusile Power Station are some of the mega projects currently under construction in South Africa. South Africa has major challenges with regards to power supply. Once operational, Medupi and Kusile Power Stations are expected to assist somewhat in resolving the issue of power supply in South Africa. So according to P15, although South Africa has capacity to deliver big projects, it may not be in a position to deliver a mega project. This is, however, not unique to South Africa as developed countries also tend to struggle with delivering mega projects.

Unfit for purpose

P18, P10, P19 and P23 regard the construction sector as unfit for its purpose. The construction sector is not fit for its purpose. There are, "*…there are no determined outcomes*," (P10) and "*it has just created so much confusion between professionals who are involved in the built environment*," (P10). According to P10, outcomes that are usually perceived at the beginning of project conceptualisation are never achieved. There is also a jostle for the role of leadership within the professional team.

The professionals' contest for the role of project management and principal agent and this leads to the blurring of professional responsibilities, "*…hence, the advent of project managers and principal agents outside the standard professions that were there in the construction industry ... the process becomes so diluted that responsibilities are shared and they are so much overlaid but none of the persons would want to take responsibility for anything, if anything goes wrong*," (P10).

P23 claims that what makes the construction sector unfit for its purpose is that the sector is not meeting demand: "*…the answer is clearly no because the performance, people, processes, and principles do not deliver the best infrastructure for South Africa, according to its needs right now*." This sentiment is shared by P18, who cites lack of capacity to deliver big projects as the reason for the sector not being fit for purpose. "*… I think we're going to battle if they put out a flood of very large infrastructure projects. Because I don't think we have expertise to handle a number of those*," (P18).

P19 claims that corruption and mismanagement have rendered the construction sector unfit for its purpose, " *… because of the level of corruption, that has taken place and also, sometimes it is not even corruption. Sometimes it is just mismanagement that has taken place. There has been a high percentage of projects, which are extremely inefficiently run, and as a result, the cost to the economy, the cost to the taxpayer has been higher than it should be. Sometimes twice, three times as much as it should be just because processes that are in place for procurement [and] for project management. When I say project management I am talking about the setting of deadlines, the programming, the scheduling, being run on political timelines and not on actual construction timelines*," (P19).

Summary of the findings of the purpose of the construction sector

Even though the majority of the experts have a negative perspective of the construction sector, the construction sector in South Africa is not unfit for its purpose in its entirety. For instance, the legislative framework that regulates it is still fit for its purpose. What might be lacking is its proper implementation but its essence is proper. Other aspects, such as technology and capacity to deliver projects, are advanced in comparison with other developing and developed countries.

6.2.3.2.1.2 Construction sector: principles

There are principles that regulate the behaviour of the South African construction sector. These principles are often enforced through various regulatory bodies that currently exist, such as the CBE, the CIDB, the Chartered Institute of Building (CIOB) (SA), and thr National Home Builders Registration Council. In this section, the construction sector is evaluated based on the effectiveness of its principles.

Data collected from experts revealed that there are espoused principles and enacted principles. The current regulatory framework and structures supposedly promotes the espoused principles, but the enacted principles are what are guiding the current construction sector. For instance, the public procurement process is meant to promote value for money and inclusivity; however, corruption and other unethical practices within the system render the objectives of the system redundant. The objectives of B-BBEE becomes ineffective where there is fronting (Khatleli, 2009).

Money, corruption, politics and self seem to be the main driving principles. There seems to be no ethics or moral standards within the sector. The high level of corruption within the sector is evidence of the unethical nature of the sector.

Money

P19, P4, P5, P10, P18 and P3 claim that money is the main driving principle of the construction sector. The desire to make as much profit as possible seems to trump all other objectives.

"*At the moment the guiding principle in the construction industry is money.*" (P5)

"*So it's also just a business approach. I think that is prevalent within this country as well. Where it is like I need to maximise my profit. If I have to undercut other people to do so, that is what I am going to do. Even if it brings a whole construction industry down as long as I stay in the game. So it's been run on all those kinds of capital principles.*" (P19)

"*It is not the quality that counts any longer in construction. It is the economics of construction that counts. The aim is about the financial output not the process of how to arrive at that.*" (P10)

"*I think your profit motive is probably at the top of the list*" (P18)

"*You find in other projects, you find people just come and get money. And this is deception.*" (P4)

"*Everything in the world comes down to money*." (P3)

The aspect of money also encompasses the systems put in place within the sector, particularly the public procurement system. As stated in Chapter 1, the traditional procurement system still dominates the construction sector. The lowest tender usually acquires the job. Thus, value for money is another driving principle within the construction sector.

"*Somebody will put together a price and that's what they will use*." (P18)
"*And the deciding factor is price…*" (P19)

Corruption and other unethical behaviour

Corruption is another 'principle' that is influencing the behaviour of the sector.
"*I don't think we have ethical values. I can't prove this per se, but I know that there is too much bribery going [on], you know. You don't get something unless you know somebody. So either there is nepotism or there's a lot of bribery … So there's no ethics … if you have to give in terms of, 10 being ethical and one not being [ethical]. It would be around one and two. There are no ethical values from my experience*." (P20)

"*You get many people still offering the brown envelopes*." (P18)

"*So there's corruption despite all of those amazing principles in the public sector and then of course in the private sector. There is also corruption in the private sector or more or less what is perceived as corruption and some interesting behaviour in the private sector*." (P23)

"*Things get taken to tender documentation stage and then a decision is taken, " No we are canning that project." But money has been expended but no infrastructure has been built. So it's these kinds of corrupt practices, which are being practiced as a means to siphon funds rather than to actually add to the economy … it's just being used as a vehicle for corruption*." (P19)

"*Construction is governed by all influences rather than the quality of the structure that needs to be built. They (construction sector) are bordering on 0 ethics. They (construction sector) are bordering on zero positive attitude. The morality of the construction industry cannot be rated with anything else because it's not existing*." (P10)

Politics

Politics is another driving 'principle' of the construction sector.

"*… [there is] heavy politics around it.*" (P18)

"*Other projects are under budget or over budget for political reasons. And there are many project like that. They will just use that project for political [reasons]. There are many projects going on tender but never go on site. But the consultants will be paid [at] stage 1 and stage 2. But the project will never go on sites, especially those big projects like hospitals. It will be a big tender and then it will be awarded to a group but we'll never see that project. And then this always happens before the elections.*" (P4)

"*…political agendas override the technical inputs that has been given. Yeah, so then projects are not managed according to technical principles. They are managed for political outcomes.*" (P19)

Self-motivation

From symbolic interactionism theory, people's behaviour may be driven by self-satisfaction, self-interest and pride. This view is shared by P1 and P19 by claiming that self is another driving principle within the construction sector.

"*I'm not necessarily convinced they do it because they feel terribly enthusiastic because they want to be better for the country ...So I want to go there and help build schools because it's my moral duty to build schools'. I'm not sure that it's necessarily all that much but it is an exciting industry to be in I think. And I think there must be moments when people eventually finish that job and [say] 'wow, look at that hotel. Isn't that nice? You know, I feel good that I was part of that and look at how nice it looks, etc.', It is a sense of satisfaction.*" (P1)

"*[The] business approach culture of this country … is just about people looking out for their own interests and not bigger picture.*" (P19)

Other driving principles

Besides money, corruption, politics and self, other driving principles is the need to meet demand. This view was only held by P17, a property developer.

"*I would say opportunities that are there and the demand.*" (P17)

P17 and P22 claim that there is ethics in the construction sector. The reasons for such an assertion is that the Government penalised contractors who colluded during the construction of the 2010 sports stadiums and has also launched several commissions of enquiry to investigate corrupt and unethical practices in some projects in South Africa (Rossouw, 2016; Competition Commission South Africa, 2011). P22's views are based on experience from working with contractors in the public sector. Instead,

P22 blames the unethical behaviour of some contractors on the current traditional procurement system, which promotes the lowest priced tender. According to P22, contractors resort to unethical behaviour in order to win tenders and meet their obligations.

"*The value system, I would say it's okay. And ethics, I mean people are now operating in an ethical manner you know. Also because now Government is watching… I mean you've seen what happened after the 2010 [World Cup] where companies were colluding.*" (P17)

"*There are different currents here. Some of them they have good attitude. Some of them want to build a legacy. Some of them they deliver value for money products. And some of them they have very good ethics.*

"*One of the problems that is failing the industry in the public sector is the supply chain management procurement methods for procuring public services where that method can compromise the selection of appropriate contractors.*

"*Some of them they drop the price because they want to negotiate P & G's later or look [to claim] contingency or compensation event or variation orders. You know, they have these strategies because that is how they make more profit in the project. Not because their rates are based on market related.*

"*Some of them due to their poor values, they fail. You know, on the price. And then eventually they cannot financially commit to the financial targets [due] to cash flow issues, and also a lack of equipment. [So they] also try to negotiate poor quality materials from Mickey Mouse suppliers (phony suppliers).*" (P22)

Summary of the findings of the principles of the construction sector

Data reveals that money and value for money are the biggest driving principles within the current construction sector. Other driving influences include corruption, politics and self. There does not seem to be shared values within the sector. Clients are looking to meet demand and value for money on their investment. Other members of the construction sector are looking at maximising profits at any cost. Even though this misalignment of values might be partly blamed on the systems that exist within the construction sector, such as the structure of the sector and the traditional procurement system, it is evident that there are major issues that might impede its performance and adversely affect its reputation.

6.2.3.2.1.3 Construction sector: processes

Systems within the sector

Systems adopted within the construction system are meant to bring efficiency and meet the intended objectives of the construction sector. Current systems in place do seem inefficient. The delivery system of a separation between design and construction is one example.

"*And we've used the English style method of type of style of construction delivery. Whether that's the most efficient or not is open for debate,*" (P2).

The traditional procurement process of tendering is another example of a system that is regarded ineffective and inefficient.

"*There are certain inefficiencies. I mean the tendering process I think is, is leaves a lot to be desired*." (P1).

"*It's not effective. I prefer a turnkey solution*." (P7)

"*And I think that the way that things are procured does not necessarily get the best building out of process, which is what the aim I suppose really should be*." (P23)

P1 went on to describe the traditional procurement system as a waste of time and resources. "*I think the one thing that I would say at the moment is really a waste of time and energy for a lot of people is the general open tendering system that is currently in place. In a case like that and I am talking some of the worst case scenarios that I've been to, you go there and this hall is just full of people. So many people that are they are all chasing this potentially good job. But the fact that there's 50 people sitting there and only one can get it, indicates to me that 49 have lost a lot of time, effort and money to be sitting there and going through the process. There's just too much duplication. It sucks in too many people with no outcome whatsoever*."

The continued use of the traditional procurement system is partly attributed to the conservatism of the construction sector. P6 says, "*There tends to be very much conservativism in the industry. So you tend to do things the way that you did, the way you were taught to do them. And you don't have the ability to move between different types of models of procurement especially when it comes to different business models like PPPs and stuff like that*."

Another reason for the continued use of the system is the perceived value for money it gives to clients (Winch, 2000). "*… But I think it's better to operate that way because when construction companies are competing or tendering obviously, you don't get one company tendering… And the reason for me as a developer is to ensure that I get value for [money], the best price*" (P17). P17 concedes that achieving value for money is not always achieved. "*So if you are not well informed, yes, you can be taken for a ride. But if you know, you can't*" (P17). According to P17, clients who understand "*the pricing model and stuff*" achieve value for money, but those who do not understand it, do not achieve value for money.

Procedures

The public sector procedures are described as numerous, cumbersome and inefficient, as compared to the private sector procedures.

"*In the private sector I would say that probably, the process is probably a little bit more efficient than in the public sector*." (P1)

"*So the public sector prides itself on having ... frameworks around B-BBEE, employment, equity, preferential procurement processes about being compliant with the PFMA, with the MFMA… There's one set of management practices, which are being introduced over there [CIDB], which is the IDMS process.*

"*We're getting so much misalignment of expectations and so much red tape and so many different processes to be followed that it becomes very cumbersome to do your work well. And it becomes distracting from the core work that you need to do.*" (P23)

The IDMS referred to by P23 is "…*a government management system for planning, budgeting, procurement, delivery, maintenance, operation, monitoring and evaluation of infrastructure*," (National Treasury, 2012: 3).

"*Well in the private sector, I see that there are different processes compared with the public. The public is more regulated on legislative [side]. Lot of limitations in terms of deviation from the PFMA.*

"*Like for example, there are some more bureaucratic processes on the Government sector, public sector. Like approval of compensation events and certain considerations for decisions to be made. [They] take more time than they are supposed to be because the delegation of authority lies on the head of the department. You know, the centralisation of the financial resources.*

"*For example, only one person in the department is able to, based on the delegations, make the decision to say, 'approve or not approve'. I am saying maybe, probably ten people have to advise the senior account control officer to approve or not approve the compensation event.*

"*But in the private sector is more, I think, more quick, those processes. There are new interventions in terms of how to optimise those process in the private sector, which is ahead comparing with the public sector. We are trying to incorporate those innovations, like BIM*." (P22)

Procedures followed within the construction sector are slow and are a cause of delays.

"*Most of the projects are going very slow. A project which should run for 24 months doubled and then we stopped, starts then yeah it is ... the current deliver processes is very, is very long. Very long.*" (P4)

"*There's a lot of delays*." (P7)

Payment to contractors and professionals by the public sector is often delayed, which results in cash-flow problems for contractors.

"*You know, XXX, those sort of organizations and it's been a challenge. And you know, if you get these, some emerging organization building a school in the rural area, hundred and fifty Ks from Bloemfontein and the money doesn't come through. I mean, it's disastrous.*" (P1)

"*The other area where the efficiencies are compromised is in the late payments from the clients. Where small practices really just have no chance.*" (P19)

"*The payment is poor and then it starts affecting the contractor.*" (P7)

Tradition, training and best practice are some of the reasons cited for how things are carried out within the construction sector.

"*You know doing things from the kinds of ways in which they were taught. So I think that the way that things are working is founded in a very sound historical way of doing complex things.*

"*I think by international standards, we actually have more building regulations, more norms and standards, more procurement processes, more advice guidance and general rules than most other developed nations*" (P23).

Procedures are not fully to blame for the inefficiencies that exist within the construction sector. Individuals who work within the system are also partly to blame.

"*It depends on the project. I came to the project where [it was] professional. We set the meeting. We stick to the programme.*

"I went to a project where there was not even a site meeting. There is no even a site meeting and then they just operate like non-professionals. Not ethics." (P4).

"*It ranges. It actually ranges from poor delivery to amazing delivery. It depends on the company. It depends on the area of expertise. I worked with some contractors in Limpopo who did amazing, the incredible and I worked with others who were terrible.*" (P5).

"*The human element, you know, there are many [policies] like, for example, the construction charter which is supposed to be spearheading the understanding and the delivery of desired outcomes in the construction industry. But those are just called PhD papers that have been presented by many people, they've been adopted but they are hard to implement because you don't have the structures that understands the process.*" (P10)

Communication

Channels of communication between the private sector and the public sector are described as problematic, particularly communication between the contractor and the public sector.

"*Communication structure is still not well still even though you've got this, you know, your SAFCEC, you got your NHBRC, you got CIDB, you got whatever. But then the communication especially between public sector and the contractor a bit of a problem. The communication still not well structured.*" (P7)

Means of communication seem to be assimilating current technologies. Digital communication seems to be replacing old forms of communications, such as paper and face-to-face meetings.

"*Methods of communication have been improved. From the cell phone you can now read your drawings, you know, you can do many things with the phone revolution. It is not acceptable for a contractor to still work on old methods, you know.*

In our experience, collaboration is amazing. Through video calling, video conference or phone telephone conference [we are] able to resolve, even from the office, issues that happen on site." (P22)

Given the conservatism of the sector in adopting technology (Chan et al., 2019; Cheng and Lu, 2015; Fleming et al., 2019; Takim et al., 2013), it is not surprising that P8 views the move to digitisation with scepticism. According to P8, digitisation might introduce an abdication and blurring of responsibilities. Common data sharing platforms are either overloaded with information that is unorganised or used to hide professionals' incompetency.

"*I mean I've sat in so many meetings and the contractor said, 'I really need the detail of that door finish etc.' Their responses is, 'It's on the server. It's on the stick'.*

"*Which is sometimes an excuse. Is [it] really there? 'Ah, it's on the server'. 'Ok, well, I didn't see it. I'll have to check'… Then when the meetings is over then you go and look and either the guys was truthful and it did happen or he's just fibbing them. He is just getting some time, you know. So that's an interesting thing I think. That's as far as communication is concerned, is also a bit of a shift.*" (P1)

Organisational structure

Similar to literature findings, fragmentation in the sector is viewed negatively (Farmer, 2016). The current fragmented structure of the construction sector is described as adversarial and confrontational. It is said to be promoting the silo effect.

"*I find that it is adversarial. Historically [there are] adversarial relationships, where people are watching their backs and not necessarily that ... on the whole [project]. It's not a collaborative spirit. Is not a collaborative culture in the construction sector in South Africa*." (P19)

"*I think it's, it's been quite confrontational. I think there's a level of mistrust.*" (P2).

"*And you can't have the way that you are procured as professionals in the way that is currently done. I think that there is some competitive behaviour and there is a silo effect of people especially in different disciplines.*

"*You know doing things from the kinds of ways in which they were taught. I think there's a good case to be made especially on the medium and long-term horizon for us to transform the way that we are working. It's quite a difficult thing to do that because the reason we are specialists is that it's too complex a task for one discipline to deal with.*" (P23).

The structure of the construction sector is partly owing to the nature of construction. There are two many processes and trades that it is impossible to have one specialist. Tradition and training are also responsible for the current organisational structure within the construction sector.

Physical steps required to produce a good product or service

In spite of being accused of being a slow adopter of new technologies (Chan et al., 2019; Cheng and Lu, 2015; Fleming et al., 2019; Takim et al., 2013), there are some signs of improved adoption of new materials and technologies. This is according to P22.

"*[We] are still a little bit conventional. Like [in] preparation of earthworks and stuff like that and concrete preparation, quality of concrete. They have to be delivered to site from the batch plant for example. Still a little bit conventional.*

And the drone technology is helping the satellite. Industry has developed so much in terms of improving GPS … where you are no longer relying on land surveyor's drawing but also on satellite mapping and all that." (P22)

Summary of the findings of the processes of the construction sector

Current processes within the construction sector seem to be the main contributors to inefficiencies that are prevalent. Corruption and some unethical behaviour are partly attributed to current systems and procedures. The tendering systems based on the lowest tender, in particular, is cited as a major challenge in the construction. Even though its objective of achieving value for money is sound, they are seldom achieved. Failure to achieve value for money is mainly because of the human actors within the system who, in desperation to secure work, might circumvent processes through various means including unethical ones. Desperation for work is not the only reason that leads to the disregard of the current processes, the nature of the processes is another reason. Long and cumbersome procedures discourage implementation.

6.2.3.2.1.4 Construction sector: people

From the interview data, it is apparent that there are many divisions within the construction sector in South Africa, beyond just the design team and the construction team. There are three divisions: the

public sector, the private sector and the excluded sector. Whites dominate the private sector. Blacks dominate the public and the excluded sector. The excluded is an informal sector made up of local communities and/or the "construction mafia". Where not explicitly stated, the term 'construction sector' in this study refers to the formal private and private sector.

Construction mafia

The Preferential Procurement Policy Framework Act (PPPFA) was promulgated in 2017 to promote Black participation in the economy through construction. The provisions of the PPPFA Act with respect to Black inclusiveness within the sector seems to be misunderstood as it has given rise to organised community forums, also referred to as the "construction mafia", demanding through intimidation and acts of violence, a stake in construction projects within communities (Donnelly, 2019).

"*You've got a sectoral, a schism where you have private sector [and] public sector in a completely informal [and] excluded sector. So there is a construction mafia. They are politically connected to people and they operate with impunity and there are bullying. They are vicious and they are real.*

"*All of this stems from new regulations to the Preferential Procurement Policy Framework Act, which allows 30% of all contract value above R30 million on state construction contracts to be allocated to certain designated groups, including black-owned small and medium-sized enterprises.*

"*So in the public sector in particular, because the principle is that you want to include through SMMEs investment in local SMMEs. You want to promote inclusiveness in local economy. It's good for sustainability. It's good for inclusion. It's great. It's actually okay. So what you do? Is I think it's 15% to 30% of whatever is feasible above R30m should be given as subcontracts to local SMMEs. That's prescribed in law. Public funded buildings. Except, notice the language in that is feasible.*

"*Notice also that it's above a certain threshold. But the word on the street is completely different. The word on the street is that, 'thou art entitled to it'. And what happens is that there are case studies of many building construction projects, which have been drawn and turned into a halt or things have been burnt down.*" (P23)

"*I can give you an example. We've got a construction site going on. People called mafia come and stop [construction] and demand work. I will give you a typical example with a XYZ. They partnered with some Australian company. They were doing a multi-billion project. I think it was close to 20 billion. Now that partner pulled out because [of] the community ... this is in [the] Eastern Cape. They were doing it for YZX. These guys came in and stopped anything. [They said], 'we demand that you employ local people. We demand that you give us this and this.' They were demanding not really coming on to say, ' give us an opportunity'. They were demanding. Causing problems. And this affected completely*

the industry. There's no more the confidence. The [confidence] has dropped. Professionals are moving out. The skilled, key skills people are moving out of the country because of the political instability where people are now forcing. … You know, Government has got this procurement thing of 70/30?

"*But the small guy cannot understand how this 30% work[s]. If there's a project, they will say, 'We want 30%.' [This] 30% includ[es] procurement of materials. Is including labour. Is including a whole lot of things for local content. But this is the biggest challenge now do the industry. "* (P7)

Even though the PPPFA Act applies to public construction projects, private projects have also been affected by disruptions on site caused by the construction mafia (Donnelley, 2019). P22 claims that besides the construction mafia, there are other community disruptions caused by the local business forums seeking economic opportunities. The emergence of local business forums also stem from the misunderstanding of PPPFA Act.

"*…in the public sector, there is something that has been affecting the performance of contractors, which is called community disruptions … The mafia is something else … And it's mainly because there is a kind of regulation that came out. Regulations that 30% component on any project implemented … When the project goes there, there is no proper preparation on the ground. You know, in terms of ... expectations are high. There's no management of the social expectation on the construction areas. And then obviously the business forum, which is a community business forum, is one of the issues. Which is a group of individuals representing different businesses, local businesses. Which is a group, protected by a kind of ... political influence or financial influence amongst them. Which is claiming up to 25% of the contract.*

"*Let's say, if you want to implement this project here and the project is 100 million. We want 25 million and this site will cooperate with our local businesses.*

"*No, you mustn't bring your contractor. You must not bring your X and Y that you are used to work[ing] with. And you know them because you are performing with them and you are able to issue a programme. A construction programme to say, ' client, I am willing to do this in six months'. But now with these business forum, by imposing those local sub-contractors or suppliers or whatever ... is no longer your known supplies, partners or whatever it is.*

"*So for example, if some contractor, had some magnificent sub-contractor for earthworks. They [have] been tested. And they have been delivering for years. And then suddenly you go to a site, the community*

will say, '...there are two local guys here [for] earthworks, you must appoint them. And the moment that they start failing and you bring the other guy, they burn their trucks.'

"*We have seen it because they failed to deliver, let's say, facebricks, for example. They are supposed to deliver, let's say 30 thousand bricks or they don't deliver. So the main contract has to make an alternative to look for his own buddies to resolve the, you know, the situation. And they bring this truck and then the truck is burning at the entrance of the site because the business representation is there.*

"*And they warn the contractor, 'I told you. It has to be a local. No more, Mr X to deliver the bricks or earthworks, or roads or whatever. And that is affecting the productivity and the efficiency of the contractor and the output obviously. The cost of the project is getting high. The time frames to deliver projects [is prolonged] ... because of the interruptions by communities and these business forums. So the political influence as well as local wards. Yeah, ward councillors' fights and all that."* (P22)

The rise of the construction mafias and local business forums has had a negative impact on projects. It has affected all the major aspects of projects, such as cost, quality and time. The community business forums or the construction mafia impose their own rates and other terms on the contractor. Under undue influence and fear, the contractor accepts these rates and terms. The contractor still carries the risk of delivering under the contract into which they entered with the client.

There are claim that the construction mafias and the business forums are *politically connected* (P23) or have some *financial influence* (P22) in the community. Media reports claim that while there are some genuine business people who make up these two groups, there are also criminal elements involved (Donnelley, 2019). Various organisations within the sector have been in talks with various stakeholders, including the Government and the South African Police Services (SAPS), to resolve this issue. As of this writing, the issue of the construction mafias and the local business forums had not yet been resolved.

Public sector

The public sector plays a crucial role in the construction sector as the biggest investor in infrastructure. Besides the politics, the ailing economy and corruption that have affected the performance of the public sector, a lack of appropriate skills is another challenge besetting the public sector.

"*[In] some instances, it is the people in authority not having the requisite knowledge of the construction sector. And even when they have advisors, technical advisors who are within the construction sector, political agendas override the technical inputs that has been given.*" (P19)

Lack of skills and incompetency rages within the public sector. The public sector in South Africa is divided into three tiers, the national, provincial (regional) and the local. Most experts cite the local tier, that is, the municipal tier, as the level with the most challenges. Municipalities are responsible for providing information related to construction sites and for the approval of plans and zoning.

"*Let me try to market myself into the local Government. It was even worse … [it] was more chaotic than the National Government type of contract*." (P20)

"*…the maladministration in municipal officers when it comes to town planning and getting approvals. Because why should we wait 24 months to get a rezoning? That's what happened. That's what is happening. It is killing our profession.*" (P9)

The findings from the interviews support the literature findings where shortage of skills in the construction sector is a factor impeding growth (DHA, 2014, Windapo, 2016).

Private sector

An exclusive club

In comparison to the public sector, the private sector is regarded as more efficient than the public sector. The perceived efficiencies of the private sector are the premise upon which the PPP model of procurement rests. Experts, however, regard the private sector as an exclusive club. Access into the private sector is through "connections".

"*…you'll always find the same face in the private sector… So it's all 'broerskaap' (brotherhood), nepotism, friends, you know, clubs*." (P20)

"*In the private sector, it is purely connections. Because if you're not connected, ... if you're not networked with specific people, then you don't even feature*." (P19)

"*Now these guys in the private sector are not regulated by anything. They employ their buddies, their friends and so on. Unfortunately, without being racist, this majority, 99% is White. These guys have got a market, nobody competes with them*." (P14)

The fall of the private sector

Some experts claim that the private sector in South Africa does not exist. This is because many big construction companies in South Africa are currently experiencing business failure. South Africa had in construction what were called the 'Big Five' construction companies. These Big Five companies were responsible for the construction of the 2010 World Cup stadiums. With many of these companies were liquidated or went in business rescue, experts are concerned that South Africa does not have

construction companies with the capacity to engage in a construction project of the same magnitude as the 2010 World Cup, hence the assertion that there is no private sector in South Africa.

"*Well, there isn't a private sector anymore*." (P23)

"*I mean you should say, how do you rate your knowledge of what's left of the construction sector? It's not happy out there. It's not a lot left. Group 5. Aveng, Basil Read, Riviero, Murray & Roberts. They are not there any more. Gone*." (P2)

"*We have seen huge construction companies going down the drain. Is it Stocks and Stocks? Is it Stocks? But I know Group 5 just went under and there was another one, Basil Read, that went under*." (P11)

"*We've seen a lot of big companies liquidating … sort of de-list from the Johannesburg Stock Exchange (JSE)*." (P8)

The public procurement policy

Some experts attribute the demise of the big five of the construction or private sector to the public procurement system.

"*The wheels fell off shortly after we had completed the stadia for the World Cup. The idea that Government could put out five stadium to be priced for and you have five contractors. And the contractors I know went to Government and said don't put this out to tender simply because no one contractor is capable of doing more than one job, the risks, time risks, quality risks, everything else was just so large that one job would sink them.*

"*That's the bottom line, because the time constraints and we learned from many years of stadium[s] being built in other countries where they are not able to make deadlines and then pose all kind of penalties. They bankrupt the people, etc. etc. etc. So you have the situation where Government then turn[s] around and said, no, you must tender. So being logical, collusion [happened] and it had to be that way because they recognised that it was just impossible to do more.*

"*So now you look at our industry. What do we have? We have Wilson Bailey Holmes and then the casualties after that, Murray & Roberts, … yet the remaining three are either under business rescue or what have you … Government has killed the construction industry and it's very very sad.*

"*I think originally when they went in to see the contractors, they said you must get this (pay penalties) and otherwise you won't get any government business. And the bottom line of that was they gave the*

money and still didn't get any more government business. So they killed them both ways and that's where we are currently. And it's a sad reflection." (P18)

Government's lack of investment

According to P2, the lack of Government's investment in infrastructure is another reason for the collapse of the private sector.

"*Other than the limited number of jobs, there is very little work, Government has just put through no work, and obviously, Government is a major supplier of some building infrastructure. So there is nothing coming through. Your engineering professions are battling. QS I am not sure about. Architects are battling and the construction industry is one-step away from dead.*" (P2)

Government policy

Government policy regarding the inclusion the previously economically disadvantaged groups is another reason cited for the current situation in the private sector and the construction sector as a whole.

"Look the industry is not what it used to be like in the past. In the past, you'll have your Big Five companies that manage and control the industry called your Group 5, your Wilson Bailey Homes, your Murray & Roberts. Those are the commonly known. What you call the Big Five in the industry.

"*But it has moved. I mean obviously within new the dispensation, new government, things change. Giving opportunity to the historical disadvantaged people. But then what happened is that there was also a drop in terms of issue of quality now. Because you got flooded. Flooding of a lot of people coming in. The quality now started dropping. And there was no more bigger cake … normally the Big Five will dominate. They will tell the Government, 'We are doing this. We are not going to do that'.*

"…you used to have a Big Five. Then you have all that flooding of people. Now the quality drops. Then Government said, 'no, no, no, we're going back to the Big Five'. … Like CIDB, have to come and start grading. Grade people to say, 'grade 1 to, whatever, grade 9'. These guys (Big Five) are the grade 9 guys. Like I am grade 7." (P7).

Foreign invasion

The demise of the Big Five has led to fears that the construction sector is now susceptible to foreign invasion.

"*And the problem that we face is that if and when the construction does pick up, there's going to be literally no one left and the market is wide open to being invaded by Chinese, Turks or Italians. And*

that is how the industry sees it at the moment. They are very concerned. The industry is very concerned. So it's not happy out there at all." (P2)

"*And I think that's one of the big problems that we have already; we have the Chinese trying to make inroads. We already know that the Chinese do not operate on the same basis. They do not comply with the regulations. They were kicked out of Botswana and we're undergoing projects with companies who will come in but still say actually we will pay our workers in China, which is what they do and they don't always employ the local people to do the work either. So it's okay getting them in. It's whether the country is going to benefit from having them here.*" (P18)

"*The South African construction industry isn't what it used to be and what you're seeing is you getting lots of the Indians and Chinese companies coming in and saying we'll do the work for you. As soon as that happens then they bring their people with them. They don't want to employ South Africans. They bring their own people. That has a serious negative effect on one industry and to the country because people are seeing that now you've got 500 Chinese people building this road. When it could have been our people building the road. So, it's got serious political issues as well. So, yeah, it's not a nice place to be at the moment."*(P3)

Current construction companies are too small and thus do not have capacity to take on big projects.

"*So I think the procurement processes in the construction sector, it's something that as the built environment we should be engaging with Government and Treasury, National Treasury to try and use it as an enabler to economic growth. We can't export our companies that are doing work in South Africa. We can't export them beyond South Africa because they are all too small. The companies in South Africa that are doing business beyond the borders of South Africa are a few large companies. The smaller ones don't. They are too small to be exported and we should be exporting our services because the African continent is actually using many foreign companies to do infrastructure. Bulk, large infrastructure, in the African continent is done by foreign companies which we should be doing as Africans on the African continent. We can't export because we're all too small and we're all looking inward.*

"*So I think at the macro level we should re-position ourselves as South Africa Inc. or South Africa Incorporated. As a company, we should be looking to export what we have, that is solid institutions, solid councils. Many come to learn from us, but we are not exporting ourselves.*

"*So we should be positioning ourselves to export our skills, to export our services, to export manufacturing and so forth into the other African countries, I'll mention Africa in particular because I*

know Africa is being serviced from outside, the companies outside Africa. So, I think that's what I would like to say on the macro level." (P13)

Shortage of skills and the brain drain

Another threat to construction emanating from the fall of the private sector is skills leaving the country, a concept referred to as the 'brain drain'. As literature has revealed (DHA, 2014; Windapo, 2016), South Africa suffers from a shortage of skills, further loss of skills will be disastrous to the construction sector.

"*A lot of the finance houses are now working in North Africa and they're taking the contractors with them, [they] are going up there. They are getting the deals and they are taking a lot of the basic contracting knowledge with them. We are finding that guys are getting their qualifications here, and then go straight to overseas.*" (P18)

"*We are trying to explore out of South Africa … It's a high cost for a South African company to go to Nigeria, Namibia, Botswana ... even Swaziland.*" (P22)

"*I mean it was fit for purpose. On the South African Stock Exchange, there were five or six large construction companies 20 years ago. I think there is not even one left. That part of the market is has disappeared. Why has it disappeared? Well, because those skills went and worked in Dubai and then that excited most of them. There is no economy here to drive things.*

"*And then things were unbundled to try and hand them out, through that CIDB process and through the preferential procurement processes, etc., to try and get them into the pockets and livelihoods of SMME.*"(P23)

"*X is working with a team who are working on the infrastructure in Johannesburg and within a period of the year, the entire team had changed. When she was following up to see what had happened with them. They have gone overseas or they have moved into Africa. People are just immigrating for opportunity*." (P5)

Loss of credibility

Besides the fear of foreign invasion and the brain drain, the other threat is the sector losing its credibility in society through unqualified people entering the sector. P10 claims that , "…*anybody who can buy a van and a wheelbarrow and hire one or two Black people, then he sees himself in the realm of construction industry*." P7 says "…*every Tom, Dick and Harry wants to do construction. Everyone who*

has a cc (close corporation) wants to do construction." These sentiments were also echoed by P11, "*…they say they are tenderpreneurs. They just want to tender for anything that's out there*."

According to the *Lexico Dictionary*, "*a tenderpreneur is someone who uses their political connections to secure government contracts for personal advantage.*" It is a South African termed coined from the words 'tender' and 'entrepreneur'. The issue of 'tenderpreunership' has given rise to moonlighting and labour broking.

"*He said , 'Can I have your list of people who are on maintenance?' Gave him a list and they said, 'Okay, let's call them in'. Not one of them could be found. They are moonlighting. They are on the list, but they're not doing maintenance. They are doing their taxi driving or whatever it happens to be. It's a shambles. It's a total shambles.*" (P18)

"*They come here and win tenders and then they go. Whereas they are actually labour brokers. Companies like this they only want bodies. Most of the time they want you to supply them with the bodies because they go for a three-year contract or whatever but they want you to bring them professionals.*" (P11)

Poor training

The poor training of artisans and professionals has been cited as one the issues facing the construction sector in South Africa. Training is said to be inadequate and does not meet the requirements of the industry. This is analogous to the findings by Windapo (2016), that poor basic education is a contributing factor to the shortage of skilled workers in the South African construction sector.

"*My brother in a developed country decided that when he left school that he wanted to be a bricklayer. Two years training. Academic, as well as on-the-job training. Only when he had finished two years [later] was he able to go into site and after being with a foreman bricklayer for a year. It was then able to lay bricks. Here, nine weeks if we are lucky and you say, 'okay you're able to do anything'. It doesn't work. We've got to get the skill level up to meet the requirement. It's pointless saying I'm a bricklayer, but I can only do stretcher bond.*" (P18)

"*Since 1996, the passing rates in higher education is dropping. Some universities in South Africa have been losing their status compared with graduates from Harvard, graduates from Cambridge or graduates from Wits or from Stellenbosch. Some universities in South Africa remain because they have been fighting against this pressure to drop the passing rates, the content of the educational services ... Even though we try bit by bit, based on the industry [to] bring technological provisions to improve … but the technology is there to improve not to affect.*" (P22)

In spite of the negative picture of the construction painted by most experts, there are positive aspect about the construction sector. P7 claims that the sector is well organised, "*I think the industry is well organised.*" P2 and P23 asserts that there is professionalism in the sector.

"*I think a lot of the guys are quite professional.*" (P2)

"*The industry as a whole is mostly professional.*" (P23)

Summary of the findings of the people of the construction sector

The divisions within the construction sector are causes of the current inefficiencies that exist within the sector. Political and socio-economic issues of the country have given rise to the new 'stakeholders' in the sector. The collapse of the Big Five construction companies has led to the weakening of the private sector. This weakening of the private sector has had negative implications on the sector. Some of the negative implications include the brain drain and possible foreign invasion.

6.2.3.2.1.5 Construction sector: performance

Even though there are no known benchmarks, there is consensus amongst experts that the construction sector in South Africa is currently not performing well. The current economic conditions are largely to blame for the dismal performance of the construction sector.

"*The performance is dismal because it is very highly dependent, directly dependent on the economy. And the economy is in the state of recession not technically recession at the moment, but it is not growing at a rate which accommodates the growth in population. So it is objectively stagnant.*

"*So it is currently performing extremely bad. Performing badly because of that and it's performing badly with reference to the needs of the country in terms of construction and infrastructure.*" (P23)

"*It is not doing well. I think it is not doing as well as it was doing about 15 years ago. So I think it's gone down the drain. And I think maybe it's because of there isn't much. I know in my industry, I mean, we have vacany of about 30%. Vacancy in terms of the buildings that we lease. So now we are not going to build. I think we are not going to build until there's more demand or there is specific demand like for example Government comes and says, 'we want this particular thing and we don't have it. So we'd like to develop', and that's how, maybe, we will be also be involved in developing it.*" (P20)

"*The sector is entering some kind of a recession. We have seen that it is a slowdown … From the economic constraint that the country is facing. You can see it by the percentage of unemployment we have in South Africa, which has increased up to 23%. Twenty-three per cent is alarming because normally if you compare sectors, [i.e.] percentage of employment in a sector, construction takes a lot of people compared with [other] services. Which is the only sector that more people are employed [in], for example.*

"*When you see, Group 5, Basil Read, going through financial constraints that are probably close to bankruptcy. There is no work.*" (P22)

"*Guys are surviving at the moment. They are not expanding at the moment. Very few organisations are actually expanding. They are just hanging in there, surviving there.*" (P1)

"*Look, the country is hit by a technical recession. There is no construction that is going on that can be used as a measure of any success in the country in this current time.*" (P10)

"*There is not a lot of infrastructure coming out of the Government at the moment. In the private sector everyone's working on feasibilities and there's not a lot of feasibilities going around. Everyone is being very careful with cash.*" (P5)

"*I'll say for the past three years. There's been a drop in the industry. The construction industry is not performing well. Like this socio-political interest I was talking about, Government has got plans. But it has no money to roll out. The [president] speech said to say, they want to invest in infrastructure. Yes is all there but there's no money to implement those kind of plans. So it's a bit of a problem. The private sector yes slightly better.*" (P7)

Summary of the findings of the performance of the construction sector

Based on the perceptions of the experts concerning the current construction sector, its current performance can be regarded as poor. South Africa's current economic situation is largely to blame for the sector's poor performance.

6.2.3.2.2 Analysis and discussion of the state of the current South African construction sector using Geels' MLP Framework

The construction sector's landscape

The socio-economic and political landscapes have played a major role in bringing the sector to the current state. In an MLP Framework, changes in a socio-technical system are from the bottom up, the current state of the construction sector **suggests** that the landscape environment within which the sector operates has resulted in the current state of the construction sector. This is in line with Smith's (2007) pathway of change, that change within a socio-technical regime can be top–down.

The construction sector's socio-technical regime

Current principles and procedures within the sector seem to be able to withstand the pressure applied on them by the landscape development even though they seem to barely being doing so.

The construction sector's niches

There is no evidence of innovations from the niches currently challenging the current regimes to change. Evidence suggests that pressure for regime change might come from technology and foreign invasion. This pressure is, however, currently minimal.

Conclusion of the state of the South African construction sector

There is sufficient evidence to draw the conclusion that the South African construction sector is in a dire state. Although there are sound principles and procedures in place, these are often circumvented or ignored. The principles and procedures are the main pillars that seem to be upholding what is left of the construction sector in South Africa. Therefore, the sector cannot be regarded as completely dysfunctional or non-existent. Both the socio-economic and political landscapes are exerting pressure on the current socio-technical regime.

The main purpose of assessing the current state of the construction sector is to determine what the implications thereof might be for the quantity surveying profession. The next sections discuss the current state of the quantity surveying profession.

6.2.3.2.3 The current state of the quantity surveying profession

Pryor et al.'s (2008) 5Ps model is used as a framework to discuss the current state of the quantity surveying profession. Experts were asked questions related to the state of the quantity surveying profession. Their responses were organised according to the 5Ps model.

6.2.3.2.3.1 Quantity surveying: purpose

Quantity surveyors are called the accountants of the construction sector (Ashworth et al., 2013). Their specialist knowledge is in cost and contracts of construction. It is this specialist knowledge that gives them their current position in society. Experts were asked questions related to their relevance in society, given the current changes taking place in the construction sector and in society.

Positive outlook

In spite of the poor performance of the construction sector and the economy, the majority of experts have a positive view of the quantity surveying currently. The profession is said to be relevant and needed in society and the construction sector.

"*What is the current status? I think the state is good.*" (P9)

"*I think before is [QS profession] irrelevant, the accounting profession will also be irrelevant. Those two to me. I see them as the same. It is relevant.*" (P14)

"*It [QS profession] is relevant.*" (P7)

"*It's [QS Profession] even more relevant today because of the need. It's a well-structured, formalised and very properly constituted formation. It is currently one of the professions [that] are still very dogmatic but very essential to the economic contribution*." (P6)

"*You know the quantity surveying profession now, I would describe it as one of the relevant professions that is actually required to drive the economic growth of the country*." (P12)

"*Yes, I think it [QS profession] will always be relevant because quantity surveyors are more like, you know, the referees in terms of maybe managing the contract and also managing maybe the finances and so on*." (P15)

"*I think it is sort of regaining its respect. A lot of people wouldn't understand exactly what is the role of the profession*." (P8)

"*Yes. I would say it is [relevant]. Yes, it's [QS profession] healthy. Well, it is well respected in industry. People that have been in the industry ask for quantity surveyors to be part of the professional team.*" (P16)

"*Do you think the quantity surveying profession is still relevant? Yes*." (P11)

The reasons for the positive outlook were based on various reasons, such as the need for cost advice in society and economic growth. Others claimed that because of the profession's scarcity (DHA, 2014), it makes its demand in society high. Trust and respect is what gives quantity surveyors a place in society, according to some experts. As a result of the trust endowed upon quantity surveyors, they were now playing a refereeing role within construction projects. Others claimed that quantity surveyors' historical roots cemented its position in society. The quantity surveying profession is becoming more visible and thus proving that the profession is becoming widely recognised in society, an assertion made by some experts.

Reasons for the relevance of the quantity surveying profession

Need for cost advice

Similar to literature findings (ASAQS, n.d. a), most experts claim that the need for cost advice is the basis for the need for quantity surveyors in society. Before any investment in construction, cost must be determined first and therefore the need for a quantity surveyor. It seems like within the built-environment professionals, quantity surveyors have carved a niche for themselves as cost experts.

"*He is the expert on cost*." (P16)

"*Of course it's relevant today. You look into the basis of the profession. What is the basis of the profession? It's to make sure that before you build anything that you want to build you take account of the cost. How much it's going to cost you. So that you know whether you got enough to build that thing or you don't have enough. So a profession like that will always be relevant*." (P11)

"*And as you know quantity surveying has been probably the key professions in terms of the built environment that deals with cost and in particular value. The value that clients are aspiring to attain. So I still believe that the QS is still the relevant professional to deal with the issue of value."* (P12)

Recent cost overruns in the construction of two power stations (Medupi and Kusile), owned by South Africa's power utility Eskom, is a demonstration that quantity surveyors are needed in managing construction budget. This is according to P8. The premise of P8's claim is that, had quantity surveyors been engaged in both projects, cost overruns could have been avoided. Cost overruns at Medupi are estimated at about R64 billion and about R90 billion at Kusile (Tshidavhu and Khatleli, 2020).

"*Fortunately the big construction projects that have experienced huge cost overruns like Eskom and the related (companies) have really demonstrated that there is a need to have the quantity surveying profession involved in these projects*." (P8)

The demand for quantity surveyors in society was also supported by a client (P8), "*I can't do anything without a QS*."

Economic Relevance

At the time of the interviews, South Africa had just welcomed a new government, with a new president installed. The previous government was accused of corruption and the economic downturn in the country. Hope and expectations of an improved economy were high. Thus, P6 and P12 claimed that quantity surveyors were better positioned to drive the economy of South Africa.

"*It is currently one of the professions which are still very dogmatic but very essential to the economic contribution*." (P6)

"*I would describe it as one of the relevant professions that is actually required to drive the economic growth of the country*." (P12)

Rare skill

As per literature findings (DHA, 2014), the scarcity of the quantity surveying profession, places the profession in a position of demand.

"So public works, public service, has identified the profession as being a very highly essential profession but currently a rare skill … it's actually currently in the top five in the country in terms of rare skills in the country." (P6)

Trust

Trust is one of the important tenets of a profession (Susskind and Susskind, 2017). Quantity surveyors are trusted with regards to cost of construction projects.

"*They see that there is a benefit to using a quantity surveyor on a project. It's trustworthy and he is the expert on cost. Trust and cost*." (P18)

Referee

The trust endowed upon quantity surveyors as cost experts of construction projects places them in a position to play the role of referee in construction projects.

"*I think it [QS Profession] will always be relevant because quantity surveyors are more like, you know, the referees in terms of maybe managing the contract and also managing maybe the finances and so on*." (P15)

"*A QS I call him an accountant, auditor, paymaster … Let's say I have a turnkey project. I [will] still have a QS. Because he pays me ... even if QS works for us because he must still certify our payment as a professional QS … Because I can't be referee and a coach where I just pay my myself. I work and pay myself. I will overpay myself … There must be some kind of a cost control. So the QSs will be there.*" (P7)

"*It [QS Profession] is very much so important because the QS becomes the now, your independent certifier of all the financials or the monetary side of the construction project. So you cannot have a project where the contractor is both a referee and a player.*" (P6)

"*Can you imagine a match without a referee? ... So our job is [to referee] as long as we keep our ethics … We're looking at the interest of both.*" (P14)

"*The QS is appointed as a referee, from the point of view of the definition. Why QS? Yeah, it's a referee but working in the best interest of the client.*" (P12)

Respected

Another attribute of the professions is that they are afforded respect in the society (Susskind and Susskind, 2017). An attribute that experts claim is the reason for the professions' relevance in society.

"*Well, it's [QS] well respected in industry*." (P16)

"*We [QS] never had any problems that were articulated in newspapers and whatever and so on … is still relevant and you know is valued accordingly within the built environment*." (P12)

P10, an architect by profession, disputes the assertion that quantity surveyors are respected in society …"*The other professions have no regard for the quantity surveying*," (P10) because quantity surveyors' unethical behaviour of falsifying numbers.

"*And therefore this quantity surveyor was expected to report falsely about the cost of the project to be able to impact on the fees.*" (P10)

Historical roots

Some experts claim that, the fact that the quantity surveying profession's roots are deeply embedded in history, cements its position in society. This assertion, has implications that suggest that the profession will exist until eternity as it is a profession that was ordained by God from the beginning of the ages. Thus, intimations made about the profession in the Bible gives the profession a basis for its continued existence.

"*[QS] Will always be required because it was required even from the foundation of the world. From the time that the Lord said, 'Okay now you go and fender for yourself Mr Adam.' And then when he had to build his own first house. He needed to make sure that he's got enough before he can start building or else he will build something that in the middle of the show, he's run out of material to build. And if you need to purchase that thing, you need to know what is going to cost you. So it will always be relevant*." (P11)

"*I think it started somewhere in the UK … But then even before that, in Luke. I think it's 14:18. Jesus spoke about it, the quantity surveying profession. But yes, even God, lets say, gave Solomon what is required to build a temple. The quantities were specific and the quality was also specific. Yes, but as we know it initially, the issues were someone needs to quantify the work and someone needs to control the payment and then initially the contractors used to be the ones who pay the quantity surveyor*." (P15)

The Quantity Surveying Act

The supposed eternal position that quantity surveyors seem to enjoy in society is also supported by the the Quantity Surveying Profession Act (No. 49 of 2000). Quantity surveyors feel secure in their role because the profession is protected by the Act, a view cleary expressed by P12. Unless the the Quantity Surveying Profession Act (No. 49 of 2000) is changed, their position in society is secure. To change an Act of Parliament is laborious.

"*But the built environment itself, in terms of professional councils can't change that. There has to be an ACT that says, 'No a QS can no more be independent'. So you must start it first from the regulatory status. You just don't relegate people. You have to apply in parliament and say, 'No, we no more need these guys as independent'. Then they say, 'Okay, then we have to scrap their ACT.' But as long as there is an Act, you can't take out these people. You see, that is why I'm saying in the UK is different.*" (P12)

Becoming more visible

As literature revealed (Smith, 2014), the quantity surveying profession is often regarded as an obscure profession. In recent times, however, the profession has been enjoying some exposure from different sources in South Africa. This was mentioned in the South African president's parliamentary speech in 2019. This visibility is a positive sign that the profession is relevant and is becoming known in society.

"*Hence the president and the minister in their speech, they mentioned the quantity surveying profession as the one that will guide infrastructure spending. So I think yeah, it is slowly now being recognised as one of the necessary professions. Has not been understood in the past.*" (P8)

"*So we've been very stable and it has actually grown because people are now, a lot of people are now aware of what we call a quantity surveyor… And I think, you can see the exposure and also the role of the universities. Now, we have more enrolments of quantity surveyors than before*." (P12)

Not all experts agree that the profession is gaining visibility. The profession is still obscure as many people don't know what quantity surveying is. In comparison, with other professions, such as engineering, it is still unknown.

"*…because so many people don't even know who the quantity surveyor is?*" (P15)

"*I believe that it's also still quite understated, as compared to other professions like maybe say like legal or law. I think engineering is much more prominent than the [QS profession]. I'm saying in terms of visibility and proximity, you find that engineering is much more, sort of known whereas quantity surveying is still very much under stated in terms of significance*." (P6)

Not all experts had a positive outlook about the quantity surveying profession. Some experts are of the view that the profession is irrelevant or losing its ground in society. The next section looks at the reasons provided for the negative assertions made about the profession.

Negative outlook

Competition from non-quantity surveying professions

What has left the quantity surveying profession in its current negative state is the current economic situation, which has opened the profession to encroachment from non-quantity surveyors.

"*… [QS is] in a state of flux, okay, we are having a problem in that the non quantity surveyors are trying to elbow in to the quantity surveying field obviously because of the current market conditions. There isn't a lot of work out there. So people are starting to try and do quantity surveying work when they're not professionally trained quantity surveyors*." (P3)

Problem tendering and under-pricing

In the past, quantity surveyors were not required to tender for their services. Since tendering was introduced in the public sector, the state of the profession seems to be poor, as resources are often wasted on tendering and the quality of services is compromised.

"*I think there was a time where professionals were used to not tender for their services. Because my understanding is that if you are a consultant, including a quantity surveyor, you are an extension of the arm of the client. So in the old days you didn't have to tender for work. And I think in that way, there were no resources wasted on tendering and that's one problem.*

"*Second problem, is that with the tendering, people now tend to under-price themselves. So if you under-price that affects the service. So basically, now what I see is that the project don't get resourced properly from a quantity surveying point of view. They don't get the source properly and the projects they never get finished on time. So there's no winner in both the quantity surveyors services, as well as the client's return on investment.*" (P14)

Invisible service

Quantity surveyors' services are intangible, unlike architects and engineers' skills. Therefore, selling the skills of a quantity surveyor at a premium is harder. Clients cannot see or touch the product quantity surveyors are selling. The only time the need for a quantity surveyor becomes evident in a project is when things goes wrong contractually or cost wise. These are views expressed by P14 and P9.

"*Look I think to me, I don't think this applies to quantity surveying only. It applies to all professions. I get the sense of that, especially [with] quantity surveying. If you are an architect you produce a drawing. If you are a quantity surveyor you produce figures but it's not ... in the eyes of clients, it's not something that they can see. So, and as a result there is this tendency that they are doing you a favour until they are in trouble. So, the status of quantity surveying is its visible but invisible as a service. Hence people think that they are doing you a favour instead of the other way round.*" (P14)

"*In our profession as a QS, [it] is a bit harder because we're not an architect. He can sell his skill in the look and feel of his product. It's a bit harder for us as QSs to sell that skill, that service, because it is not visible. You're managing people's money. You're keeping things accordingly contractual. It's not visible. And maybe it's harder for us in our industry to do that. Whereas with an architect, a client sees this fancy product. 'That's what I want'. And he'll pay.*

"*We can't sell it. Because it's not tangible. You don't see it. It's invisible. And they only see it when it goes wrong, when they land up in dispute and the contractor goes insolvent and for all these different things. That's where it goes wrong. It's too late then, So it's hard to sell that as quantity surveyors, to sell that service for a premium.*" (P9)

Lack of government investment

The precarious position in which the quantity surveying profession finds itself is blamed on Government's lack of investment in economic infrastructure.

"*But now, because the economy is not doing well, the Government usually focuses their resources addressing your social issues rather than maybe investing in infrastructure. The focus has been mainly on the issue of social service and social infrastructure rather than maybe investing in economic infrastructure*." (P15)

Small cake to share

Another challenge expressed by some experts was that there are currently too many professionals in the built environment vying for limited projects. A lack of government investment on infrastructure has led to this situation.

"*But the only problem there are too many professional. Yeah, there are too many professionals … but now the cake to share is too small ... I think it is affecting negativity because now by all means you are fighting to get a project*." (P4)

"*I think we are starting to reach a stage where we have got excess capacity.*" (P15)

P6 disputes the claims of excess capacity based on the infrastructure needs of the country. Instead P6 contends that there is a need for more quantity surveyors to be trained as the infrastructure is required countrywide.

"*I think we still have six teaching schools in terms of quantity surveying. That needs to change. It needs to be broadened so that there is more accessibility, because quantity surveying is related to delivery of infrastructure, which to me is something that happens countrywide*." (P6)

Loss of status in society

P5 asserts that the influx of professionals or quasi-professionals into the built-environment has resulted in the professions losing their elitism in society.

"*The professional has always been a very prestigious and honourable line of work. It still is but I think we're getting to a point where it's not considered, so a socially, it's not so much a status as it used to be. Same for teachers or a doctor who is considered to be a very high social status [person] in the community. Now, it's kind of part of the broader context of things.*

"*[The reason is because of] supply and demand. Maybe, there is an oversupply. It has evolved*." (P5)

Passive

P13 accuses the quantity surveying profession for its passivity and also for being steeped in tradition.

"*I think it's [QS Profession] passive. We are traditional and not responsive to the client's needs. So we just react to what client's ask. But client's don't know what they need. So we are not able to go beyond what they have asked for. So I think in those terms we are not proactive. I think we are passive.*" (P13)

Loss of market share to others

According to P13, the lack of proactiveness is making the quantity surveying profession to lose its market share in society. Other professionals, such as engineers, are gaining ground in spaces that could be occupied by quantity surveyors.

"*Overall, I also think that we are losing market share. We are positioning ourselves below our potential. We can offer much more than how we have positioned ourselves. Exposure to different roles in project development from the entire value chain clearly shows that there is a much bigger role to play than we are currently playing. You know, your engineers don't understand financials. Your social people don't know how to integrate social with construction.*

"*And then you end up with your engineers [who]also don't understand communities. So we are exposed to all the disciplines in the construction industry. We interface with all of them. And we understand all of them because for you to do a cash flow, you must understand planning. So that understanding enables us to position ourselves differently in the market.*

"*So I look at [the] mining sector where I spent all my professional life as a QS. We were the link between head office and operations on the ground. So all your people who are running projects, your most senior, don't have an idea of what happens when we do the financials runs. It was us who would sit with the guys doing the financial runs to have an appreciation . 'You know, when you do this, it affects NPV negatively. This is what it does to IRR.' They don't see that. They don't even know what's happening on the operational cost. They just design and build and stop there.*

"So I think as QSs we are punting below our weight.

"*Where we could add a lot more value is on the proactive management of strategic client objectives, such as your end-value management, which is a project management concept. But project managers do not use it. We understand, we could do end-value management better than other professions, I think. We have got a better appreciation of the contract management side of it. Your effective cost, productive cost, you know, management. I think we should be occupying the spaces across the industry.*

"*What is happening now, and I got the privilege of working with a multidisciplinary engineering firm. What is happening is that engineers are doing their own BOQs and their own contracts and they*

run those things. I think with our exposure and understanding of how these rates are built up, we are better positioned to administer these contracts. My limited exposure is that they (engineers) are shallow.

"*The shallow part is the appreciation of the commercial aspects by engineers is not as sharp as that of quantity surveyors. So in the engineering environment, we have relegated that to engineers yet we could play a bigger role*." (P13)

Traditional quantity surveying is irrelevant

The traditional quantity surveying role seems irrelevant to P13. According to P13, technology has made the traditional quantity surveyor redundant. If quantity surveyors only observe their traditional roles, the profession might go extinct. To suvive, according to P13, the quantity surveying profession needs to reposition itself, in terms of where it adds value. P13 claims that this shift will also affect its fees. The bulk of the fees are still allocated to the traditional role. However, in future the fee scale should be adjusted so that the bulk of the fees are allocated to the advisory role of the quantity surveyor. This is according to P13.

"*… these measurements and bills of quantities and stuff, those can be computerised. With technology, those are things that are easy to do and I think if we don't watch the space we might go extinct."* (P13).

"*So I think in the traditional form, most of the work (traditional) can be replaced by computers. So, if you look at the fact that almost 1/2 of the QS fees, you know, go into the early works, that those ... works can be replaced by computers.*

"*You can set up good modern tools and get very good, good, good estimates. You can get reasonably good bills of quantities with computers and less people. But the contract admin is where we need more emphasis.*

"*So, so if we are still having the bulk of our money sitting with computers then we are at risk. We need re-position or money to sit with, at value add, doing the advisory rather than the technical work.*" (P13)

Summary of the findings of the purpose of the quantity surveying profession

Evidence from the data indicates that quantity surveyors are still relevant in society even though it faces many challenges, such as the traditional role of the profession becoming redundant because of technological encroachment. The main reason for the relevance of quantity surveyors in society is because of their construction cost knowledge. This knowledge is what legitimises their existence in society.

6.2.3.2.3.2 Quantity surveying profession: principles

Value for money

Quantity surveyors are driven by the need to provide clients value for money. Clients are also looking for value for money. Thus, value for money is cited as the main driving principle for the profession.

"*So our clients are also looking for the best deal that they can get and so our clients don't help sometimes that they're just looking for the best return on their money*." (P3)

"*So in terms of defining [quantity surveying], I would [define] a quantity surveyor or quantity surveying profession as being a profession that will always make sure that value is attained for a client*." (P12)

The value for money principle is criticised mainly by architects who claim that quality and a holistic value should be the driving principle on construction projects.

"*What my experience has been of quantity surveying input has really been [a] bottom line approach. I have not seen a shift in the approach from, in the input where it's just a matter of, 'Okay our budget is this, this is what we need to stick to.' And it's not, it is never been much of a contribution towards the overall value. It's just being a contributor to, 'We need to be under this price'*." (P19)

"*It is not the quality that counts any longer in construction. It is the economics of construction that counts*." (P10)

"*Quality was an endpoint and people took time to do that. Now cost is an end point and time isn't always following that.*" (P5)

Brand and money

Even though the quantity surveying profession is currently instituted as a functional profession based on its traits, it is a private enterprise profession. Evidence suggest that quantity surveyors want to protect their brand and keep making money hence they choose projects that they get involved in.

"*We don't do any government work. Okay, because the Government doesn't pay very well. Government really doesn't know what is doing because they're not in business to make money.*

"*They've got a different set of rules that they work to. There was opportunity to go work on Kusile power station, and we said no thank you. It's government run. It isn't going to run very well and at the end of the day, you could do damage to your brand as well. So we keep away. We stay away from government wherever possible*." (P3)

Corruption and other unethical behaviour

There is evidence of corruption and unethical behaviour in the South African quantity surveying profession. Quantity surveyors engage in corruption through various means, which include falsifying payment claims of contractors. Officials in the public sector, contractors and the other built environment professionals are often involved.

"*[A former colleagues] were telling me that, 'you did the right thing by not opening a private organisation because now what do you do when the whole professional team is driving this corruption. Now as a QS, you are the one to sign on the payment certificate. But you know that there is corruption that must be built in.' So they were telling me, 'You did the right thing to stay in an organisation like that.' Although that corruption is everywhere but you know, it depends on whether you want to be part of it or not. … When you are a PQS company that relies on the professional fees from this client and now this client is telling you that you know what I've got 10 billion that you need to look into so that contractor can pay back my private account and you are going to get 200 million, 500 million. The political side of things causing all this*." (P11)

Wheeling and dealing

Quantity surveyors are accused of malfeasance. They have lost their independent professional judgement and impartiality in projects. Most of them are only working for the interest of the client. Their fees are sometimes based on how much they can save for the client. At times they have an interest in projects through PPP consortiums and similar.

"*We [QSs] were always considered very ethical because [of] the way we were getting paid. We were getting paid a fee. Your [as QS] emphasis was on saving the client money and doing it the best most economical way. But I've seen now, sometimes that you getting on performance based and it's wrong. If the client says 'If you save me money, I'll pay you more money' and then it's not ethical any more. So that's where the ethics is gone. It used to be very good and I find it's gone down now. Quantity surveyors are wheeling and dealing. It's bad. It's bad. But it's evident. Why? Because you get paid a fee you know. If you didn't make any money out of the project, you know, profit, they must keep it like that [being paid on a fee basis]. Where you are independent, impartial and you get paid a fee. A set fee. Whether the project comes out higher or lower.*

"*If they pay like performance based[fees, things would be different]cause then they cut corners. I think, that's exactly why you don't give a full professional job. Now I know that another firm that used to do it, they [clients] say that 'if you save us money, we'll give you 10% of the money you save'.*

"*So now, they go and they just, screw the builder to the ground. And just kill him. [QS say to contractor]'We are not paying, we are not paying, we are not paying'. To save and to make them look good. And then they save money. The client gives them more fees.*

"*It works both ways. You must pay the builder fairly. As well as look after the client. You mustn't just look after the client. They are only acting for the client. It's a problem.*" (P16)

Wheeling and dealing has eroded the independent quantity surveyor. Currently, clients and contractors have their own quantity surveyors.

"*You see what's happening now. You are getting QSs for the client and QSs for the builder. Professional Qs are acting for the builders now. So it's like lawyers you know? [Professional independent QS] is being eroded. It's sad.*" (P16)

Divided loyalties

Clients accuse quantity surveyors for divided loyalties. Some quantity surveyors have shareholding in PPP construction consortiums. Others are more loyal to the design team with whom they are working than to the overall success of the project. This is because of the 'brotherhood' mentality that is based on looking after each other's interest. The aim is to ensure that they are appointed in the next project. Clients in property development and facilities management have had to resort to appointing their own quantity surveyors to oversee the work of the quantity surveyor appointed by the PPP construction consortiums or tenants. Even though quantity surveyors appointed by PPP construction consortiums or tenants are professionally registered, they have divided loyalties and are thus not trusted by clients.

"*You find that when you do project like, especially when you do a PPP, you have a QS to oversee another QS, but they belong to the same profession. They are registered the same way and therefore they abide by the same rules. But you find that the client will insist [on having] their own QS while there was another QS.*" (P20)

"*Because, you know, what is, what is the problem is, what I'm trying to say is that , when you do PPPs, you're saying, 'private sector, please all I want to do. I want a turnkey situation and I don't even want to maintain it. I don't want to do life-cycle costing. I don't want to do all of this, but I will pay you so much money.' which becomes engineered to come to that particular amount. But now, because you are agreeing on that type of system, the quantity surveyor becomes the shareholder and therefore now because of the quantity surveyor is a shareholder, then he becomes part of the system that needs to make as much money as possible. But he is the quantity surveyor. Because of now the quantity surveyor becomes part of the ownership group, then you have this other quantity way to oversee …*

"*The point I'm trying to make is that, if you have one QS, you have one QS; you don't need to oversee because the minute this one sees that this one is not doing the right way, obviously you have to report them. So that they can't be. So now if a QS is not allowed to own a construction company, why would you allow a QS to be member of the consortium that includes a construction company? Because of now,*

it is allowed that the QS become member of the consortium of the construction project that he is also a QS at.

"*So now, the what, who does he report to now? Whose interests? Because he has got the interest as a shareholder. Not the interest as a client who is me, who is going to end up using this job. So I think that the, the law doesn't stop a QS from owning or becoming a consortium member on those type of deals.*

"*Yeah, you have a QS oversee another QS. I have always said that a QS must be one QS.*

"*I have a building now and then a client comes and says, 'I want to lease this building for the next 10 years. But I wanted you to give this building as you are giving me and let's negotiate on the pricing, but I'll bring my own team.' But I'm still responsible as a landlord to get the building to a certain level when the tenant comes in. So now I have certain responsibilities. Now, because he says, 'I'll bring my own team to do this thing', a certain amount they will get from tenant installation (TI), because that's what I will provide, but then I must reinstate; for example, if I have to replace the HVAC and whatever but because of he comes with the whole team, so he sort of relieves me from providing it.*

"*So now then I must give him the money to do this thing, but I don't know what he is going to end up putting into my building. So now I'm not going to manage the building because it's a 10-year lease. It's self-service. All I have to do is just make sure that maintenance regimes are followed and I get all that information. But at the end of the day, what I have found difficult is that when now, this tenant wants to move out, now he is going to move out and leave his things there. And then my lease would have said, 'You must leave the building in the condition that you left [that is, in its current condition]'. But he did everything.*

"*Now it becomes sort of a problem. But in terms of me dispensing this money, because it's not a TI. So we are not amortising this money on the rent, but it tends to creep into the amortisation because now we would have the money that we would have paid; [it] doesn't go to a manufacturer, who will [be] held responsible in terms of warranties and guarantees. It goes into my tenant. So it becomes difficult. So now I tend to bring my own QS and say, 'Okay fine, you can do everything that you do but I have somebody who is going to oversee and it's not even me because I want a technical QS. To make sure that whatever you are doing is there.' If he says to me, 'Oh, I'm supposed to remove this pipe and I am putting a new one,' it must be that. I must not find out that no, he just patched it for it to work, but then I'm giving him money for the new one. So those things also ... That the QS becomes too much part of the ownership.*

"*And then as a result, you know, those are the sort of the thing[s] that change. So now then, his interest would be to the tenant you see, not to me as a client. And then, you know, the one who's dispensing the money for that thing to be done. So then you end up having two QSs overseeing – one QS overlooking the other. And they sometimes, they do fight. They resent each other; that, 'You know what?Your client doesn't trust me to do this thing transparently. As a QS, I should be transparent.' But then you never know because we are in this industry. The environment has affected the* broerskap *(the brotherhood) you know? You don't know how they actually got that QS in the first place. Maybe he is the QS who's been doing all the buildings. He is interested in working for the tenant because of the tenant. There's a potential that they would be [doing] another building and him as a QS or her as a QS will be the one doing that building as well. So the loyalty there is...*" (P20)

There is evidence to suggest that quantity surveyors do not understand their role as independent professionals. They seem to believe they are working for the client and not in the best interest of both the client and the contractor. This perception might be explained by clients being the ones who pay quantity surveyors.

"*Yeah, it's [QS] a referee but working in the best interest of the client.*" (P12)

The perception that quantity surveyors are working for the clients is one shared by some clients (P17), who perceive that quantity surveyors are working for them. If the role of the independent quantity surveying professional continues to be eroded, there may be no independent quantity surveyors in future.

"*There will be a need for them[QS] to keep up with technology. Because systems of how they are doing things will keep evolving all the time in order to match the need of the clients, client's need. I can't do anything without a QS.*" (P17)

Discounting fees versus undercutting fees

Quantity surveyors' behaviour is also guided by tendering based on services and fees. Other quantity surveyors undercut their competitors at the expense of quality of the project. Other repercussions of fee discounting and undercutting of fees is encroachment by others who are not quantity surveyors. Quantity surveyors' fees and services are linked; a change in fees will affect the service provided. Services of quantity surveyors are linked to the identification of work documents. Thus discounting or undercutting fees have the potential to render the recommended fees and identification of work redundant, a threat expressed by some quantity surveyors. Another threat of discounting or undercutting of fees is the removal of other companies from the market.

"*Remember we talked about tendering before. I'm talking about big companies, multinationals. Those guys they undercut everybody. But they under-service the client.*

"*And also, your industry, unfortunately is that I can mention the company that was in trouble with XXX. The owner of that company is not in the built environment space. Now, you get people that are running these professions because this thing is [regulation] relaxed – that if you got one-third or of whatever non-professional whatever. It depends how powerful that guy is. That guy he runs a big, I mean, multidisciplinary organisation. It's not a QS. It's not a QS. He is not in the built environment space. So that thing also affects ethics. Because what I see today is that people do something now, they don't know what is going to happen down the line. You can take shortcuts and all that. But when a claim comes, you start getting questions from your PI insurance companies. That's when you realise people never foresaw this thing. So that is the status of your profession as far as I am [concerned]*." (P14)

"*Now we have to compete. It means it's my discount against yours. So, where quality would be compromised. And it defeats the very purpose of us being the construction managers of budgets. Because now if our work is not identified and protected, [and] our fees are also discounted, it puts a constraint in terms of the quality that we need to put out there to justify our work.*

And the identification of work, you know, you find engineers doing QS work. You won't find doctors or QSs doing doctors' jobs. We respect their work. I wish we could be afforded the same respect as doctors receive. So I think those issues at policy level can be ironed out and clarified." (P8)

"*The other thing that is affecting professionals at the moment is the fee discounting, it's actually causing companies to close down*." (P5)

P5 claims that the current fees scales in the built environment have a built-in factor of 20%. Those who go below 20% are '*cutting their own throat*'. (P5). This claim by P5 infers that discounting fees within the 20% margin has little effect on the profitability of a firm. Professional firms can remain afloat provided they do not fall below 20% built-in factor.

"*The professionals have taken an interesting approach. So what they've done is they've escalated fee scales, so that you can discount. So instead of me saying to you, 'here's the 2011 fee scale,' I'll give you a 15% discount and that's it. That gives me a 5% margin. What they've done is say, 'Okay, take that, add a 20% margin on top of that, and then you're able to discount into the 30 or 40%.' The only professions that haven't done that [are] either electrical or mechanical engineers actually. So I actually saw quite an interesting way that they explained that they can't discount fees to the same rates ...*

"Because people are discounting fees at rates that are below cost. They are trying to do work for turnover. But you're going to get into a situation when your overheads exceed your income. And [it] is a difficult time. But you can't.

"*So the scale of projects that you're going to take on is going to be different to the scale of projects that another QS firm with ten people is gonna take on.*

"*But the impact is going to be the same. You've got a rising cost of living and if you're discounting your fees, those fees were worked out so that you would be at a 20% margin; anything under 20%, you have to be super efficient or you're actually, you're cutting your own throat*." (P5)

Unprofessional

Unprofessional behaviour has crept into the quantity surveying profession. Professionalism , according to experts, relates to issues of behaviour and ethics. Behaviours such as having no proper office while continuing to tender for fees and services is regarded as unprofessional behaviour. Professionalism means that you are sought after, that is, "projects come to you; you don't run after projects".

"*Now, the new generations, the office is the car. They the run projects, we don't know, you never go to the office. They don't have [an] office*." (P4)

"*And you have the Competition Commission on the other side. And you have Government coming with discounting of fees, you know? So you'll find that there's a mismatch in terms of aligning policy. That it actually understand exactly what the quantity surveyors do. What engineers do you know? You know, what competition ... do we have to compete or do we have to be appointed for our skill? Do we have fee scales, you know?*" (P8)

One of the causes of unprofessionalism is an oversupply of these professionals. Oversupply includes the increase in the number of the current professionals and the proliferation of occupations into professions in society. It was highly desirable to be a professional in the past because of their scarcity. Currently it seems that many occupations are considered 'professions', thereby removing the elitism and esteem once accorded to the idea of the professions. One of the attributes of a profession includes exclusivity and elitism (Susskind and Susskind, 2017). If these are eroded from any occupation, its status as a profession become questionable.

"*It's an oversupply. And I don't mean that in a bad context. I just mean that there's a proliferation of professionals in different sectors to the point where we're all professionals. And so only the best of the ones who kind of survive if you want to call it that. It's not as prestigious as it used to be and in this thing where we're all baying for work and there's this kind of cutthroat mentality that's happening, that's come out of necessity, but it also is not coming across as professional*." (P5)

False accounting

Quantity surveyors falsify numbers to please the client and to secure their fees. Instead of being objective, they are influenced to create a false impression about projects. This behaviour, if not corrected, could be the death knell for the quantity surveying profession.

"*I'll give you an example, where we're doing a project instead of the quantity surveyor being ... doing what the core mandate is; to account for the project, he was creating or he was influenced by the client*

to create an environment that suited the client's perspective. Cost value of the fees is dependent on the cost value of the project, and therefore this quantity surveyor was expected to report falsely about the cost of the project to be able to impact on the fees. So until that those ethical things are corrected it [QS profession] will die." (P10)

Legislative framework and professional bodies

Norms and standards

The legislative framework and professional bodies that regulate the professions are regarded as essential. They provide norms and standards. The regulatory framework must, however, not go over their boundaries. This was in reference to the Council for the Built Environment (CBE) in particular, whose reputation the evidence seems to show should be held in suspicion, and is by some experts.

"*The fact that here we've got it [SACQSP]in law. I don't have a problem with that, provided the CBE stays reasonable and doesn't go too out of the box and do funny things. You know, if the CBE goes right down the wrong path, it could be a potential concern to me.*

"*…an overview of my views of the Council and the association, the fact that there is an association that spends a lot of time and effort to get documentation out and send the documentation, I think is a good thing for everybody.*

"*Somebody thinks about it deeply and comes up with a standard form. When [or] if you want to change it you can change it but at least you don't have to reinvent the wheel every time when you trying to put a certificate out*." (P1)

Policing

Professional bodies play a policing role. The threat of being struck off from the roll makes professionals toe the line.

"*And I think it goes back to when the society was crying, 'regulate our brand'. Because we have learnt that letting everyone go and do the their own thing is not necessarily the right way to go. But then, the fact that if someone has misbehaved or has given poor service instead of going to the police you can go to these people. The chance of the chartered accountant be[ing] removed ; the attorney being struck [off]. The advocate who has lost [his status]... it's usually one thing that usually maybe forces everyone else to toe the line ... what I would call using shame to change people's behaviour*." (P15)

Moral compass

The regulatory bodies are compared to churches, inculcating moral values in members. Human beings seem incapable of maintaining moral virtues on their own, hence the need for councils and associations.

"*I've spoken [about] this with some people and the issue was why the council is necessary... Through churches you and I we have learned, you know certain moral things. Which means we are less likely to be [a] burden on society, because there is this value you have learned through the church at zero cost to the Government. Until maybe we reach a certain level of development we will require all these government-mandated institutions to control behaviours, to develop people until maybe they reach that level. They've [councils] got a role to exist in our society*." (P15)

Slow on corruption

In comparison to the RICS, the regulatory bodies are regarded as slow or ineffective in dealing with corruption and unethical behaviour.

"*Where I find they [SACQSP] are behind … is because the RICS, I am also a member of them, and they are more advanced in terms of global compliance and also ethics and also corruption. There is a new compliance thing that all quantity surveyors at RICS have to comply [with]. It is coming out in 30 days*." (P16)

Summary of the findings of the principles of the quantity surveying profession

The position of quantity surveyors as independent professionals is under threat because of corruption and unethical behaviour. Evidence suggest that the regulatory framework that exists may not be effective against corruption and unethical behaviour. Corruption and unethical behaviour challenges one of the key tenets of the profession, that is trust. The evidence of clients and contractors appointing quantity surveyors to oversee each other suggests that trust in quantity surveyors in carrying their duties out independently and impartially is starting to erode. If corruption and unethical behaviour is not rooted out, the profession may suffer the same fate as Arthur Andersen and Enron (Ho and Wang, 2007; Li, 2010; Susskind and Susskind, 2017).

6.2.3.2.3.3 Quantity surveying profession: process

Systems within the profession

Identification of work

Quantity surveyors' claim that the fact that they have not been able to identify work, in recent times, has put the profession in an undesirable position. Identification of work is regarded as uncompetitive behaviour by the Competition Commission (Prinsloo and Andersen, 2015). This is not only within the quantity surveying profession, but also in the other built-environment professions.

"*We haven't been able to gazette fees for the last three years. And we cannot have an identification of work at the moment. So the complete built environment is in limbo at the moment. That's bad*." (P9)

Identification of work is linked to fees that quantity surveyors charge. These have also not been approved yet for the same reasons as the identification of work.

Gazetted Fees versus recommended fees

Quantity surveyors claim that the fee scales should not be regarded as anti-competitive, as they are recommended and not prescriptive (Prinsloo and Andersen, 2015). They are recommended because the fee scales should be used as a basis for negotiating fees with clients. Methods used to arrive at the fee scales are based on scientific methods. Claims of fees being recommended instead of being prescriptive are challenged by evidence that shows that quantity surveyors still regard fee scales as gazetted. This could be an indication that there might be confusion in the profession with regard to their application.

"*Fee scales, I mean as you know, the CBE has decreed that we shouldn't be issuing fee scales anymore because it's anti-Competition Commission stuff. Personally, I don't, I don't personally buy that. I think to have a guide, recommended, and I stress recommended, because [it] is not, is not obligatory. At least it gives the guys an indication of what, what the norm would be. You can discount it up and down as you like. I mean you can do what you like after that, you know, you are not obliged to [do] that but at least it's a guideline. And I personally feel recommended tariffs of fees is something that should stay. So long as it remains recommended.*

"*I would support that and it's a guide. I mean at the end of the day where does it come from? It actually comes from salaries surveys that are being prepared by the association, which eventually get presented to the council and the council churns around a little bit and eventually it gets the recommended tariff comes out. So it's, it's, it's something that is it's not sucked out of the air. I mean there's a bit of a science behind it, you know, as to what people are actually being paid and, you know, salary scales and stuff like that*." (P1)

Some experts blame the delay in the approval of fee scales on politics. The change in government as a result of elections has affected the approval of the fee scales.

"*Right now what affects the Council most is exactly from the political side of things. You have your councils and these councils like five or six of them. They are under one council, [all the] built environment professions. And then they submitted their fees, I think some time back, fee scales, to this one [CBE] and this one needs to get it approved by whoever at the top government level or whatever legislation or wherever.*

"*Now those fees are not approved as yet because of some Competition Commission whoever, who doesn't want to approve these things. So it affects [us] because now we've got fees that are not official as such and they are not published. Although we know them. They are in our website, but they are not official. So that instability in the political environment, because that's what caused this thing not to be signed.*

"*Is causing this problems in terms of now, we're not sure what our fees are. We know that council has said, 'These are the recommended fees,' but they are not yet gazzetted as such because of that. And again because that environment, I think by the time they were submitted, it was another regime and now is another one*." (P11)

The non-approval of fees, in particular, is what has opened the quantity surveying profession to labour brokers. They charge fees that are way below the recommended fees in order to win tenders. Quantity surveying companies that use gazetted fees to compete are thus edged out of the competition. This is seen as the threat to the profession and a potential source of discouragement to studying to become a quantity surveyor.

"*But now the Council does not regulate against the giving of discounts. The fees are there and it states exactly. Even when they are approved, it's not a matter of must. That, 'Thou shall charge this amount'. It's a recommended amount that you should charge. So that, you know, it brings dignity to the profession. But at the end of the day you are free to go and offer your own discount, but at least you start from that basis where you know, everybody else starts from that basis, and then you can give your own discounts and whatever, which then helps the profession and the environment. And that's what I believe your Competition Commission does not understand that. They do not yet understand that. They have not yet understood that. That's why they are not approving these fees.*

"*They think if it's competition everyone must be allowed to charge whatever. As in like they will be no basis because ... that's a mess. We are killing the profession now. Because you are going to get exactly these types of people that will come in here and take these tenders and their labour brokers. And they take your freelance people out there who don't have work. They exploit them really and they come here. Like, 'The fee should be around R850 per hour'. The guy says,'No, R150 per hour'. Now that will take away the whole object of why did you go and study in the first place?*" (P22)

"*Look, I think when things are booming, everybody can find work anywhere. Okay, so we get left alone and everything's hunky-dory and we do what we do. Yes when the market starts to become tight when the money is not there, the rand–dollar rate, whatever the case, may be is not so good then it starts to affect us. Because then everybody thinks that they can do it and if I come to you and I say as a professional you need to pay me R1 000 an hour, and then somebody else says, okay. I'm not quite a*

professional but I won't charge you [more than] R500 an hour, and I can do the same job, who are you going to employ?

"*Because yeah nine years of working to get to become a PrQS [become meaningless]*." (P3)

The non-approval of fees and identification of work is seen by P4 as positive; they see it as an opportunity for quantity surveyors to use technology as a competitive advantage and to carve a niche for themselves. In that environment, quantity surveyors can offer different services than those gazetted, and charge their own fees.

"*You will have seen that two years ago the Competition Commission started deeming some of the QS services un-competitive.*

"*Well, let me say, it's services because services are based on fees, isn't it? So, so whatever service you've been doing in a particular way based on the gazetted fees now becomes non-viable because now it's been deemed to be you know, un-competitive. So you need to start looking at a different way of delivering your service because instead of the gazette, the gazette now has become irrelevant. Because you have to tender for work. You have to basically negotiate fees based on 10% or 12% total basket or 2% QS fee whatever. So that gazette becomes irrelevant. And how do you now account in terms of that? And that's why I'm saying your service now becomes un-competitive because somebody else is going to do it different to you and become competitive. But whereas you've been doing it this way, the traditional way. And you're doing it because it's based on the Gazette. But how do you adapt? You have to change the way you're doing your services.*

"*You have to stick into artificial intelligence, you know. Use automated measurements. Use all those things and it takes you one day instead of one month to measure a job.*

"*In terms of the Government Gazette, those are the services. But in the private sector it's different because your services can be defined and redefined.*" (P6)

Standards

The regulatory bodies are also responsible for providing standards to the profession. The SACQSP is responsible for the qualification of quantity surveyors at both academic and professional levels while the ASAQS provides standard documentation. Standard documentation is useful in promoting best practice, as the basis of that practice is the same even though they can be altered. Both regulatory bodies create a platform for information sharing through research conferences. The setting of standards is seen in a positive light by experts.

"*The fact that there are bodies like that. The fact that there is an association that spends a lot of time and effort to get documentation out and send the documentation. I think is a good thing for everybody. Somebody thinks about it deeply and comes up with a standard form.*" (P1)

"*So councils are relevant. Even these associations. Associations, you know, present us with a plateau of information sharing*." (P12)

"*Council is relevant in that case and also council is relevant in terms of fostering or creating a platform for engagement, you know, in terms of research. We've got the research conference that provides a platform for people to look at things differently or to give us alternatives of how we should actually work and what the challenges are as we move forward. So a council is relevant. If there was no council, who would actually come up with that opportunity to say [to] guys, 'We've got this international research conference and you know, people can come and listen,'? Who was going to do that? Even the association [is relevant]. The association is just voluntary. So council is also relevant in ensuring that we maintain standards.*

"*The Council is for registering, controlling at academic level, and for registering candidates. The association does more [of] the documentation and the technical side. They do an excellent job. So standard documents, updating stuff. That is very good*." (P16)

Protection

The Council is not only relevant in protecting the ordinary man in the street against poor performance of quantity surveyors, but it is also relevant in protecting quantity surveyors against each other. In the case of misconduct, a citizen can use independent tribunals, which the Council has put in place to present their case. Behaviour of quantity surveyors is governed through codes of conducts (Ashworth et al., 2013). Quantity surveyors seem to take pride in the protection these measures ostensibly offer, even though evidence has shown that these measures seem to be ineffective in controlling behaviour. Some clients and contractors have carved a way for themselves to manage unethical behaviour, through the appointment of their own quantity surveyors to oversee one another.

"*Council is relevant in various ways. I will give an example. Council is relevant in making sure that an ordinary man in the street is protected. And hence we have this code of conduct and also protection between quantity surveyors that I cannot steal your work. You cannot go to a client and put a bad advert about me.*

"*And also we are trying to protect the ordinary man in the street. You know, putting a system [in place]. There is a system that is followed, [a system] of tribunals. If you have made a mess, you know, with a client, you've got a chance to present your case; the client [can] present their case. You've got a chance too and then [there] is a tribunal, which is an independent tribunal. And they go through that and then*

they advise Council that 'No, we believe this man is wrong, this woman is wrong and our sanction is, you know, he or she must pay or maybe suspend him. What does the code [of conduct] say?" (P12)

"*In anything that we do we have to work within rules. Rules are important because they set the motion [for] a whole host of things that could go wrong. An unmanned gate or an unguarded facility is prone to abuse whether you say you live in a modest society or not. But if it's an ungated and unmanned access then it just invites a lot of unwanted consequences. So the framework within which quantity surveying is birthed, it must protect those in it. It must protect those that are not in it.*

"*It must explain the modus operandi in terms of it being constitutionally correct and having a straight-line approach that then promotes an ethical way of doing things. It must then promote that. We work within a framework that is not necessarily foolproof, but it gives somebody comfort that in dealing with this community [of] quantity surveyors, they are accountable. They are responsible and they represent a certain offering within the framework of the built environment*." (P21)

Procedures

Professional registration

The process of registering quantity surveyors and continuous professional development (CPD) is viewed in a positive light and with pride.

"*There are regulations in terms of professional status. For you to attain your professional status, this [is] what you need to do. You have to work for a period of three years or more. A minimum of three years or more and get the experience and come and show or come and demonstrate that you understand and you can be a professional of good standing and so on. And also fostering issues of continuous professional development. So such things are what Council does*." (P12)

Exclusions and gatekeeping

Registration of quantity surveyors is regarded by Government and the Competition Commission as exclusive and analogous to gatekeeping. An accusation some experts refute.

"*…what Government is trying to do is they're trying to say, why do you need to have a profession? Why do you need to be registered? You are trying to ringfence yourselves around from the rest of the ... and you [are] trying to make your profession exclusive.*

"*Is that bad? No in theory it's not bad. But in reality you need the competence. So you have to have competence and in order to have the competence you have to have gone through a certain path. You can't just expect an open up and say having fees is anti-competitive and you should be allowing anybody*

to practise and call themselves and do the work of a quantity surveyor. And if you do that, you will have a disaster because it's not just quantity surveying. They're saying why can't an engineer do the same and an architect. Why do we need to ringfence and say you need to be registered and have a certain degree behind your name before you can do that work? It's because ... we've done that over all these years because of the competence that comes with that degree." (P9)

High failure rate of Assessment of Professional Competence (APC)

Government's accusation of gatekeeping is supported by the evidence of a high failure rate of candidate quantity surveyors as well as literature related to the profession (Lyons, 2015).

"*When they (the candidate QS) comes to do the APC after five years. We still have a 50% failure rate*." (P3)

Given that South Africa is still somewhat divided along racial lines, the failure of the APC by many Black people does not advance the case of the quantity surveying profession. Instead, it seems to strengthen Government's argument that the council plays a gatekeeping role.

"*Why is not everyone registered? You know? 'Why is not every Black person being registered? Why is the Black person failing the exam?'*" (P15)

The RICS versus SACQSP registrations

The high failure rates of candidate quantity surveyors has led to candidate quantity surveyors by passing the current SACQSP pathway, and instead pursuing registration through the RICS. The RICS is thus regarded as a threat, not only to the current system of registration but also to the survival of the SACQSP. Experts view the involvement of the RICS in South Africa with suspicion. They even accuse it of being interested in just money-making rather than in upholding South African quantity surveying professional standards. The RICS is covertly accused of passing mass numbers of candidates for money-making purposes.

"*What I have picked up as something that's got a deficiency right now, is that you find again that professional companies go for your university graduates, like **real** universities not [the] University of Technology. Then you find these public companies going for the University of Technology graduates. These guys they battle to get registered at the Council because of the stringent requirements. So they have to do a whole lot of other modules*.

"*Now they [bypass] the system through the RICS. We've got this RICS animal in the country that is messing us up. Is messing this country because they come in the country and then they start registering local guys as professionals. Although those guys still need to be registered by our Council*.

"*But then once they are registered through these guys [RICS], then they don't have to fulfil a whole lot of other requirements from the Council, because they are now treated as if they are already professional. Because we have that agreement that was put in place to recognise each other. A mutual agreement between the RICS and the Council. The mutual agreement was meant for recognising those guys that are coming from abroad. When they come into the country, to say, 'You are already RICS. So we will recognise you. So we'll just ask you a couple of questions and then register you as a professional because you must be registered as a professional QS in South Africa to operate fully.'*

"*But now we find our own now going through that door. So now they making us redundant as the Council. Now that creates a huge loophole that needs to be closed at this point in time*.

"*People are going through the RICS. So they bypass our own procedures. They are a professional organisation. We don't have anything to do with their requirements as such. But what we figured out is that these very same people when they come to us here to register. Now, these are candidates who have gone through the RICS, and they come to the Council. When you start questioning them, you find they still have those gaps that we identified that were supposed to have been closed by our skills modules.*

"*So that gap that was identified between the University of Technology's graduate and our main university graduate stays there. It is still not closed because then the RICS does not close that gap. So it would seem though it's an allegation at this point in time. But it would seem that they just, you know, go for this huge intake because of course, huge intake means money*."(P11)

Experts cite poor education and training of candidates as reasons for the high failure rate of candidates. Candidates from 'real' universities seem to fare better than those from technical universities.

"*What I have picked up as something that's got a deficiency right now, is that you find again that professional companies go for your university graduates, like* ***real*** *universities not [the] University of Technology. Then you find these public companies going for the University of Technology graduates. These guys they battle to get registered at the Council because of the stringent requirements. So they have to do a whole lot of other modules*.

"*Now, these are candidates who have gone through the RICS, and they come to the Council. When you start questioning them, you find they still have those gaps that we identified that were supposed to have been closed by our skills modules.*

"*So that gap that was identified between the University of Technology's graduate and our main university graduate stays there. It is still not closed because then the RICS does not close that gap. So*

it would seem though it's an allegation at this point in time. But it would seem that they just go for this huge intake because of course, huge intake means money.” (P11)

“*Because people aren't trained properly. Well in my view.*” (P3)

Not all quantity surveyors approve of the current exclusionary behaviours within the profession. P4 claims that the profession’s exclusionary tendencies are inadvertently limiting the growth of the profession. In line with the systems, from the professions’ perspective, the heartland that the quantity surveying profession has created for itself is akin to an artificial prison.

“*There are certain professions that are more closed than others. If you look at sport, I mean sport is open-minded. That is how I look at it. But when you look at these professions that relate to, I mean for instance medicine and ... are those open-minded? I am not sure. But they are not because there's said to be certain element of risk to be protected, to be preserved. To preserve the profession. Preserve and become more conservative and more exclusionary. I think quantity surveyors being more open-minded can do much more than what they're doing currently.*

“*They are sitting in that cocoon of becoming accountants and measurers and certifiers, etc. But the profession itself, the way it's structured is that they must be open-minded to become more let me say project managers and engineers and architects. They can deliver all that, you know, without having to do another course ... at an open-mind level. Because a lot of people become so ‘hoog club’ (in a tunnel vision). They look one side. Whereas the country needs more. And they are more knowledgeable*.” (P6)

Tendering for services and fees

Evidence presented previously demonstrates that the negative attitude that experts have towards current system of tendering for services and fees. It is regarded as a waste of resources and it does not always meet its intended objectives. In the old system, quantity surveyors were awarded work in the public sector through a roster system;aA system that seem to be preferred by quantity surveyors.

“*Where it's [system of getting work] changed is at state level as that was protected work. In other words, you would be on the roster system, you would just wait your turn, and you would get that hospital. You'll get that road and you just get work. Now that doesn't happen. So now you have to compete, and compete on price and your service*.” (P9)

“*I think there was a time where professionals [did not] used to tender for their services.Because my understanding is that if you are a consultant, including [a] quantity surveyor, you are an extension of the arm of the client. So in the old days, you didn't have to tender for work. And I think in that way, there were no resources wasted on tendering and that one problem.*

"*Second problem, is that with the tendering, people now tend to under-price themselves. So if you under-price that affects the service. So basically now what I see is that the project doesn't get resourced properly from a quantity surveying point of view. They don't get the source properly and the projects they never get finished on time. So there's no winner, both in the in the quantity surveyor's services as well as the client's return on investment*." (P14)

The tendering for work and services has given rise to one-man firms. One-man firms are firms with one registered professional quantity surveyor, with support from junior candidate quantity surveyors, or they can be made up of just a registered professional quantity surveyor without any support. The one-man show is able to survive tendering, as their overheads are low in comparison to the bigger firms.

"*It's too many one-man shows competing for few opportunities and it puts too much pressure on pricing. It becomes very difficult to sustain yourself in that space, especially in public sector. Those in [the] private sector, because private sector is loyal with whom they work, you can survive it. But you have to operate in a competitive environments where you must bid. That place is too congested. The companies lack systems. They are one-man shows. They have not invested in systems. So the capacity lies with the owner and you know, very few manage to grow [the] capacity of the others. What tends to happen, the owner who is quite senior, has got very junior [staff] ... because that's the only way they can survive. You can't pay, you can't hire senior people at that level because you can't sustain them*." (P13)

Bigger firms have had to diversify their services in order to survive. Multinational firms cut their expenses by transferring their work to other regions to remain profitable.

"*Because, there are [fewer] projects. They [QS] are having to compete on price and because they compete on price, the bigger guys are battling with overheads and the nature of it. And then technology [is] coming in and the big guys can move [projects]. I mean someone like XXX are picking up what they are doing in London and moving that information, [those] techniques to South Africa. But if you look at XXX, which is a large QS practice. I mean now their mainstream [work] is project management, [it] is not QS. So, you know, they've moved [from] QS and cost management. The big thing with them is project controls. It's a big thrust. And then running systems and everything else on that. So you've got, you know, small guy, one-man band been running projects for years. They would still be projects going into the future, but on a sort of declining [basis] because now the big guys can compete*." (P2)

Once again, not all quantity surveyors regard tendering in a negative light. Tendering may foster excellence in the quantity surveying profession. Quantity surveyors who provide good service are likely to survive competition and those who are not good will be taken out by market forces.

–Where it's changed is at state level, as that was protected work. In other words, you would be on the roster system, you would just wait your turn, and you would get that hospital. You'll get that road and you just get work. Now that doesn't happen. So now you have to compete, and compete on price and

your service and maybe it's not a bad thing that I think. It's not a bad thing. It's good that because it forces competition. It sorts out the supply-and-demand problem.

"*If your work is just given on a platter, I don't think it's good. It forces people to ... the fact that they've got to stay in business you have to be good, because if you do a bad job your clients are not going to come to you again. You're not going to survive. So you'll do one job and that's the end of you. Those firms that are good, that are providing good service will continue. So the supply-and-demand sorts itself out by market forces. So I think it's actually not a bad thing*." (P9)

Black and White

The tendering system is a public sector system and is seen as promoting divisions between Blacks and Whites. Whites seem to enjoy the bigger share of the cake, as both the public and private markets are open to them. Blacks are conversely forced to tender in the congested space of the public sector, as the private sector is closed to them, as a consequence of legacy *broerskap* (brotherhood) behaviour.

"*It [roster system] was very protected, I think in the old school. It was protected, government work. Private sector [has] never been protected. It's got its own issues and that will solve itself over time. And that's the same old white firms [that] used to get the work and it's changing. I think that will change over time*." (P9)

"*So these guys – Whites – have got a market that nobody competes with them. But remember, here [public sector] there are taxpayers. They pay. So what happens here [public sector]? These guys here [private sector]. They can take work from here [private sector] and subsidise these [public sector work]. Okay. That's what we told XXX. We said, 'These guys will squeeze these small guys [Blacks] out. When the small guys are squeezed out, you've got no one else to go to. You go to these guys [Whites]; they'll tell you what they want.' It's like now having exclusive rights.*

"*So the environment that Government has created now, when they created tendering, that tendering is not 100%; call it 50/50. The competition is only on 50% [for Blacks]. And only [a] few people work on the 50%. The other guys, they work on 100. Okay, we've got 100%, but some sectors will happen to be Black by the way. They work on 50%, where everybody can put their hands on, you know. So the environment for [the] small Black consultant is not good. That's why you see a lot of them leaving the industry*." (P14)

Encroachment

Current systems of doing quantity surveying work are challenged by technology. Technological encroachment is in turn creating encroachment from other persons within and external to the built

environment, to encroach on the quantity surveyor's territory, because "…*everybody thinks they are a quantity surveyor because take-off of quantities is happening almost automatically*." (P23)

"*Even now with the new technology, whereby I mean quantity surveying is done by software more than the brains of the people behind*." (P10)

"*And everybody thinks they are a quantity surveyor because take-off of quantities is happening almost automatically. It is very quick to work out. So everybody thinks they are a quantity surveyor. I remember having one of my first discussions. I remember being absolutely shocked as a very young professional a number of times. Having a conversation with somebody around the door and they came to me with a bills of quantities. And they said, 'Everybody thinks they can do it cheaper until they try it and then they realise they can't. You have put in R1 000 for this door. I went to Builders Warehouse and the door costs R30 and how is it R1 000?*

"*OK, you say 'That's actually the door. That door does not have a handle. That door has not been hung. That door doesn't have a frame. That door hasn't been painted.' That's what a door is. A door isn't that*." (P23)

"*I've also seen the technological is actually threatening the quantity surveying profession*." (P19)

Currently, quantity surveyors do not regard technology and BIM as a threat. Quantity surveyors claim that they will be able to survive technological encroachment just as they did in the past (Ashworth et al., 2013).

"*You've got the BIMs and all of those things [that] are out there ... but I think at this stage they have not yet disrupted us [QS]*." (P13)

"*There is that adaptation thing. So I do believe whatever comes, quantity surveyors will be able to adapt to new ways of doing things, you know? You can see it even now that, before we used to have that machine that measured, it plotted areas. At XXX, we used to have that, just to get the areas. But now [it] is very simple with DIMX, because now you get the drawings. You don't even have to wait for drawings for a long time. They courier them and then you have to go through them. So you can go through the drawings on your laptop and determine a whole lot of things. You can break down the building, for cost control purposes, measure using that, quicker, faster. The more complex the world is becoming, the more improvement, the more the professions are challenged to move to a higher level*." (P12)

"*But when we were at 'varsity we were doing things manually still and the desktops were still coming. We used the mainframe computer at university.*

"*And then there was this new thing called the 'desktop computer', which some people said is gonna 'change your life' because everyone is going to sit with a desktop or laptop and do your work on it and it's a high-speed idiot. It's a computer. So then the people, like an accountant said to me once, 'Well quantity surveyors, you guys are going to be without a job because these computers are going to do the job for you.' So it's the same that people are saying now with BIM. It's the exact same. They're saying, 'You quantity surveyors are going to be without a job because now the architects and engineers can work out the quantities'. And they are so wrong because what happened there, is that the quantity surveyors that learned the technology were actually more in demand.*" (P16)

"I think it [QS profession] also needs to evolve. We are experiencing technically the Fourth Industrial Revolution. The architect has also moved into the BIM, so we need to justify our existence then, you know as much as technology is moving and it's such a high pace. I feel that we also need to the jack up our level of expertise as far as technology is concerned." (P1)

Another reason why BIM and technology are not considered a serious threat to the profession is that they are also imperfect.

"*The one thing that has come and is obviously influencing our day-to-day is the use or rather the technology that is currently at our disposal, which I still think it's not without a human factor in it. It can't at this stage, we can't leave it to the machines. There's still a lot more that is required in terms of how that technology is used. And yes, it has made it slightly easier and slightly, slightly faster for us to do what we can do.*" (P21)

"*Look, BIM is obviously something but I think, and I am sounding like an old man when I say this, but I mean BIM is definitely on the way. But I don't think it solves everything either. There are some people that think that BIM is going to replace QSs and blah blah blah. I think that's nonsense. It's not going to happen.*"(P1)

The fragmented structure of the current built-environment system in South Africa is cited as another reason for BIM's minimal threat to the profession. The current fragmented structure will not be easy to change, especially as the structure is enforced by legislation. BIM favours collaborative structures, such as the turnkey solution.

"*The BIM model is meant to make sure that everything is properly integrated. When you mention the UK, whatever, UK, USA, they never had such a model in South Africa. And in Hong Kong, China, they never had such models. They have always had a model where the contractor is the one who appoints everybody. In our country the model is a totally different thing. Unless the country changes the whole [model] through legislation.*" (P12)

Quantity surveyors in the engineering field feel even less threatened by BIM. They work on a money-making philosophy, rather than on a money-saving or value-creation philosophy of building quantity surveyors, which BIM promotes.

"*I mean we talk technology; [it] is like saying we were talking about BIM. BIM has got a serious effect on the building side of quantity surveying. It means nothing to us on the engineering side, because our philosophy is totally different. We're money-making. So as I was explaining. I said if, if I can build something and I can finish it six months earlier than doing a proper design and doing all the things, but the returns are greater than the risk of now having claims and accelerations and whatever, then we build it. So we tend to get projects approved with between 10 and 30% of the design complete.*

And when you do that, it's going to go wrong. If you only complete 30% of design, it is going to go wrong. And that's what we're there for – to reduce that cost overrun as much as possible. So the main focus of the engineering QS is totally different from a building QS, cause a building QS you know exactly what you're getting. You've done all the calculations and they go, whereas we are the total the opposite; we don't know what we're doing. We just producing stuff and nine times out of ten it works, than we say that that they still make money quicker than if they'd done the full design." (P3)

Architects seem to have embraced BIM and believe that quantity surveyors lag in its adoption, as it threatens their existence. Some quantity surveyors are accused of still using pencil and paper for take-off quantities.

"*You can already take-off quantities out of my Revit model. It makes it easier for me. But you know, there's definitely an issue for QSs around how that technology works. The QSs haven't embraced Rivet in terms of what it is able to do for them.*

"*Some QSs still measure with pencils on paper. Other QSs [are] now using PDFs and doing quantity take-offs off PDFs and you know, there are one or two QSs who have actually embraced the Rivet and are using the Revit models to do material take-offs to create bills of quantities.*

"*I don't know. I could speculate that is fear that maybe it's going to make you obsolete. I don't believe that but you know, the technology is there. The technology is already working at that level. If we look far into the future, what about nanobots that [we] could construct out of the technology that comes from a BIM model. You know, we wouldn't need labour. Nanobots would construct a thing now off from blueprint that comes out of a digital source*." (P5)

Organisational structure

Legislative framework including the various Acts within the built environment

Current organisational structures within the profession are highly regarded. Government's oversight role is viewed as an indication that it respects the professions and is interested in protecting and preserving them. Evidence also shows that not all experts regard the current government's view of the professions as healthy.

"*I would say, it's well-structured, formalised*." (P6)

"*I think it's improving. I think there [are] established chapters, like the Council for the quantity surveying profession; the built-environment profession linking with other existing professions, like engineering professions and government. Also, [I] like having a link through the Department of Public Works with the existing councils. And also the supporting organisations like associations, which also keep the industry alive through providing training and training skills development. So I think we are doing very well there, but I'll feel where there may be a gap in terms of or one of the challenge like we had this identification of work.*" (P8)

"*I think you know in terms of legislation, Government has come up with very good legislation. You know, in making sure that quantity surveyors are regulated or the profession is regulated.*

"*And there's been, you know, the engagement between Government and the built-environment councils on a regular basis. It provides a very good indication ... Like now there is a new Bill, surely you heard about it? They were suggesting we should have one council and the others should be boards. We said no. So, the presentations of various councils in terms of the identification of work to Government and to the Competition Commission showed Government has got an interest in protecting these professions and preserving them and making sure that they function according to their mandates as per various acts.*

"*Government plays an oversight role. So the oversight role you can see it with this thing of Competition Commission in terms of the fee scales. So, 'No guys, you know what? We need to look at the fee scales and understand how you work and why the fee scale? Why not ... the quotations and so on?' So there's a lot of interest by Government in regulating the profession or in maintaining, preserving. And also protecting the professions*." (P12)

The current fragmented nature of the built environment is also viewed in a positive light. According to P4, South Africa's model is applauded elsewhere.

"*…that it is the correct thing to do, and there is no need to reform that in South Africa because, to be honest, the South African model of construction delivery is still one of the best in the world and I can attest to that. And it's written [about] a lot in terms of people that visit this country, [they] have*

applauded the speed at which buildings are being put out and the economics of it. And the quality of it." (P6)

According to Winch (2001), the fragmented delivery structure supports the existence of the quantity surveying profession. The affinity of quantity surveyors to the current structure is therefore not surprising.

No teeth

Evidence shows that the structures and policing role of the regulatory bodies is challenged by those who claim that these regulatory bodies have 'no teeth'. Rules and systems they have in place are ineffective in keeping encroachers at bay and also in unearthing unethical behaviour. The rules and systems do not protect the professionals. Affiliations to these organisations are just for prestigious purposes but there is no value added to the individual members.

"*Our industry, unfortunately … can I mention the company that was in trouble with the municipality? The owner of that company is not in the built-environment space. Now, you get people that are running these professions because this thing [regulations] is relaxed that if you got one-third of a non-professional [as directors in your QS firm]. You can still run a QS firm according to the Council regulations]. It depends how powerful that guy is. That guy, he runs a big, I mean, multidisciplinary organisation. It is not a QS. He is not in the built environment space. So that thing also affect ethics*." (P14)

"*I think it's more individuals who enjoy the prestige of being in an institute and stuff, but what's value-add? Surely, the institute should be promoting the professional. They are not. I think the institute should be fighting in court cases. We should have a legal team [that] backs architects, same for QSs. If you get into difficulty whatever, they should back you. Why not? [There is] Not a chance [that they will back you in court]. You are on your own*." (P5)

One of the reasons the professional bodies lack teeth is the people who are appointed to lead these organisations are not fit to hold the positions they hold. The CBE, for instance, is accused of appointing people who "*don't know what they are doing*," (P12). P12 claims that the CBE will, in future, be absorbed into the Public Works Department.

"*The questioning of the existence of the CBE [is] very, very important because you put an overarching body [in place], but [the] people you have appointed there don't know what they are doing. And now you've got professional councils that know what they are doing and now, they must report here (CBE) and this person asks them irrelevant questions.*

With time, the CBE will be absorbed by Public Works. That's what I foresee. And now if they are observed. Now it goes back to where we were because councils were put in directly to public works. Yeah, because public works is doing oversight, you know?" (P12)

The ASAQS is accused of appointing an accountant to lead its organisation. As an accountant, the ASAQS leader's loyalties might be elsewhere.

"*I don't know this thing about QSs. I mean we've got an accountant running the QS profession. It doesn't come natural to them. We are actually selling our profession.*

"*From the marketing side, [it] is fine. But the CEO of that organisation should be a QS. He might be doing a good job, but it's like Bafana Bafana [South Africa's national soccer team] coached by somebody from outside. If Bafana Bafana loses, that guy doesn't lose. So I'm saying if we want to get this profession right, we are supposed to run it ourselves*." (P14)

Another reason the organisations' structures appear to be toothless is they seem to be bullied by other organisations, such as the Competition Commission. Both the Competition Commission and the SACQSP were legislated by the same government. So why should one organisation have authority over another? The SACQSP has a right to exist under its regulations just as the Competition Commission. Why can the SACQSP not defend its mandate? These are some of the questions with which experts are grappling.

"*I think with a number of people, because of the issues around the Competition Commission. I am not if you have followed that one? I think some of maybe the hard-line stance used to be why are we [QS profession] even needed? But then my view was a simple, another branch of government can't really tell the other, 'You don't need to exist'. Because we were both established through [an] Act of Parliament. And I was just thinking [how] the Competition Commission was also starting maybe to get into other professions' turf.*" (P15)

Parallel Black structures

The ineffectiveness of current structures has led to the formation of other parallel structures that seem to promote Black interests. The South African Black Technical and Allied Career Organisation (SABTACO) is an example of such an organisation. These parallel organisations are viewed as splinter groups formed by disgruntled former members of the existing structures. The leadership of these organisations seem to be made up of candidate quantity surveyors who may have failed to attain professional registration through the SACQSP. Instead of addressing their issues with the existing structures, they raise them with Government. Thus these, '*drop outs*', are the undercurrents that cause friction between current professional structures and the Government. Issues of Black pass rates and gatekeeping are some of the issues that these former disgruntled members have used to gain an audience with Government.

"*Then that was one of the issues but then there were yes, I think similarly. If we look into South Africa between 2000 and 2019. There was [the] rise of the AfriForum, the Black AfriForums, the BBC. But then, the Black interest, the so-called Black interest kind of outfits. But then I think the focus used to be mainly about accessing tenders and government contracts at the top but not necessarily to do anything*

from the bottom because I don't think they ever received any mandate from the population to establish structures.

"*But then what used to happen is that you find out there is one about the engineers. I didn't even know it existed. Then in BBC you will find out there is the so-called Black council, your built environment council and so on and so on. And what was happening was that those were basically the parallel structure[s] appending the government institutions. And I think that was one of the of the bigger mistakes.*

"*You find that the leadership of those institutions may be dropouts but they are not affiliated with whatever. And they used to, seems as if they find audience with the leadership rather than maybe those institutions that were mandated by Parliament to regulate the profession*." (P15)

Usurpation of the architect's role

It seems that the current economic downturn and the money-driven approach of the current construction sector has created a leadership role for quantity surveyors. Clients are wary of investing in infrastructure before receiving advice, particularly the type that generally is provided by quantity surveyors. In the past, architects were the first point of contact between architects and clients, but economic conditions and shifting values have reorganised the design team members' roles. Architects have been relegated to mere designers.

"*Most of the projects, many projects, government projects are led by the quantity surveyor because[of] how projects starts. First, they [clients] don't have the budget. They want first, the quantity surveyor himself to get involved and then yeah.*" (P4)

"*Quantity surveyors are more and more project managers now. They (architects) were traditionally but they are falling away more and more.*" (P16)

"*If you look at how an architect's role has changed, they have lost a lot of ground over the last 15 years. They used to always be the principal agent, now they are becoming just designers. So the project managers have eaten into a lot of the work of an architect. [The architect's] traditional work. So the project management profession has grown [at] the expense of the architect… I see many of the project managers as quantity surveyors already. So they've come become project managers by means of the[ir] quantity surveying experience*." (P9)

The leadership of quantity surveyors is understandably viewed with cynicism by some architects. P10 claims that quantity surveyors "*shoulder themselves in[to]*" positions of project management or leadership positions. According to P10, the type of project management in which quantity surveyors

engage is that of calling meetings and quantifying time in projects. Since architects and engineers are wholy responsible for the design of the project, construction projects should be led by them instead.

"*And they will always have a quantity surveyor... to deal with the economics of the project. If it's an architectural project, [an] architect should always lead, but there's been so much confusion. People choose or are chosen to have favour from the client; they shoulder themselves in. Then they get appointed as project managers on the project. And what is it? It is just to call meetings and be able to quantify time. That's all. And most quantity surveyors, I find them in that space now. Which is wrong.*

"*The best people to lead projects are engineers and architects because they've got a better overview of the project*." (P10)

Architect have lost their role through abrogation, complacency and the need for specialisation. Specialisation implies that there was a room for another person to take up the role of project leadership, as opposed to architects assuming responsibility for both leading and designing the project. P16, a quantity surveyor, supports the notion of specialisation. According to P9, the role of project management should be occupied by a new professional. Current members of the built-environment profession are not the right fit for the position.

"*…the **abrogation** of duties by other professionals to quantity surveyors, and they (quantity surveyors) are increasing their specialisation*." (P23)

"*If you look at how an architect's role has changed, they have lost a lot of ground over the last 15 years. They used to always be the principal agent; now they are becoming just designers. So the project managers have eaten into a lot of the work of an architect. [The architect's] traditional work. So, the project management profession has grown [at] the expense of the architect.*

"*Because the architects have not stepped up to a moving environment and have not changed in providing [services]. So the project manager saw that opportunity and stepped in. And said, 'We need additional management and the architects never stepped up and they've lost ground.' I see many of the project managers as quantity surveyors already. So they've become project managers by means of the[ir] quantity surveying experience*." (P9)

"So the architectural role, which was [a] more holistic role, is been [encroached upon] … in fact, even quantity surveying was one of the roles that cut in. But it's really, I think as a trend of specialisation. So the architect before was doing everything but then the pace at which things were done way back then were all a lot slower. So it allowed for all of that. So as a pace has quickened it is required for

outsourcing. And in the progressive outsourcing of those roles, that's where a lot of other professions have come in." (P19)

"*Quantity surveyors are more and more project managers now. And engineers as well. But I don't believe one of those professions is ideally suited to become a project manager. It should be a specific profession like it is now. It shouldn't be an architect, or QS becoming a project manager. This is the way it was when the project manager came about, the principal agent. So it should be with those other skills.*" (P16)

Physical steps required to produce a good product or service

Findings reveal that quantity surveyors are slow adopters of technology, with many accused of also being late adopters of technology. Some tasks, such as take-off, are still done manually even though quantity surveyors acknowledge that technology can improve their efficiency. This slow adoption may limit their usefulness in a society that is fast becoming technological and digitised.

"*Some QSs still measure with pencils on paper. Other QSs [are] now using PDFs and doing quantity take-offs off PDFs and there are one or two QSs who have actually embraced the Rivet and are using the Revit models to do material take-offs to create bills of quantities*." (P5)

"*You can set up good modern tools and get very good, good, good estimates. You can get reasonably good bills of quantities with computers and less people. But the contract admin is where we need more emphasis.*

"*So, so if we are still having the bulk of our money sitting with computers then we are at risk. We need [to] re-position or money to sit with, at value add, doing the advisory rather than the technical work*." (P13)

Summary of the findings of the process of the quantity surveying profession

Similarly to the findings of the construction sector, the regulatory framework governing the professions is held in high esteem by experts. Even though the regulatory framework has its own shortcomings, it is deemed important in maintaining professional standards and in protecting and preserving the profession.

Quantity surveyors like librarians (Wood and Evans, 2018), do not regard technology or BIM as a major threat to the profession. Of the built environment professionals, quantity surveyors seem to be late adopters of technology. Some quantity surveyors are still using paper and pencil to take off quantities. What quantity surveyors seems to regard as the main threats to their position are encroachment by others and changes in current legislation and structures. This is in conflict with the literature that claims that

technology, the Fourth Industrial Revolution, BIM are potential threats to the profession (Kulasekara et al., 2013). Current poor economic conditions and a changing value system, from quality to profit, have inadvertently moved the quantity surveyors to a leadership role within the design team.

The conclusion that can be drawn from the analysis of the processes of the quantity surveying profession is that current processes are somewhat achieving their purpose, albeit with challenges.

6.2.3.2.3.4 Quantity surveying profession: people

Poor training and education

Similar to the findings in the construction sector, widespread poor training is blamed for the high failure rate of candidate quantity surveyors in the profession. Candidates are not given proper training to carry out the work they will be required to fufil.

"*When they [candidate QS] come to do the APC after five years, we still have a 50% failure rate, because people aren't trained properly. Well in my view.*" (P3)

The quality of university is also blamed for the quality of quantity surveyors produced. A number of experts claim that some construction firms have experienced business failure because of the poor quality of graduates produced by universities.

"*… they [graduates] got a piece of paper from universities, but know nothing. So the industry is still going to suffer for many years in South Africa … You've got a person coming out of university. He's got M.Arch but when you test the knowledge of that person, it does not compare with the person who has a B.Arch.*" (P10)

"*The four years at I school I don't think is a problem. While the university differs there are those that make sure that you work three years and then after three years, you get practical [experience]. At least when you finish your four years, you can almost run on your own. You've got those that people [stay] from first to final year, [and] they know nothing.*

"*But that aside, the problem that I see is that there is a lot of people that don't get proper training. Once they get [that registration certificate it] is like [a] driver's licence. When you think you've got a driver's licence, in most cases that's the time that you must learn to drive. So what happens with our guys [when] everybody want[s] that certificate.*

"*They go out, especially the small companies. They go out, 'Now I've got a paper'. They go and produce sub-standard documents and through [those] sub-standard documents there are two things that happen. There are those contractors that know nothing. So those mistakes that those guys make are the death certificates for the contractors who cannot stand up [to] the consultants to say, 'you know, you didn't measure this'. Because they don't know better.*

"*On the other side, in the private sector you can't [produce sub-standard documents]. Because most of the guys who work in [private] projects they can challenge the consultants. So you've got that training, in my opinion, that sometimes is not properly done and it gets politicised.*

"*There was a time where a former Minister of Public Works, people went to [the minister to] complain, 'You know this people [SACQSP] they don't want us to be professional.' The minister even said, 'I want to issue the certificate.' The Minister of Public Works. You understand?*

"*And so it tells you [about] the product that you get. There might be other politics in training, but in most cases the quality of these guys that are not properly trained affects the final product. And you can go and research. There are a lot of contractors that go under because of the mistakes of these little quantity surveyors that do shoddy work. But most of the damage happen in public sector*." (P14)

Gaps that experts identified in the training and education of quantity surveyors include professional practice and ethics. Training on skills only, without incorporating ethics will kill the profession. Ethics must become part of the core modules that are taught and not just an accessory to the main courses.

"*I get invited to lecture and speak on professional practices and is not only in architecture and engineering, quantity surveying etc., it is one subject that which has been left out? It's not practised*." (P10).

"*I don't think you need to police or have policies in place … the policy that needs to always be in place is that of professionalism and how professionals conducts themselves. Ethics. If you want to talk about anything that's the biggest thing in the profession, it would be ethics*." (P5)

"*[In the past]it was expected that, because of the thorough process that a QS went through to become [a professional]... it was unlikely that factors like political pressures would have an impact on them. Ethics. The level of ethics was upheld. I think as a profession we have sort of dropped the ball on that. We must take it as a bible. We must carry it and read it in our spare time.*

"*They're [ethics] not put at the centre. We are focusing more on the skills side, which is good. Well and good, but we need to develop a total professional. We need to ensure that what we put out there is not only going to produce a high level of excellence but [is] also going to maintain good ethical leadership. And act without fear or favour because one of us has impacted on all of us. Just one.*

"*So even at [an] academic level, that must be sort of elevated from that 'by the way thing' to 'the thing now'. Because the challenges are complex now from the economic side, from the political side, from all fronts. Where now, skills in our profession are not sufficient, you know. So students need to demonstrate that level of, 'what do we understand by ethical leadership?' 'What do we understand by ethical*

behaviour?' And how they see factors affecting current professionals to behave in a manner that is not befiting the profession?And sacrificing their own hard earned [efforts]?

"*Yeah, so as much as we see this impact, then we need to know what had led them to that. I mean even students that I will interview, they will be blank in that. 'What work have you done in that?' Maybe in their module they don't do that. [That is] thorough engaging and making sure the student understands what he is going to represent, what will be the pressures out there? And what internal mechanisms have they built to resist that? And to make sure they understand the repercussions of their decisions. So that they internalise them and it is not something that they have to visit. It is something that is part of, you know, understanding how important that is. Whether you are in public or private space because we think sometime the corruption [is on the public sector] ... but it takes one to corrupt the other one.*

"*So if we could ensure that before they come into the system, even the ones that are in the system, we need to get back and say, 'What led to us behaving in a way that has brought the industry into disrepute?' Some of the injuries are self-inflicted. So we can just reflect and say, 'We know these things. What made us to behave the way we are and how can we now reverse that and ensure that going forward we get back to ... or even get better [at] respond[ing] professionally and ethically to the challenges?' Because we are going to be enormous now. If we go down the slope, we will self-sabotage*." (P8)

Accessibility to the profession

In spite of the poor quality of education and training of quantity surveying, the education of quantity surveyors should be made accessible to as many potential entrants countrywide as possible. The infrastructural needs of the country dictate so.

"*I believe the universities, in terms of the education framework that is used in South Africa, are working towards ensuring that there is more accessibility to education for quantity surveying. There is still limited teaching [in] schools.*

"*Previously we had the top six [teaching institutions] and at the moment, I think we still have six teaching schools in terms of quantity surveying. That needs to change. It needs to be broadened so that there is more accessibility, because quantity surveying is related to delivery of infrastructure, which to me is something that happens countrywide.*

"*So, if you are offering it or [are at] a teaching school, those schools needs to be countrywide for them to be relevant. For them to be more effective. It's of no use, I mean, maintaining the same schools for the same profession, when the service is required countrywide.*" (P6)

One-man practices

As previously alluded to, the current economic situation, exacerbated by the tendering process, has reduced firms to one-man practices. This raises issues of the capacity of quantity surveyors in terms of handling large-scale projects in South Africa.

"*It is a one-man show. Before it was a big office but now most of [the] QSs [are] a one-man show; just one*." (P4)

"*It's too many one-man shows competing for few opportunities and it puts too much pressure on pricing. It becomes very difficult to sustain yourself in that space, especially in [the] public sector. Those in [the] private sector (because [the] private sector is loyal to [those with] whom they work), you can survive it. But you have to operate in a competitive environment, where you must bid; that place is too congested. The companies lack systems. They are one-man shows. They have not invested in systems. So the capacity lies with the owner and you know, very few manage to grow capacity off the others. What tends to happen [is] the owner who is quite senior, has got very junior [guys]... because that's the only way they can survive. You can't pay, you can't hire senior people at that level because you can't sustain them.*" (P13)

Labour broking

Labour broking is prevalent in the quantity surveying profession. Experts fear that labour broking will kill the profession through 'stealing' work and misrepresentation. Labour broking is regarded as criminal behaviour that Council must deal with through the criminal justice system.

"*Who will come? But the company itself that got the tender is not a QS company. It's a labour broker. But they are calling themselves [a] QS company. So that actually kills the QS profession, because now instead of us having regulated companies like, for example, maybe there is a 150 of them in Johannesburg. Now you find that there is 500 of these companies, but there is officially [only] 150. Now this 150 are not getting the work that [they are] supposed to get, because somebody [outside that 150] is stealing the work. And now the Council needs to step in and stop those. And investigate those companies and stop them and take them to jail ...*

"*The tender will be, 'Yes. We need QS companies that are going to tender'. And then they come and pose as a QS company*." (P11)

Immigration and other markets

Similar to the construction sector findings, poor economic conditions are causing quantity surveyors to look for better opportunities elsewhere. Some quantity surveyors are emigrating, while others are changing markets or sectors in which they work. There are those who have left their professions

completely. Some quantity surveyors are reported to have deviated from their career entirely, and are currently selling cars or working in fast food franchises. Their skills sets can be applied to different places of the economy aside from construction. P6 claims they were able to transfer the principles of quantity surveying to the discipline of human resources and other areas other than quantity surveying.

"*Because, how many [who have] graduated from quantity surveying have emigrated from South Africa? Many. Is that the solution [for] the future of the construction sector? You are actually sabotaging the future.*

"*So why [do] people change? How [do] people make that decision? Because they want to be okay. They think, 'Okay. I studied quantity surveying. I graduated [in] quantity surveying. I am a professional quantity surveyor. But I'm struggl[ing] to exercise my profession. And it is becoming, in South Africa, in the construction sector, a critical environmental for me to practise quantity surveying. [Let me] rather go to a place where I get compensated accordingly. [I] also enjoy practising, I enjoy my profession.' You can be a frustrated quantity surveyor in the industry with a huge expectation that one day [it] is going to change*." (P22)

"*No development means your professionals are going to look at other alternatives. So they [are] either going to emigrate or look at other job markets (if you wanna call it that)*." (P5)

"*So the environment for [the] small Black consultant is not good. That's why you see a lot of them leaving the industry. They can go anywhere. I mean one lady ... She went to [the] automotive [industry]. She is repairing cars now.*
But other people they can go and work for Eskom, [or somewhere] else. Because the beauty [of] QS is [its] flexibility. You can work in so many sectors. What is happening is not good for [the] small guy." (P14)

"*I believe the experience makes them [QS] more knowledgeable. Once you've been through 10 years of quantity surveying, you can do anything.…This thing opens you up to an extent that you can do anything. You can become a shoe merchant. You can become a trader. You can become a logistics person. I mean, I've got friends who now have opened up franchises like what do you call it? XXX? There's a friend of mine who graduated with me, who owns a shop, a [chain of] shoe shops. There is another friend of mine who owns a food line.*

"*The profession itself, you can use the skills to produce those things. I was doing change management in the* ***XYZ government department*** *and I applied quantity surveying to HR. I remember we created a*

*bills of quantities of all the staff that needs to be recruited, to enhance the technical capacity of the **XYZ government department**. We created a bills of quantities for them. So that's what I'm talking about. That you use the skills, the technical base, [and] apply [it] to other [areas].*

"*I was putting up a clinic in Vosloorus at some stage, putting up a building. Okay? As I was doing that the hospital management came to me, the doctor who was going to be in charge ... and said, 'Give us a progress [report] on where you [are] going and when you anticipate finishing the building.' And I called them into the boardroom and I did a presentation for them, [by means] of [a] Gantt chart, [with] everything to [show] where we were going, our milestones, critical path, and when we [were] going to finish the building. To my surprise, they were very happy. They ;said, 'We are happy with the dates, please note that we will need access on this date.' But to my surprise, a month [later], the guy came back to me and said, 'You know, the nursing profession doesn't have anything like that. We want you to come and lecture our nurses on how you do your timeline, to see if our nurses in the clinics will be able to time their activities the way you are doing them. okay?' So I went there and I lectured them [on] how to do a Gantt chart, and how [to] programme activities, and [to] monitor and create your milestones and your timelines. And your critical paths. So basically, I was applying the same techniques to another profession, another area. So that's what I'm very passionate about.*" (P6)

A poor macro-economic situation can thus also inadvertently create opportunities for quantity surveyors in other areas. Thus, poor economic conditions may not be negative for the profession, as they are able to easily apply their skills set outside the construction sector.

Closing shop

Some quantity surveying firms have not survived the current economic climate and are closing shop.

"*Risk work [has] always been a problem. It is becoming a bigger problem. Competition is becoming a bigger problem; I think there's more and more firms coming out. Less and less work, more and more professionals. But I think at the end of the day the markets maybe sort [themselves] out. Those that can't get work disappear. They close shop. So market forces, I think ultimately keep the supply and demand at bay. I think so.*" (P9)

Summary of the findings of the people of the quantity surveying profession

Findings of the people in the quantity surveying profession are similar to those in the construction sector. Poor training, labour broking and emigration are some of the challenges facing the profession currently. The macro-economic conditions have, however, created some opportunities for quantity surveyors, although they must be sufficiently observant and enterprising to seize them.

6.2.3.2.3.5 Quantity surveying profession: performance

Highly regarded

Findings show that quantity surveyors are highly regarded by others within the built environment, a positive sign that cements their position in society.

"*I still think for the most part, it's very professional. I kind of think QSs are by their very nature very left-brained, rational beings. And they kind of work in a very logical profession*." (P5)

Poor service

Poor performance in the services of quantity surveyors is attributed to the non-supervision of juniors by seniors.

"*The work is not there and then what happens is because there's no work, the guys cut fees and they're just going tighter and tighter, and they can't deliver the service. So because they're going tight on their fees, they've got juniors doing the work and seniors don't oversee it and then you end up with problems and it just spirals out [of control]*." (P18)

Summary of the findings of the performance of the quantity surveying profession

There doesn't seem to be anything inherently amiss in the quantity surveying profession's service. Shoddy work and poor performance seems to be brought about by corruption and unethical behaviour, as well as inexperienced juniors filling the role of more senior personnel, as a direct result of the competitive under-pricing in tenders. The quantity surveying profession seems to be regarded as a respected profession.

6.2.3.2.4 Analysis and discussion of the state of the current South African construction sector using Geels' MLP Framework

Before analysing the current state of the profession using Geels' MLP Framework, it is important to demonstrate how the current state of the construction sector is influencing the quantity surveying profession.

There seems to be a direct relationship between the construction sector and the quantity surveying profession. This means that what positively affects the construction sector will also positively affect the quantity surveying profession, and vice versa.

Corruption and unethical behaviour are also prevalent within the quantity surveying profession. Quantity surveyors have to tender for their services. The tendering of services does not seem to meet its intended purpose, which leads to under-pricing and poor service. Furthermore, the current procurement of services through tendering is not the preferred method by quantity surveyors.

Like the construction sector, which is a slow adopter of technology, the quantity surveying profession is considered the slowest adopter of technology when compared to other professions. Threats of encroachment or invasion by external persons are also a concern within the quantity surveying profession.

The only anomaly from the findings is that quantity surveyors seem to thrive in difficult economic times, unlike others within the construction sector. This may be attributed to the elevation of money as an important commodity in difficult economic times. As a cost expert in the construction sector, their status is elevated to that of leadership in construction projects. Evidence shows their role in leadership may become 'permanent' as architects have abdicated their leadership responsibilities in construction projects. Another aspect that places quantity surveyors in a better position than other built environment professionals is that quantity surveyors are able to apply their skills in other economic sectors beyond the construction sector.

The quantity surveying profession's landscape

The current negative socio-economic and political landscape is negatively influencing the construction sector in general, and the quantity surveying profession specifically. Once again it is the top–down influence rather than a bottom–up approach that is influencing changes in the socio-technical system of the quantity surveying profession. Quantity surveyors seem to be reacting as a direct result of the current socio-economic conditions.

The quantity surveying profession's regime

The legislative framework, particularly the Quantity Surveying Profession Act 49 of 2000 is one of the pillars that is enabling the profession in withstanding pressure from the industry landscape. Changing the Act is laborious and thus it is possible that the current status quo might remain for the foreseeable future.

The quantity surveyors' niches

Technological advancement does not seem to be a threat to the current quantity surveying profession. Quantity surveyors acknowledge that technological advancement might influence how they practise in future, but many quantity surveyors regard technology as an enabler rather than their replacement. By creating a new role of leadership in the construction design team, quantity surveyors have enlarged their heartland at the expense of architects. Even though the landscape developments are adverse, quantity surveyors' position in the niches currently seems secure.

Conclusion on the state of the South African quantity surveying profession

The conclusion that may be drawn from the evidence of the findings is that the state of the South African quantity surveying profession is currently somewhat secure. In spite of the pressures from the landscape developments is able to keep its secure position, partly because of the Quantity Surveying Profession Act 49 of 2000.

6.2.3.3 Objective Two and Objective Three

Objective Two aims to identify socio-technological factors that are likely to influence the current quantity surveying profession, and Objective Three hopes to determine the potential influence of socio-technological factors on the current role of the current quantity surveying profession.

The literature review identified factors currently influencing, and are likely to influence, the current construction sector and the current quantity surveying profession. Empirical evidence was collected to compare the literature findings with views from experts. The PESTEL framework was used to identify the current factors likely to influence the current South African quantity surveying profession.

Experts were first asked to identify factors currently influencing the quantity surveying profession and/or the construction sector. Second, they were asked to identify factors that will influence the quantity surveying profession and/or the construction sector in future. Last, they were asked to identify factors that have influenced the quantity surveying profession and/or the construction sector in the past.

First, all experts agreed that factors influencing the construction sector are also likely to influence the quantity surveying profession. While there was consensus that all of the PESTEL framework is likely to influence the profession, the degree of influence of each factor was varied. Experts ranked the degree of influence from 1 to 6. For instance, a factor with the highest influence was ranked number 1, and assigned the number 1. A factor with the least influence was ranked number 6. Some experts, however, paired or grouped certain factors together. For instance, some factors were ranked as socio-political, as they believed that these factors are intertwined and cannot be separated.

Most experts concurred that current factors influencing the quantity surveying profession and the construction sector will likely influence both in the future. Thus, current factors and future factors that are likely to influence the quantity surveying profession are discussed together. Where there are divergent views, these are explicitly stated. The implications of these factors on the quantity surveying profession are also stated. Findings of the current and future factors that are likely to influence the current quantity surveying profession and their potential influence on the quantity surveying profession are presented in a discussion format.

6.2.3.2.3.1 Current and future factors that are likely to influence the current quantity surveying profession

6.2.3.2.3.1.1 Ranked Joint 1 and 2: Political and economic factors

Government policies and investment

The political and economic factors were ranked number one by most experts (P3, P9, P1, P12, P2, P4, P14, P13, P10, P21, P16, P18, P20, P5, P17, P7). This is because government policies influence the economy. One of the government policies that experts claim has an adverse effect on investor confidence is the proposed policy on expropriation of land without compensation. If there is uncertainty in the political landscape, that uncertainty affects investor confidence. The implication of this on the construction sector is that investment in infrastructure reduces as investors are unsure about their investments. This lack of investment then negatively influences the construction sector and the quantity surveying profession by association. This lack of investment has led to placing many quantity surveyors at risk. Most quantity surveyors' main service is in providing feasibility studies for potential investors, and if investors are wary of investing in the current political environment, this jeopardises their opportunities to work.

"*I think at the moment the country has major problems. The construction sector has problems because I think the economic conditions that have been laid down and are currently in place by the Government do not reassure investors that their funds are safe. And people, if they're not certain, they hold back, particularly in the construction industry. It's not like selling stocks and shares, [where] you can buy today and sell tomorrow. It doesn't work like that. It's longer term. I think there [is] uncertainty in the market, which has given a negative view of the construction industry*." (P1)

"*And risk work is a big problem in this industry. You start getting in stage 5 of 6 stages. They [are] saying, well the clients are saying, 'We [are] only paying you once the contractors start putting the first spade in the ground. And all the work you do up until [then], [sometimes] years and years, in some cases and if it doesn't go ahead and in many cases, it doesn't, that's what's killing our profession*." (P9)

"*There's a lot of things that Government needs to do to create a positive environment. And I think once that happens, they will get investments and once there's confidence and investment, I think then infrastructure will begin to develop and on the back of that, you'll get the construction industry as a whole will begin to pick up. Banks are risk averse. It's far more difficult to get financing on projects almost to the point where the banks are being ridiculous about the terms and conditions that they're imposing on people before they are prepared to grant finance. Projects are not happening because banks are not granting credit*." (P5)

"*A lot of projects are still at the feasibility study [stage]. Just [to] see if they can get the money or not. Most of the government projects, 50% of the government projects, is more on the feasibility study*." (P4)

"*There's quite a reluctance to move forward on projects until people understand what's happening with the land issue in South Africa. Who's going to invest in property if it's going to be expropriated without compensation? That's a no-brainer and that's not just you know, it's not [a] White or Black thing. I've got clients in all sectors and it's a concern. People are definitely wanting to see what the government does on this expropriation before they start investing*." (P5)

The lack of investment, and the few projects that are available within the public sector, have made the current tendering system highly competitive. It has also created an artificial oversupply of professionals. To survive, quantity surveyors have resorted to discounting their fees to levels where they just about survive. Those who cannot compete, such as bigger firms, have had to downsize, diversify or close shop. Another implication of fewer projects is that it has somewhat led to corrupt practices and unethical behaviour within the quantity surveying profession. Claims of substandard work, falsification of numbers, and misrepresentation are high. Projects and clients' investment plans ultimately suffer.

"*It's becoming much more competitive. As a result of that, you find fees are being cut. It's too competitive. Everybody's undercutting the next guy to the point that you actually cannot do it for that fee… if your fee is being cut you're going to cut your service. If you are cutting the service, your project and your client [are] going to suffer. So I see the industry suffering as a result. The profession is going to suffer because of what is going on and that's always a result of oversupply, too competitive, undercut fees, reduced service. Ultimately[this causes] problems on a project because if you [are] cutting [a] service, it's going to impact on the ultimate result – the end product of your project*." (P9)

"*Quantity surveying by its nature is the accounting [feature] on a project. You cannot go ahead without somebody to do the accounting, and the adding and the omission of the numbers to make the project work, and nobody else is better qualified than the quantity surveyors. The profession itself, looks so diluted because it bends backwards, and backwards and forwards, just to satisfy the client without having the confidence to tell the truth at the initial stage. Inform your client as an accountant or as the financial advisor. They're actually financial advisors to the investor, whether this project is viable or not viable, but they're scared to do that. Because if they tell the truth there is no project, if there's no project it is no work for them*." (P10)

Another government policy that experts believe is negatively influencing both the construction sector and the quantity surveying profession is Broad-Based Black Economic Empowerment (B-BBEE).

Experts are of the view that it is not achieving its intended purpose and needs to be re-considered. Another reason for the reconsideration of B-BBEE policy is because it is frequently used for fronting.

"*The minute you open it [competition within the construction sector] internationally, you will start getting value or you start getting good service from the locals. They will prove themselves. But now, [it] is entitlement syndrome. Like they know, 'They are going to appoint B. So I [the Whites] am [going to]get in with B. He is BEE'. Then they appoint you for the project, but you don't have a cent.*.

"*Politics must come with [the attitude], 'We have attained the targets that we have set. It is post-1994. In the construction sector we've ranked contractors for government projects and so on. If you have to go for a bigger project, then we'll have to look internationally and locally.' So people should compete properly.*

It [BEE] must be removed. Do you think BEE should stay forever? It's a problem. The Whites bypass it. They take their helper at home, unknowingly to her. They take her ID and then this thing of women ownership [also contributes to this practice]. There is no proper audit." (P12)

"*Black empowerment has compromised the industry, [including] in terms of contractors, virtual contractors. We call them virtual contractors. [For example], there is a Black guy and he's contracted [and] everything. He is a Black empowerment contractor, but 70%, 80% everything is sub-contracted. Some of the sub-contractors are White contractors. You got all the skills, all the resources, but he's [on] the front line. The 'face'. Then it [is] jeopardising the industry in that type of approach. Because the benefit of Black empowerment is a problem. Also EPWP [Expanded Public works Programme] as well. Why EPWP? People can have preference for one [more] than others. The original idea was good to promote the development of skills through the EPWP but I don't see the reach [as being] so extensive*." (P22)

P22 asserts that policies are somewhat discriminatory against White people. For example, competent White contractors who are capable of delivering infrastructure are denied access to certain contracts, because of policies such as B-BBEE. B-BBEE influences the construction sector adversely. Good quality work may at times not be reached. It also promotes fronting in the construction sector.

"*Even though today I will see the ugly picture all the way around. That Black empowerment creates rights that some contractors abuse. And discrimination in the reverse way. So where you find good White companies being discriminated against ([in response to] the previous political system], which means you [encourage] the coercion between Black and White contractors in the sector. You give priority to a Black company [rather] than the White company.*

"*Because they [Whites] are also human beings; even though they were previleged, they are still human beings. They can change. They can be good at what they do. They have talent. … I see that the Black empowerment has compromised the industry, as well in terms of contractors*." (P22)

National political and economic conditions will also be influenced by other geo-political conditions (both local and international), such as BRICS and Brexit (P20, P6). How South Africa responds to this influence will affect how the construction sector and the quantity surveying profession respond to these changes.

"*I think construction is currently affected more by the market itself, the economics. A lot of these companies are not surviving. And you're seeing a lot of diversity. People are trying to play in different markets, in different nationalities. And factors are not on their side; doing business in Zimbabwe and Greece and the UK. And doing the same business in South Africa is not the same. There is a lot of political changes happening around the world. For instance, one of them is this BRICS thing, then Brexit. It's affecting a lot of businesses, sectors, you know construction, property. People have invested overseas and now they've come back with nothing. So it's affecting a lot of what we do here. So those are the dynamics. The whole Trump economics of blocking everyone outside and basically bringing back American firms back into America. It's a huge factor. So a lot of politics are affecting the industry*." (P6)

"*And the economic one, obviously, it's all about the money. You know, we are in a capital[ist] market; the rich become richer. And then when people become richer they leave South Africa because of the political situation. So, it is very difficult with the economy; we are in a recession because obviously we've got, we get affected by what's happening overseas. We have Brexit. We have Donald Trump saying, 'You know, manufacture inhouse'. So we don't have big manufacturing plants that are South African.*

"*So now, Ford has moved out because I know they were our tenants. So they moved because they're going back to American. So when you want Ford now, you are going to import it. It's not like the Germans when they've decided that we [the Germans] can have this plant here. The value of the rand, it's sitting where its sitting. It's not improving. It's gone down so quickly, but it's almost like it's getting manipulated. And the lower it is, the more you cannot get that technology [to manufacture]*." (P20)

Corruption in construction projects

Besides lack of investment, corruption in the public sector is impeding development. Although corruption is present in the private sector, corruption in the public sector was cited as the one with the most influence on the construction sector. P13 went on to assert that if anyone does not want to become involved in corrupt behaviour, they must not undertake work in the public sector. Those involved in construction projects within procurement are suspected of corruption, and there are a number of ways corruption is driven through a construction project.

Public officials create what can be regarded as pseudo-projects, where projects are initiated but are aborted at the tender stage. These projects, according to P4, are most prevalent towards Government elections. There are usually payments made to service providers for service provided up to the tender stage. This raises questions of whether payments made to service providers are perhaps a means to siphon money to fund election campaigns.

"*The current impact is mainly political, [and it's] politics that have destroyed the administration. It means that for you to be sustainable, if you don't want to be corrupt, then [you should] be in private sector. [But the] private sector is very closed and it has got bigger barriers to entry. So, I will say the political [factor] is number one. Economy [is] number two and number three will be your social*." (P13)

"*Other projects are under budget or over budget for political reasons. And there are many project[s] like that. They will just use that project for political [reasons]. There are many projects [that] go on tender but never go on site. But the consultants will be paid at stages 1 and 2. But the project will never go on sites, especially big projects like hospitals. It will be a big tender and then it will be awarded to a group but we'll never see that project. And then this always happens before the elections*." (P4)

"*You've got in some instances when you're approaching budget year-end or financial year-end and certain monies have not been spent and it's going to look bad on the economy, on Treasury's feedback from the Department; then money is just spent for the sake of making the figures look better without necessarily being spent where value is required or where value is obtained.*

"*For instance, you'd get say, in a state-owned entity (SOE), money being spent on your internal projects, internal service providers who are extremely overpriced, who inflate their professional services costs and even on projects where it is very clear that that project is not going to be financially viable, but the process is continued to its conclusion so that money can be released into that project. And yeah access can be given for siphoning off of funds and in the end, no project actually gets built.*

"*Things get taken to tender documentation stage and then a decision is [made], 'No, we are canning that project.' But money has been expended but no infrastructure has been built. So it's these kinds of corrupt practices, which are being practised as a means to siphon funds rather than to actually add to the economy … it's just being used as a vehicle for corruption*." (P19)

Where projects are carried to full term, money is usually diverted for corrupt purposes through inflated payment certificates or final accounts. Quantity surveyors are usually central to this corrupt process, as they usually prepare payment certificates. Corruption has arguably brought the construction sector and the quantity surveying profession into disrepute.

"*You see, that mess from the top of political environment, it's like a disease that [is] contagious. It goes from whoever, the president and it starts infiltrating almost all sectors of the economy. We've seen it happen even with your QS firms. The employer's organisation is now corrupt, the QS firms [are] only rendering a service; now, they must sign the payment certificate or whatever or the final account. But in order for corruption to take place for this guy, the employer guy to get money or the employer's representatives, the money must be embedded into the final account. Because that's the only method of payment.*

"*So the QS must be involved in this whole thing. So then it affects them. I've seen people leaving the profession. People with good ethics leaving the profession because now they said, 'No I'm not going to be part of this thing. I want to sleep at night. I cannot sleep. I cannot sleep like this. People are changing my bills of quantities and they are changing my 200 cubes into 2 000 cubes because they are building in that [corruption money] into the final account because the client has already said there is an extra R1 billion that must be built into this final account. And then we are going to share it afterwards*." (P10)

"*The construction sector has been affected by political problems. The political problems that were related to corruption scandals and so on, from 2010 World Cup corruption. So, to some extent, the construction sector has actually lost its credibility*." (P12)

"*The new generation of the quantity surveyor, now, they are coming in[to] the sector where [there is] corruption, [in] the way the appointments are done, they are more interested in getting money and [are] less ethical. And this is affecting them. But the old generation they still, they have got the name, they [have] got the experience*." (P4)

There seems to be little political will to deal with corruption, even though P4 argues that the new government shows signs of being willing to deal decisively with corruption and unethical behaviour, giving hope that the future might be different.

"*On [the] political side I think that there is a will to fight against corruption. There is a will. And then this will affect the process to get the appointment. And then at least maybe the people will improve a little bit. It will improve, construction. For the majority of South Africans, [they] can't access the private sector. The political will must improve the BEE factor in [both] big projects or even private projects; the Government must intervene. Just look at Sandton. Who is the Black architect who can be appointed*

to design a small building in Sandton? It's all the private [consultants]. We want the political will to improve our people." (P4)

A lack of investment in infrastructure, by both the public and the private sectors, as well as corruption, have had the most negative effect on the construction sector. Experts cite these as the reasons for the collapse of the private construction sector and also for the emigration of professionals. After the economic boom, prior to the 2010 World Cup, the 'wheels' of the construction sector came off. Public infrastructure investment slowed. Under the new administration of former President Jacob Zuma, corruption increased.

"*The wheels [of the construction sector] fell off shortly after we had completed the stadia for the World Cup*." (P18)

"*The politicians can change their rules as they see fit, which means political stability usually becomes the foundation under which everything falls. And I think the current challenges around the political leadership ... let's say one can go back to, maybe to Nelson Mandela's last speech as he was addressing the nation. Let's say, the first one and the last one, and Thabo Mbeki's first one and the last one, and Zuma's first [and] last [speeches]. Maybe just go and look into word; you might find [corruption] has been growing in numbers. The corruption perception over the past 10 years or so, it might also have impacted the industry and the political decisions. When political decisions are [made] and the public purse is not managed. Then when the public debt rises, you can't really cut teachers' salaries. Then things that usually get sacrificed is the Government's expenditure on infrastructure*." (P15)

Construction projects used to score political points

Sometimes development is either delayed or accelerated for scoring or settling political points. For instance, before elections technical and professional advice regarding important aspects such as the feasibility of the project is ignored to satisfy the electorate. Professionals go against their own independent professional judgement to make infeasible projects succeed and to satisfy the needs of the client. This often results in the quality of the work being compromised, which might result in serious consequences, such as the collapse of built structures. Within the quantity surveying profession, bill preparation is often hurried. Instead of measuring and quantifying items, monetary allowances are made. This action does not provide a true reflection of the actual cost of the work that needs to be carried out.

Sometimes developments in certain parts of cities or towns are stalled to settle political scores. If projects are somehow implemented, other political parties will incite the community to disrupt the projects through community unrest or through sabotage by the 'construction mafia'. This once again negatively affects construction and the quantity surveying profession.

"*Look, in the public sector it is more around what the political agenda is, that is being pushed. Because projects' decisions can be made around projects [that] are detrimental, knowingly detrimental to the project, purely to score political points*." (P19)

"*It weakens [the politics weakens the professions]. Like you're an engineer, but then there's a politician who comes and tells you, 'Now I don't care. I want to have a bridge'. But when you tell him you can't have a bridge because of this, it [doesn't matter] because it's political. He is serving the people who want to see a bridge; he now compromises and you have to compromise to satisfy that politician to get a bridge. Where tomorrow it collapses. So that's why I am saying it's a challenge because of this political problem. It's true people get forced to sign things. Let's say I'm working. I mean I am a professional QS, and I'm forced to sign a payment. It's a government project. If I don't pay, those guys are threatening me. Saying, 'You'll get a call from the minister [saying] you must pay those people.' He is clean. I'm compromised. I have signed*." (P7)

"*So the political influence as well as local wards. Yeah, ward councillors' fights and all that. Also is the structure of the political environment in the area [that influences construction projects]? Like for example, the antagonism between the different political parties. If this school [that is being built] is on the DA ward? And the adjacent is the ANC or EFF? This too is going to influence [the project] by interrupting the project on site*." (P10)

Maladministration of public institutions

Prevalent maladministration of organisations such as Eskom and Transnet is having a negative influence on the construction sector in South Africa. Eskom's inability to provide South Africa with enough energy to function effectively discourages investment. Lack of investment negatively influences the construction sector and the quantity surveying profession.

"*But the political factors that affect us [are] of course this whole mess that is going on in the country right now. The country is going through some kind of a recession Because of our political environment. Of course also caused by the performance of organisations like Eskom; that they cannot supply enough energy. But it all comes from the political side, your president or former president … were affecting the performance of these key organisations that are driving the economy. And so because of the Guptas putting their hands into these [organisations], we find these organisations [are now] not performing well. Thus, the economy goes through some slump and with your slump that means the construction industry also goes into that slump. So there's not enough work for us in the QS profession. It is not good for the entire society*." (P11)

"*All these SOEs, Eskom, Transnet, all these, they have put us where we are now. And if you appoint [the] wrong ministers, people who are not experienced and so on, they didn't understand what was happening. And [the] wrong management at different entities. What was the name of that guy at the SABC? Look what happened. Look at Denel. Look at SAA. Those things affect us. They affect us because now you've got an airline that is not functioning properly. Once Government has provided a very good platform for development, then you know where you're going*." (P12)

Inefficiencies and indecisiveness

The inefficiencies and indecisiveness in public institutions are also negatively influencing the construction sector and the quantity surveying profession. There are delays in approvals, such as payments to contractors, compensation events in NEC contracts, zoning and other town planning requirements. This problem is attributed to various factors, such as inefficiencies of systems in place, which tend to be cumbersome. Sometimes they are attributed to a lack of decisiveness, with decision-makers afraid to take responsibility for certain decisions, given the current corrupt and climate of mistrust. Others suspect political interference and corruption could be the reasons behind these inefficiencies.

"*The public is more regulated on legislation. Lot of limitations in terms of deviation from the PFMA… For example, only one person in the Department is able, based on the delegations, to make the decision to say, 'Approved' or 'Not approved'. I am saying maybe, probably 10 people have to advise the senior account control officer to approve or not approve the compensation event*." (P22)

"*It's a non-decision-making environment that we find ourselves in. Nobody's making any decision about anything and then there's a lot of doubt going on with the leaders of the construction industry, as to whether anything positive is going to happen. So then it begins to affect the investor component valve adversely.*

"*The people are scared of taking a risk, even if they've been given positions of authority to make decisions. For their decisions are dependent on other people's interpretation; they are sort of babysitting. That's where the problem is. People find comfort in not making a decision because then you're not stepping on anybody's toes*." (P10)

Others place the blame of government inefficiencies on a lack of relevant skills within public institutions. These are blamed solely on politics. When the new democratic government took over from the apartheid Government in 1994, many White qualified professionals in public institutions were replaced by non-Whites, some of whom do not have the requisite qualifications to fill those positions.

Some of the implications of inefficiencies and indecisiveness within the public sector include delays in projects and cash-flow problems for both contractors and professionals, which in some instances leads to business failure. Lack of decision of the public sector regarding identification of work and fee scales has rendered the regulatory bodies ineffective. The efforts of the professional bodies in effectively regulating the professions are hamstrung by this indecisiveness.

"*[Nowadays], if you do work for certain government departments, and I'm talking government and quasi-government, when you talk about the health sector and the tertiary, you know education sector and stuff like that. I mean my recent experience over some of those have really not being terribly great. Funding is there. They start and there are delays and for some reason then, and [there is this] emerging market of contractors who are very much reliant on cash flow. In other words, they don't come with huge capital. Deep pockets [contractors], if they don't get paid for six months, they can carry it but the emerging market is finding that very difficult.*

"*At BYZ project, the contractor just walked off site because he hasn't got any money to carry on paying the labourers. The money isn't coming through. There is one excuse after the other by the Department people [about] why there is a delay. But eventually something cracks and suddenly the guys just walk off and understandably so. Understandably so*." (P1)

"*As I say, it's about our educational systems. You know people who've been in the industry, the old order guys, etc. For example, the very same current situation of Eskom. Eskom has gotten rid of what they think was the White order. No. Eskom has gotten rid of their knowledgeable people, who successfully managed the problem they have now.*

"*But those people have been replaced by what is called transformation, bringing other people who [have] no experience, who [have] no knowledge; they got a piece of paper from universities, but who know nothing. So those people dropped the standard of quality, of the craftsmanship in the space. And replaced it with a university acknowledgement or certificate but with no knowledge to implement what they have even learnt at universities. So everything has sort of taken a step down, [a] few steps down, but we need to rise from there*." (P10)

"*Right now what affects the council most is exactly from the political side of things. You have your councils and these councils like five or six of them. They are under one council called 'the built environment professions'. And then they submit their fees, I think some time back, fee scales, to this one [CBE] and this one needs to get it approved by whoever [is] at the top government level, or [approved by] whatever legislation.*

"*Now those fees are not approved as yet because of some competition commission, which doesn't want to approve these things. So it affects [us] because now we've got fees that are not official as such and they are not published. Although we know them. They are on our website, but they are not official. So that instability in the political environment, that's what caused this thing not to be signed, is causing this problem, in terms of now we're not sure what our fees are. We know that the Council has said, 'These are the recommended fees, but they are not yet gazzetted as such because of that'. And again because that environment, I think by the time they were submitted it was another regime and now [this] is another one.*
"*Having this environment of, 'You are in the profession for life. Looking into matters forever'. But now people that must approve your stuff, they are [here] in [the] short-term, like [a] five-year period and then they are only just thinking about five years for themselves there. After that they are out and they leave.*

"*It affects the Council. Because now the Council cannot fully regulate what it is that should be charged for the service. And now it would seem like the Council is useless, where [it] is not the Council that's useless. The Council has done what is supposed to do, but now at that political environment space, that's where the problem starts*." (P11)

6.2.3.2.3.1.2 Ranked Joint 3: Social factors

Experts were divided on whether social factors or technological factors should be rated third, in terms of factors influencing the construction sector and the quantity surveying profession. P23 rated socio-political economy as the number one influencers. Social was rated as the third biggest influencer, by P9, P12 , P13 and P14. P16 rated social factors as the second greatest influencer. Others (P13, P8, P12, P10) perceive that social factors will be the top influencer in future. Societal needs for infrastructure will drive the political and the economic agenda.

"*Government is saying you must spent 30% of your money on sub-contracting. And they are telling you, 'Don't bring any sub-contractor from outside'. So how do you spend 30% of the project value in the locality where there is no capacity? You need innovation. So that innovation is currently not there in our thinking.*

"*We will be pushed into it over the time, but it's coming fast. It's fast coming. It's there actually. Currently, it's creating what is called the 'construction mafia', [who] exploits this space. So this 30% for you to survive it, you have to deal with the construction mafia, who will keep the communities quiet. So it [social factors] will fast become number one in South Africa. For future, the immediate future, social will be number one. But we'll soon understand how to deal with social*." (P13)

There is some frustration with regards to the speed at which basic services are provided in society, and the demand for the slow transformation of the economy to be more inclusive. These frustrations have manifested in the form of service delivery protests, the rise of the construction mafia,and the sprawling informal settlements. Infrastructure needs will largely be driven by rapid urbanisation and population growth.

"*Politics and economics. The finances. If the finances are not allocated properly to deal with bulk infrastructure, etc., then you're going to have the construction industry suffering. For example, in the event that there could be some construction happening in a particular place. If there is no infrastructure or it has never been planned for and the land has been occupied. As you can see now in the informal settlements you can't put infrastructure there. You've got to go to the basics and perhaps remove the people and finish the infrastructure or you cannot have the infrastructure flying all over. I mean like you'd have had when there's no electricity installed in places. In the past, it was underground and it makes a better environment. And as you can see all these quick developments. All the bulk infrastructure. It's all on grade, on the ground, which begins to impact now on the mobility of the people and everything else around. So it's [a] mess. It messes up the whole construction industry. It's an environment that has no direction. You build for what it's worth, but then there is no future*." (P10)

Another social factor that experts perceive will influence the politics and the economy is the high unemployment rate. One of the reasons cited for the high unemployment rate, besides lack of economic activity, is a lack of skills. Lack of skills is blamed partly on poor education. If these social issues are not adequately addressed, experts perceive that there might be a social war.

"*Well, the issue of the economic factor is one of those. Because our economy, the South African economy is in big trouble. We spend more [than] what we produce. We import more than we produce locally. The other issue is the political environment at home. And the social as well. There is a lot of social issues that have to be addressed. The level of unemployment and also the skills levels are affecting the industry seriously.*

"*One of the responsibilities of the industry is to contribute to the reduction of unemployment… creating assets in the country. You are creating assets in the society. They are a benefit to the society with your contribution to the society*." (P22)

"*Number one is the population growth, which is social. Because it's the thing that's putting strain and drives the need. Climate is a major problem, because we're going to have [that], in conjunction with population growth, right? Climate is going to cause major suffering and harm to people because we are not planning their needs in terms of water [access]. So that means that some people will have access to resources and some people won't have access to resources, and resources include basic resources,*

like water, which [a lack of] will drive war. So basically war, I think is the answer. I am not even joking. I wish I was. Do you know that we are going to have 80 million people in South Africa by 2050?

"*At the moment we are under 57 million and the dams that we have can't properly [and] equally distribute potable water to [who is in South Africa] now. Now we've got to have another quarter of the population again in the next 50 years. If you want to have a dam in your city, you can't build one in four years, five years. You got to get it in the budget now for ten years before its online and operational. Nobody is planning for that stuff. It's a disaster*." (P23)

The current social factors, such as the construction mafia, community protests, and stoppage of work, is having a negative influence on the construction sector; however, if the needs of society are properly addressed they will create opportunities within the construction sector and the quantity surveying profession (P13, P6). Other benefits that will derive from social factors include wider adoption of technology and innovation (P6). To meet a fast-paced society, the construction sector and the built environment will be driven to adopt faster methods of delivery. Technology will influence societal expectations from slow- to fast-paced (P18).

"*But because there is going to be like urbanisation that's going to be happening, I see a lot of migrations and demand. We might need to turn the flat spaces into high-rise space. So there will be a counter demand in terms of the growth population and rapid urbanisation that will happen. So we [QS] have [to] keep up*." (P8)

"*I think we still have six teaching schools in terms of quantity surveying. That needs to change. It needs to be broadened, so that there is more accessibility, because quantity surveying is related to delivery of infrastructure, which to me is something that happens countrywide*." (P6)

"*As I've [said] in the past, they would have lower expectations because they weren't exposed to all the technology. So now, with the technology they [clients] have higher expectations*." (P16)

Increased societal needs will increase the need to become more efficient with resources, as there are currently limited resources to meet the needs of society. Quantity surveyors are likely to retain their new leadership role in construction projects (P12, P7). Their leadership position in future will, however, depend on their ethics. Quantity surveyors will need to be more ethical in future to retain their leadership.

"Like I say, the future wouldn't, you know, in a way, affect [the QS]. The construction industry wouldn't ... because QS is the role player within the industry.

Because the contractor, consultants will never do anything without the cost. I mean every month we've got cost meetings, where you report back to the client. The QS can be the principal agent, 'cause he can manage the entire thing even without the architect. He can actually manage the whole team because he's responsible for the cost. He is more like representing the client. "*They are actually principal agents. They are the PAs. In most cases, they are appointed as principal agents. They act like construction managers, because QSs and construction management is still the same.*" (P7)

"*But the client found comfort [from the fact] that the calculations come from a person who has [the] expertise to do that. But then it is the very same concept that they need to tell the client that [is] based on the factors that have been put before me, about your finances, etc. You will not be able to afford to build this building. But they would allow the client to limp along and persuade the client to find the money that they don't have; to create a project that would never exist.*

"*Hence, you'd find that if the quantity surveyor or any other profession [is] not ethical, or they do not stand their ground, even their existence will disappear…Construction costs, gets panelbeaten to make it [the project] of a lesser value for anyone else. Therefore contractors may not need quantity surveyors, because they'll make their own decisions. That 'will build this for x amount'. Do you understand? So the value of the role of the quantity surveyor is out of the window. It may not exist.*" (P10)

The needs of society will also drive the types of procurement methods in construction. Different types of collaborative practices, such as PPPs, might be widely used as necessitated by societal needs (P2, P18). These new needs might create opportunities for quantity surveyors (P8, P2).

"*I think, the way they might have to trade in the future is going to change. Because the nature of the contract is going to change. So the old, while there will still be lot of work coming through FIDIC and New Engineering Contracts. I think there's going to be more PPPs coming through and that style of work, which is design-build-operate type of work. You've got other players coming in like the banks, the lenders and they take a view, never mind the CIDB rating. They will take a view on [the] balance sheet, [as to] whether the guys can deliver.*" (P2)

"*But they [QS] need to be more, sort of transaction advisors in PPPs. Yeah, like it will link into the organisation, into investor confidence. Like in a PPP set up, where someone sort of designs and builds. And maybe the State or the developers, the owners will have to have [a] financial plan of repayment [or] investment over a period. So I think if you take QS, we will have evolved to that state, because things will be rapid and cost would have to be managed very tightly.*" (P8)

6.2.3.2.3.1.3 Ranked Joint 3: Technological

Technology was rated as the number three influencer of the construction sector and the quantity surveying profession by P6 and P20. It was rated the second most important influencer by P6 and P22. P17, P5, P15, P3, and P23 rated technology as the third major influencer of the construction sector and the quantity surveying profession. A few experts (P11, P13, P7, P5, P1, P12, P22, P2) agreed that even though the current influence of technology on the construction sector and the quantity surveying profession is minimal, technology will become a bigger influence over time.

Experts agreed that technology had begun to influence the construction sector and the quantity surveying profession. Computerisation, BIM, software, ICT and automation were beginning to influence how work is carried out in construction. Many claim that technology is improving and enhancing their efficiency in how they carry their work. Speed and improved quality of work were some of the benefits of technology on quantity surveyors' tasks. In future, however, technology is likely to be a threat to some of the professional tasks of quantity surveyors. Some quantity surveying tasks risk automation. This technological encroachment might lead to the reduced need for quantity surveyors in society.

"*Technologically, it's going to be very different to where we are today. It's going to be all computer-driven. Social, technical, I think over time it's going to be very different to what it is now. It's going to change. It just hasn't happened yet; it's just going slower than it needs to be, but over time it's going to correct itself. In terms of you going to get young Black professional guys coming through and they will dominate the industry. They are not at the moment, but they will. It's just a matter of time*." (P9)

"*If you look now, let's say before technology, you need a lot of QSs to carry out work. You need a QS on site. You need a QS there, but with the technology, the number of the demand might reduce. The demand [for QS] will reduce*." (P7)

"*We've just said now there's going to be this revolution that is going to take place. People, particularly on the ICT side, are thinking of how to fast track. It took three months to produce a bill of R14 million. Now, it takes four weeks to do that. So now with time, I believe the issue about bills of quantities might not be like printed bills of quantities. It might be that you've got the bill, PDF it, then you throw it on the website; people will tender on the website*." (P12)

Technological advancement will also influence how construction work is carried out. Construction automation and robotics will play a bigger role in future. 3D printing, drone technology and similar technologies are some of the technologies that are likely to grow in South Africa. As the green agenda gains momentum, green technology and green buildings will also influence the construction sector. Change in the construction materials used will also influence construction technology and its methods.

Changes in construction technology, construction methods and materials is likely to influence current quantity surveying practices. Quantity surveyors will need to adapt their practices to accommodate these changes. This might result in specialisation in the profession.

"*You can see it in [a] 3D visual, any kind of 3D model. You see how you operate. How you build. You can see the whole process of construction, from A to Z. You can see, 'Oh, there is a clash here'. So even now with limited resources, you seeing on BIM, for example, you see clashes. You can go through the whole [site], 'I see a clash there', without having to drive there.*

"*So you can be here, but you still control [the site], and you advise. Your interaction with a project that is thousands of kilometres away from you [remains the same as if you were on the physical site]. When you do a conditional assessment of an existing building, you can send the drone. You have a drone that can give you a 3D scan of the entire building. Bring it back. Import it into your system or whatever you want to use. You have the entire model. You can measure up. How many windows? 'Cause it has converted [all] the data the drone captured from the building, outside [and] inside*." (P22)

6.2.3.2.3.1.4 Ranked Joint 4: Environment

In spite of the current global preoccupation with sustainability, experts do not regard the environment as a significant influence on the current construction sector and the quantity surveying profession, although this is likely to change in future (P23, P3). One of the reasons the rating is lower than other factors is that there are more urgent needs in Africa that need to be addressed first (P16). Another reason is that clients in the mining sector are driven by making money more than they are about addressing environmental issues. They will use their financial muscle to stave off the implementation of environmental policies in the mining sector. Environmental factors were rated last by P6, P12, P3, P16. It was rated third by P20, and fourth by P17.

"*I mean, we talked environmental, being conscious of not putting carbon dioxide into the atmosphere. In years gone by, we just pump[ed] the carbon dioxide out. We didn't worry about it. Now, we're obviously realising the effect on the environment. We've got to clean it up. Cleaning it up cost you money. So the guys [in mining] will fight the environmental stuff as long as possible*." (P3)

"*I went to an interesting conference; it was an Africa conference. They took a vote from everybody in the app. The main focus of the conference was environmental. What came out of that conference is that Africa [has] got other problems. Environment to me it's bottom of my list. Rather give people water*." (P16)

In future, related issues, such as sustainability, carbon emissions, green technology and climate change, will start to influence the construction sector and the quantity surveying profession on a greater scale.

Best practice related to green buildings will influence the need for quantity surveying skills of life-cycle costing.

"*So also, another thing is the environment. All these topics, if you look at them, they really affect it. It's like a key indicator factor; key factor indicators because if you look at the environment, national resources is scarce. Global warming is affecting [them] drastically. That's why the industry has to talk about [the] geen building approach. Because people realise that there are serious issues with global warming, with natural resources [becoming] scarce. The environment is [becoming] more and more damaged. You can see the high temperatures from extreme weather patterns. And that affects the industry also.*

"*For example, you will find the new forecasts, your construction site for example, is dry. You have to spend a lot on water, which is one of the resources to contain dust because it's so dry, [because of] the droughts and the water level. The industry requires water. And water resources are [becoming] scarce. So water will become one of the critical [factors] in the industry*." (P22)

"*If it just becomes a legal requirement that you cannot have a building whose carbon footprint exceeds a certain quantum, then that has to be complied with. But again, unfortunately you find that some of these things get circumvented at compliance level, within say the municipalities. Where again, you find that the competence level is not at the level where it needs to be so. [For instance, possessing] sufficient comprehension to understand if your glazing requirements are X Y and Z. The reason behind it, is this: you need a certain competence to be able to assess whether something is meeting that requirement or if it's just a tick box approach.*

[For example]Where in a building you do not have double glazing then you fail; when in fact, through rational design, it can be approved. But if you don't have the competence to assesses or to realise that this rational design, this is what it means, you fall back on something that long-term might not even be meeting the requirements, because maybe the production of that double glazing fenestration system has a higher carbon footprint than the whole [project].

[By] putting that legislation in place, [we are] trying to reduce the energy consumption impact, [but] if it cancels it out because of the energy footprint achieved by ensuring you use that kind of double glazing, then you're not actually meeting the value that was being proposed in the first place.

"*So it's really, it is quite a complex thing to put in place to ensure that there is compliance*." (P19)

"*You [the QS] have to look at that whole that whole life-cycle analysis. So what is the cost to the environment? What is the value to the environment? What are the implications?*" (P23)

What might impede the wider adoption of sustainability in construction is government policy. Government is a slow adopter of technology. Another reason for the slow adoption of sustainability in construction projects is that government has other social imperatives to meet, such as job creation and more inclusivity in the economy.

"*Technological, I don't think so because we are still doing the same thing, especially because the main client is the Government. The Government will never allow you to bring a new technological thing. They will never allow you. To give an example, now, we are talking about green, green design. And then because there is a cost implication, they will never [implement it]. There is no budget on that. They will not put a green design budget on any project. And even for a small thing like, landscaping. They will never do it because they say [it's a] maintenance problem. They don't ever do it. They will never fix. They will never come and fix. Just do what they always do*." (P4)

"*You see, the biggest consumer in South Africa is Government. So Government will cushion us from the effect of technology because their biggest market anyway is SMMEs. Private sector is where it can be [adopted] faster. Because in private sector they are looking for value. They are not looking for activity. So the same way that Government has cushioned the employees in parastatals, they will be able to cushion the public sector, QSs and the built professions. But in the private sector it can be fast.*

"*So what you are likely to see is the private sector will move [further] ahead than public sector, in terms of the application of technology. So those [who] would play both sides, will have an advantage because they will be able to make more money in the public sector because they have got technology. But your SMMEs will still be able to participate without technology protected by Government.*

"*Instead of the bigger guys with technology lowering their prices because they have got [a] technological advantage. They will not necessarily lower their prices. They'll make more profits. They will keep their prices comparing with your normal guys, who don't have technology but make more profits. But the guys will then still be in the market.*

"*The private sector will be able to tell you, we are going to run our projects on BIM, the Government will not say no to it. I have had one client say that to us, 'Though we'd never run the project on BIM. At bidding stage that's what we'd offered. We said we'll run the project on BIM, 7D model.' So it means, in future when that client tastes the 7D model, it's going to want 7D model[ling] in all these projects. So only those who can respond to that spec will win the bid.*

"*In the government sector, Government will not say upfront, 'My spec [means] you must do my project in [the] 7D model.' Because they know the masses will not be able to do that 7D model. So that's the*

gap. So [it] is in that manner that they will be able to cushion [public sector employees. So it will improve people's efficiencies, those who have got [the] software, but it may not disrupt the market at that point. These softwares are not cheap. So it's mainly your large companies that afford them." (P13)

6.2.3.2.3.1.5 Ranked 5: Legal

Legal was also rated as least influential, partly because experts regard it as the same as political (P12). Another reason is the seemingly general disregard for legal frameworks in South Africa (P22, P19). Legal frameworks are regarded as ineffective in influencing behaviour in South Africa.

"*And from the point of legal, I think, the legal framework in the construction sector is, that's my opinion, I mean has been weakened. I am saying this because okay, they are contractual regulation[s]. There are a lot of contracts. But there is still a substantial [number] of irregularities in the administration of contracts. The costs of the legal fees, for example, the cost of legal processes is high. So rather some people go into insolvency or liquidation because to enter into a legal process … That's some of the issues ([like] for example, non-payment) that affect it [construction sector].*

"*So, some big fishes like a big contractor can afford to pay those legal fees. But those emerging contractors, small guys, they can't afford legal [counsel] and that [is] also affecting the industry drastically. Because remember, the employer may, for whatever reason, [not] want to pay this guy. Because remember maybe [because of] insufficient skills, did not deliver on time, the department decided to terminate them. And they have their own opinion. They say, 'You are terminating me even though you are the one who put obstacles [in place]. You didn't pay me on time, for example, and there was change of scope etc. All those issues affected me. I was not prepared to hire more people. I was not prepared to buy one more quantities of materials.' Eventually, that guy loses, because he doesn't have sufficient legal cover, is not able to fight the Government*." (P22)

"*Legal one doesn't [influence], people don't comply so it's definitely not*." (P19)

"*But as a rider to the thing on the underpayment story. Then Government is going to have to get its act together. That within the terms of the contract if that's a 7-, 14-, 28-day payment period, it's got to happen on that time. Not, 'Well, I know that [the] contract says 28 days, but can we [move] it to 58 days?' You can't operate but that's currently what they're doing. And they are largely to blame for a number of the smaller guys just getting lost because they don't pay on time. And you can't operate your business if the money's not coming in. Cash flow is king*." (P18)

P20 claims that the legal frameworks have not changed much from the apartheid era. In future these will need to be changed.

"*And in terms of legal, we still have a lot of apartheid laws and whatever. We have not changed a whole lot of things. So legally, those things have to change but I think in terms of labour relations, we are the most progressive country*." (P20)

Current procurement policies related to tendering have created and are generally blamed for, amongst others, high levels of corruption, unethical behaviour and the collapse of the private construction sector. They have also created mistrust and adversarial relationships within the sector. In future, more collaborative practices might be adopted, changing the current position of the quantity surveyor profession within the construction sector's structure. Quantity surveyors might work under contractors or other professions in project set ups, such as turnkey or PPPs.

"*But the reality is that I kind of favour the turnkey [set up]. I prefer [it] in the sense [that] the responsibility is with you. You do your design. You built. You handover. Especially, because in South Africa [it] is mostly the JBCC, NEC, FIDIC and GCC. But the most favoured is JBCC and GCC. FIDIC is more international. People are not favouring it. NEC yes. It's like design, construct, operate.*

"*This one is a turnkey. I come with my own professional team. We design. We build. We hand it over to the client. We don't operate the thing. We design and build. You are able to manage the risk, mitigate risk within yourself with the consulting team. You still have your professionals but you are able to mitigate all the risk and everything because you are responsible. So with the consultant, contractor there is a lot of finger pointing, where you start writing letters to say that, you know, 'You are in contravention of this clause in [the] GCC. You are supposed to provide me [with] drawings. You've delayed me with this thing. I must do a new programme.' So if it's internally it's even less for the client. And even the overrun costs, where the quote is R80 million, it ends [up] being R100 million. It is happening*.

"*I mean your Medupi project, it started with [an] amount. It's a problem because the consultants, they are blaming each other. That's a typical example to say, 'You've got this thing. These are your consultants.' We are just the contractors but now they are pointing [at] each other. But if it's like [turnkey], it's you doing that thing. I prefer that kind of approach and that's what happened with the stadiums [for the World Cup]. It was one of the successful things. It's like, 'We're giving XXX Construction Company whatever...' When you bid, you bid with the consulting team and everything was well managed in a way, you know. Though, there was some kind of collusion and stuff like that. It does happen*." (P7)

Cumbersome and stringent policies are delaying project implementation in the construction sector. This affects the cash flow of quantity surveyors, as their fees are dependent on work done. The legislation

governing the built-environment professions is cited as the main element supporting current structures within the construction sector in South Africa. If the quantity surveying Act is changed, the roles played by the built-environment professions, including quantity surveyors, are likely to change. Whether this will be positive or negative for the quantity surveying profession is debatable.

"*So the public sector prides itself on having frameworks around B-BBEE, employment equity, preferential procurement processes about being compliant with the PFMA, with the MFMA. I'm now talking only about construction in South Africa. We're not talking regionally. We are talking South Africa. So we have those things which, as I mentioned, have become so absorbed [by] so much red tape and stuff like that, it becomes really expensive and cumbersome to work with.*" (P23)

"*But the built environment itself, in terms of professional councils, can't change that. There has to be an Act that says, 'Nno a QS can no [longer] be independent.' So you must start it first from the regulatory status. You just don't relegate people. You have to apply to Parliament and say, 'No, we no [longer] need these guys [to be] independent'. Then they say, 'Okay, then we have to scrap their Act'. But as long as there is an Act, you can't [remove these] people. You see, that is why I'm saying in the UK [it] is different.*" (P12)

6.2.3.2.3.2 Summary of the findings of the factors likely to influence the current quantity surveying profession

The summary of the key factors likely to influence the current quantity surveying profession are provided in Table 6.8 below. These factors were ranked according to the highest to lowest influence, in both the workshop and focus group. Letters next to the factors in table 6.8 represent each factor.

Table 6. 8 Summary of factors likely to influence the current quantity surveying profession

Politics	***Economy***	***Social***	***Technology***	***Environment***	***Legal***
Expropriation of land without compensation **(A)**	Competition high **(I)**	Fast paced **(R)**	BIM **(Z)**	Carbon emission **(II)**	The QS Act 2000 **(OO)**
Government policy **(B)**	Oversupply of professionals **(J)**	Expectation high **(S)**	Software **(AA)**	Green technology **(JJ)**	Procurement policies **(PP)**
Corruption **(C)**	Undercutting of fees **(K)**	Ethics **(T)**	Computer driven **(BB)**	Best practice **(KK)**	Stringent policies **(QQ)**

Poor administration **(D)**	Risk work **(L)**	Quality driven **(U)**	Automation of professional tasks **(CC)**	Climate change **(LL)**	
Bad management **(E)**	Few projects **(M)**	Economic driven **(V)**	Automation of construction work **(DD)**	Life-cycle costing **(MM)**	
Indecisiveness **(F)**	Collapse of construction sector **(N)**	Lack of skills **(W)**	Robotics **(EE)**	Sustainability **(NN)**	
Inefficiencies **(G)**	Loss of expertise **(O)**	Poor education **(X)**	3D Printing **(FF)**		
Political will **(H)**	Eskom **(P)**	Collaboration **(Y)**	ICT **(GG)**		
	Brain drain **(Q)**		Drones **(HH)**		

6.2.3.2.3.3 Comparison of present and future factors likely to influence the quantity surveying profession with past factors

Experts divide the past in the South Africa construction sector and quantity surveying profession into four periods, that is, pre-1994, post-1994, the 2010 World Cup and the Zuma era/or post Polokwane. Pre-1994 is the apartheid era. Post-1994 is the period following the new democratic era. The 2010 World Cup refers to the period (2004-2010) leading up to the 2010 Soccer World Cup and the Zuma era (or the post-Polokwane period, which refers to when Jacob Zuma assumed leadership of the African National Congress (ANC), and therefore became President of South Africa. Jacob Zuma was appointed as leader of the ANC from 2008, becoming President of South Africa from 2009 until 2018. Many experts describe the period under his leadership as the worst period in South Africa post-1994, in terms of both corruption and its impact on the country's economy.

Ranking of past factors that influenced the construction sector was done by checking off and explaining, as per the same method followed for present and future factors. Time constraints did not allow many experts to answer this portion of the questions and in some cases no detailed explanations for their choice was provided. Answers provided by a few experts who *were* able to answer this portion of the

interview do offer some idea of the perceptions about the construction sector in the past. Their responses were compared and coded accordingly.

6.2.3.2.3.3.1 Ranked Number 1: Political and Economic Factors

Government policies

Experts agreed that political and economic factors were the dominant factors affecting the construction sector, and the quantity surveying profession. South Africa and the construction sector were divided along racial lines. The construction sector and the quantity surveying profession were divided along racial lines. Most Black people had limited participation in either the construction sector or the quantity surveying profession. The apartheid laws were intended to explicitly promote the interests of White people.

"*Come on, in this country politics definitely affected everything. I would definitely say, [in] South Africa you can't get away from politics. Politics affected the economy, it affected where we were getting money from, what we did with that money, where we were spending money*." (P5)

"*I think the economy in those time was strong; even though the country was isolated, it managed to run. It managed to be self-sustainable. It was a strong economy*." (P23)

"*The National Party was the Government. And that government was racist. In the private sector mainly, there are still serious issues, there are discriminatory issues, issues [of preference] as well. So the Black-owned industry [has] to build a reputation. Before 1994, you couldn't find a Black contractor to build, let's say, a R100 million project or a R40 million project in South Africa. Difficult to find. Maybe one, I haven't heard. I doubt [it]. When was the first Black quantity surveyor graduate in South Africa?*" (P22)

"*We're dealing with things that take time. The whole, let's call it, 'nonsensical system' started at the time when [foreign] people landed in South Africa, that is 1652. Now it takes up until 1994 to say, 'Now, we are all part of this whole situation'. Now that's how many years? Three hundred and forty something years of building some slavish mentality into people. So eradicating that is not going to take [just] 25 years or 50 years. It's going to take time*." (P10)

"*We are predetermined to say before 1994 and after 1994. Well look, there has been a lot of transformation in the industry. Transformation is there. But [that] transformation has not been well calculated. We got numbers just coming in. Messing up, not doing the proper quality [checks]. But then it was predominantly White, all [of] industry. In the old days, we Black people want to always be wearing a tie. 'I want to be teacher'. 'I want be a policeman'. 'I want to be kind of like a clerk, nice'.*

And the Afrikaner guy goes with a short and he deals with bolt and nuts and oil. So the industry has transformed from what it used to be." (P7)

"*It [the construction sector] also had problems like the professions. It was a problem. A Black person was just a labourer. It was different. It was at that stage okay. It favoured the Whites. Most companies were White companies. They are still there. Such as JKL and such like. They grew from old companies. They just changed names. South Africa was dependent on other countries for funding and so on. There was one international company that built the tunnel. They came from outside, but came in through certain agreements. Just like reciprocities*." (P12)

Even within the quantity surveying profession, there were divisions along racial lines. The professions were closed to Black people. There were not many Black people accepted at universities to study quantity surveying.

"*You see those ones are difficult. Then things were not structured properly politically. The whole system was lopsided towards one group of people. So the whole thing was meant to favour White people. To protect the interests of Whites. I mean quantity surveying was also used to exclude certain groups of people. I mean if you look at the profile at X University. Only one Black person used to qualify at a time. Sometimes no [one]*.

"*So I would say that the legislative framework then was meant to introduce something that was very important in the built environment, but with serious shortcomings in terms of the political environment in the country. Only certain groups of people were allowed to do a course in quantity surveying and to be a professional QS. Not everybody. Very few people. Engineering had more people. So I would say that legislation at that stage was relevant but to a particular set of people*." (P12)

After 1994, the construction sector and the built-environment profession were opened up to all South Africans.

"*Is good for the professional. Good for everybody, because now this Government's initiatives of saying there are historically disadvantages individuals (HDIs), B-BBEEs and so on is meant to correct that. Do you understand? We are opening but let us allow for these big White firms [to] open for other people. They must put certain Black people in the management and so on so that we balance the whole scale. So the bottom line, you are benefiting the Blacks, the whole Blacks. The imbalances are being corrected*." (P12)

There was less corruption

Corruption in the construction sector is not a new phenomenon. There was corruption during the apartheid era.

"*Corruption in the industry, I think was a little bit less. But there was corruption as well*." (P22)

Even though there was corruption in the past, it was different to the current type of corruption. The previous manner of corruption was hidden, in the sense that there was still delivery of quality infrastructure. Currently, there is corruption and poor quality infrastructure. Another way in which corruption is currently carried out is through closing an indebted company and starting another, which was not done in the past.

"*Look sometimes if you are corrupt but you do good work, you can't see that corruption. But here you are, you saying, 'You build a road but there [are] no roads.' So but there is actually somebody who has done the roads and we're still driving on that road. So the issue of corruption is out of the picture. Because you can see there is deliverables. At least something is delivered. You don't want a situation now to say there is school here but when you go there, there is no school. You understand? You can say that it's relative for me to say.*

"*But from what it was in the past and now, there has been transformation. Lots of participants. Some grow. Some die. Some companies close [but do] not die per se. The company is closed. You find the same group of people, they liquidate their own company, they start the other company because they are indebted and all those things but you can't predict it*." (P7)

P14, however, perceives that corruption has been rebranded and magnified since the Blacks took over. Current corruption is not much different from the corruption that took place in the past, although it does seem to run along racial lines.

"*And unfortunately corruption has been re-branded. Let's look at this thing. If you are my client and I buy you a cow. Let's say I buy you a cow – that's corruption. You must remember there are certain ways of living. For me, it might be having a nice feast with my family in December. For you as Van der Merwe, [it's] to go to a World Cup [match] in France. Do you understand? So our Government, we are trying to follow a certain culture. For example, if you're my client, because these guys [White guys] they go hunting, somebody pays. It's not corruption. Right? Now you are my client. You say to me, 'Look I don't want to go to France. I want you to put so much into my daughter's wedding, [or] whatever. That's how I want it.' It becomes corruption. So, I am saying, we need to reclassify this things.*

"*I mean you go to France you spend how much? R100 000 on one guy. Is not corruption, right? I give you R10 000 to go and do whatever. I'm just saying. We just need to think about how these things work*." (P14)

An increase in corruption during the Zuma administration

Corruption seems to have increased exponentially during the time of Zuma. This increase in corruption had an adverse influence on the economy. The construction sector and the quantity surveying profession suffered as a result. Private construction companies that built the soccer stadiums for the 2010 World Cup have experienced business failure as a result of the corruption that followed from the collusion. With the new government elected in May 2019, experts expressed hope that things in the political and economic arena would change.

"*Just like Zuma wanted us to have this nuclear plant [built] by Russians. He was trying to [forge] links with Russia without realising that Russia wants to make money out of us. Construction then was characterised by political influence*." (P12)

"*I mean why are South African companies sitting on cash stock piles? Why [have] we got a growth rate of less than 1%? When the average growth rate in Africa is about 5%? And as a percentage of the total African economy, we're running at 1% and Sub-Saharan Africa is running at 5%. That means other countries in Africa are running way out ahead of us. I mean, we are the gateway to Africa. We are not; we were, but not anymore. Because Kenya, Nairobi is now one of the gateways into Africa, but we're not the gateway to Africa. So for various reasons, I think that over the last, [the] Zuma era and corruption, [the] overstaffing of state institutions, Eskom, [the] SABC. We are losing skilled people at the rate of about one a day, three hundred a year. That's published figures and the economy is just not, not ticking along. I mean after 2010, running [at] 5% growth and if you're not, if you're not growing then we just ticking along. So it's, those are reasons*." (P2)

"*I mean the Zuma era actually took us back. We probably could have progressed more. There could have been more work. There could have been more of that and that but as you know, our economy just went the other away. We were going that way but now with Zuma we went the other way. So it affected everybody. So with Ramaphosa coming in we [are] hoping that there will probably be growth, an upward growth in the economy, you know in the economy and work will come again*." (P17)

"*So when everything has gone off well, [the] World Cup went off tremendously well, Government then goes back and says right collusion. And I think what they forgot in the process was that they're dealing with companies whose mark-up is maybe 5%. They don't have deep pockets and to be hit with [a] R350*

million penalty was heavy. There's no doubt about that. But then behind the scenes Zuma and six of his ministers met with the contractors and said, we now need another R350 million." (P18)

While post-1994, the new government was more focused on the socio-economic factor, in an attempt to redress the imbalances brought by the apartheid era, when the Zuma era began the shift changed to "*self-empowerment*" or rather self-enrichment. Quantity surveyors became implicated in corruption through the inflation of the bottom-line figure.

"*Look in the early to mid-'90s, I think there was a drive to for social reparation. And then there was a drive for economic growth through socio-economic input. And then they switched. And then there was a drive for self-empowerment. That self-empowerment came after Polokwane [December 2008].*

"*And that was after the economic deep [global crisis]. Then, it's all survival mode. Each man or woman for themselves. What I saw was an inflation of bottom line when the corruption started setting in. So then there was [complicity] in inflating the bottom line. Because without the quantity surveyors' [complicity], then pricing would have remained realistic. But because of the agendas that were in place to inflate the cost so that they could siphon take-offs, quantity surveyors were complicit.*

"*I remember quite clearly this one quantity surveyor, he was not very senior and not that experienced but suddenly this person was making mega bucks on projects – not even huge projects. Making mega bucks [from] huge budgets. And when I looked at the size of the projects that were being given these huge budgets, these huge costings, it did not make logical sense at all. And where a project say in one year, was maybe R500 000, in a period of four years, that project was now maybe R4 million. And these prices were just, I mean I don't know because just from a lay person's perspective, I just thought, 'This cannot be. Inflation is not going at this rate. So what is going on here?' Because it didn't make sense to me at all.*" (P19)

Economic boom of World Cup 2010 eroded

In spite of the collusion and the corruption that followed the World Cup, experts seem to agree that the 2010 World Cup was a period of economic boom for South Africa. The gains made during the World Cup have since been eroded by the poor economic decisions that followed shortly after.

"*Fortunately, we had the World Cup activities. The industry picked up a bit, but we did not build on that. So it's been sort of cyclical. One phase of this activity, everyone is busy and then suddenly, there is an economic crush in the US or wherever. So when the top level, whether [it] is world issues or country issues, I think we [construction sector] are at the forefront of experiencing [the fallout from] that. Yeah, I think we have all these technological gains and answers but in terms of economic activity, we have regressed more than 10 years. And it has sort of taken all the gains we gathered in 2010.*" (P8)

Following the 2010 World Cup and the period under Zuma's presidency, the construction sector and the built environment professions (including the quantity surveying profession) entered into survival mode, in an attempt to protect their own interests. This has promoted a culture of competitiveness.

"*Now [it] is like [everyone] for himself in the industry. We used to support each other. Now we are competing against each other. Then we were complementing each other. If you are here, I can go anywhere. We don't have to like sit in one area, but we could work together. So now I see people silos mushrooming everywhere. Everyone doing his own thing. Trying to make ends meet.*" (P8)

Not every expert looks at competition negatively. P12 perceives that competition will make professionals more committed to continuously improving.

"*Competition is good. Look competition is good. And competition is going to make sure that there's improvement in terms of the services we provide. Do you understand? If we don't compete, anyone can appoint a lousy QS and then kill our profession. Competition is good. Competition between architects is worse. Do you understand? Architects make models. At this stage, we compete on the basis of fees only and the company profile.*" (P12)

Better administration of the public departments pre-1994

Even though the apartheid Government only served the interests of the Whites, there seems to be consensus that public institutions were more efficiently run during that segregationist period, partly because the public officials were qualified for the positions they held. Post-1994, in the late '90s and early 2000s, some of these qualified officials were replaced by unqualified public officials, in an effort to correct inequities of race. Where there are still qualified professionals in public institutions, their influence has been weakened because politics overrides technical input. Experts believe replacing qualified public officials with unqualified people has negatively affected the construction sector and its professions. Consequently, the professions are not respected as they were in the past.

"*So, historically those things [systems and structures of the construction sector] were working. They were actually working for most people, [although] not for everybody. But they were working for so many people. And they have become unfit for purpose over time.*" (P23)

"*And on the political side, the public space has been infiltrated by rowdy elements that are not even part of the profession. I mean, I used to work for Public Works, around '98 and 2000. It was a proper department. From your head of department (HODs) downwards, there must be people from the*

profession – your director generals (DDGs), your directors, whether they are architects or the engineers. Back then [in the late '90s] it was a pure infrastructure department. People that understood the language of the built environment.

"*[QSs] We were respected for that. And unfortunately during the last [few] years, when the top leadership changed, it impacted the leadership of the department and us as well. We were not spared. Now when I go to [the] Infrastructure Department, they're completely different [from] what I used to know. Municipalities, like I indicated, that maybe this new dispensation, maybe as a profession, we need to identify these things and say, 'What went wrong? Why did we deteriorate to such an extent that rowdy elements [have taken over]?' I mean people that are not [built-environment] professionals have already taken over. Now we must account to politicians who have no idea [of the work involved]. Let them do the political work and leave professionals to do the work. I mean it is so terrible, like you go to municipalities, say like PST. Municipal managers, even if they're an engineer, they are so powerless because they will come up with plans and say, 'This is the IDPs, it is costed. And this is what you're going to do next five years.' Then the politicians say, 'Just throw it out of the window, this is what you are going to implement.' 'Cause there is a political instruction. And now we must come and say, 'How do we save the profession?' [We] limit the political noise. Have a clear plan of implementing the development plan that will say how state institutions should look. How a professional organisation should look, you know? [In] academia, what type of students should come out?What types of leaders should be involved in professional departments and state institutions*." (P8)

P22 claims that during the apartheid era, construction processes were efficient and of a high quality, even though it came at a high price. However, in the quest to complete projects on time, health and safety issues were often ignored, leading to many fatalities in the sector.

"*The processes in the past… today you wouldn't be able to build with the same speed you [did then]. But there were processes that worked in that time for that particular environment. Well-structured processes. The margin, for example, for failure was minimal, to the point that human life was compromised. You know how many people died in construction during those times? There was no professional health and safety regulations. So at any cost. How many, in the railways were killed? People got sick. They didn't care. They had only one purpose: to finish on time or to reach the point to satisfy the developer at any cost.*

"*So, the management of human resources was different. How many people died in the mines from illnesses, long illnesses? How many people died due to safety issues? There are statistics showing that there were processes, there were good processes, but there was [also a] very strong [drive] to deliver [whatever the cost]*.

"*I suppose [this was] due to the political authority. They were [a] very strong disciplinarian. Before 1994, during [the] apartheid era, people [were] killed. Today you go to jail maybe spend 20 years, maybe five years. So there were processes but different principles towards the industry*." (P22)

"*Quality of infrastructure was much better and higher than it currently is. Quality control was more reliable. Let's say, checking the roads. Compare a road built now to a road built before. [It is] still you know, solid. It is still. There are no issues. Same roads there are no issues. No maintenance for 20 years, it's still a good road. And you compare it [to] a new road they just added, two or three years ago. You already see potholes, cracking. Something tells you that quality is wrong. And also the performance in terms of, everybody was focused on the money and the profits. And the performance was, I think, at that level of satisfactory [enough] in terms of quality*." (P22)

The construction sector has always been influenced by economic cycles

From the time gold was discovered in South Africa during the late 1800s, the construction sector has always been influenced by economic cycles.

"*So it depends on the economy. And the economy has been quite volatile. So in times of boom, there's been a lot of activity in the construction industry. Like in Johannesburg in 1876, when gold was discovered. Johannesburg suddenly boomed and it was a tent town. People lived in shanties. And it had boarding houses and literally zinc structures that people lived in. And it's still the same. Because people still come to Johannesburg for opportunity and they still come and live in the most ram-shackle or shack that they can throw together because they are seeking opportunity. So yeah, that's the story of the construction sector. It's always going through those ups and downs. And is always a contested thing for space or access to resources and for opportunity*." (P23)

6.2.3.2.3.3.2 *Ranked 2: Social factors*

The new Government inherited the infrastructure backlog from the apartheid Government. Social need drove infrastructure investment post-1994 and created opportunities in the construction sector. Quantity surveyors benefitted from this infrastructure development.

"*Look in the early to mid-'90s, I think there was a drive for social reparation. And then there was a drive for economic growth through socio-economic input*." (P19)

"*Because traditionally, the QS profession was mainly based on the back of public infrastructure. So it was not at the time when you need to go to investors and advise them and give them the long plan of the facilities. People were more concerned with the actual establishment of infrastructure, because there was a lack. For instance, Eskom, 'How many houses have we electrified? How many schools?*

How many dams and clinics?' So it is meeting [that] backlog, [the] infrastructure backlog. So the money had to be found some way to meet all those challenges." (P8)

Pre-1994, another factor that made the construction sector strong was the cheap Black labour, which was plentiful as the result of the apartheid laws. Adoption of technology in South Africa was somewhat influenced by the bountiful cheap labour, in that there was no need for innovation with an abundance of manual labour. Wider adoption of technology in the construction sector was therefore likely to be slower.

"*In terms of social factors, labour was cheap because the Black population, [a] disadvantaged population, [was still used widely] for cheap labour, [which also enabled] [greater] profits. It was very close to slavery. Human rights, social rights, all those kind of things were disregarded. But still in the past the political influence. The economic influence, social influence affected the course of the [construction sector's 5Ps]*." (P22)

6.2.3.2.3.3.3 *Ranked 3: Legal factors*

Even though experts group the legal factors with politics, others commented that the legal framework of the pre-1994 construction sector was more stringent than the current one, as it was driven by the harsh political system of that time. It was partly the legal framework of that time that made the construction sector function better than the current construction sector.

"*The legal [framework] was very strong. There were cases in those times but with consequences. The punishment was very drastic. It is death penalty or hanging. Hang them.*" (P22)

6.2.3.2.3.3.4 *Ranked 4: Technology*

In the past, technology was not as advanced as it currently is, and construction processes were much slower based on the technology that was available at the time. Built-environment professionals, including quantity surveyors, had more time to carry out their tasks than they do currently. To increase productivity, more workers and professionals were needed. Technology has increased the process of delivery. It has, however, increased the number of competitors and somewhat devalued the work of quantity surveyors.

"*They were slower [the delivery processes]. I think they just understood that projects took time. We didn't have all this [technology]. Concrete took 28 days to reach strength and then you build on top of that and you would let the brickwork dry and then plaster it and then let the plaster dry and put your paint. Now we're running multiple processes. The brickwork is up and you are already plastering. So we finding the shrinkage on plastering, which becomes a quality control issue, but it's also become a*

by-product of the process. So we are using dry walling instead of brickwork, why? Because dry wall is quicker.

"*We are using steel frame with boards. Because people are trying to make the structure lighter. They [are] looking at alternative technologies. In CVY we did a steel frame structure and they put these smart boards on and then we taped them and then we plasteedr that board and when you finish it looks like the existing building. Same functionalities. Same, you wouldn't know that it was any different.*" (P5)

"*So whereas, you know, in the past you had that lead times and the chance that you had to look at it, to look at an architect's drawings, [that] may have been weeks or months. It's now probably hours. You probably get something on [your] cell phone. And you probably are expected to give a cost estimate within minutes, and it has to be accurate and you haven't got the time. You've got the details there, so you can't not engage with it. But the time that you've been given to engage with [those] details is probably [next to] nothing. So I think that how the technology has changed [has] been to 'telescope' your work and to increase the number of competitors in your field and essentially devalue what you do.*

"*Because people now think, everybody thinks they are a photographer because they have a camera on their phone. And everybody thinks they are a quantity surveyor because take-off of quantities is happening almost automatically. It is very quick to work out. So everybody thinks they are a quantity surveyor.*" (P23)

"*Out of five that were working in a project, technology would wipe out four. Only one must stay. And now the four need to think on their toes. And that's why then this expansion then, your cost engineering type of thing [happens].*" (P11)

6.2.3.2.3.3.5 *Ranked 5: Environmental factors*

Environmental factors did not influence the construction sector and quantity surveying much in the past. They have only recently gained some influence on the construction sector and the quantity surveying profession.

"*In years gone by, we just pump the carbon dioxide out. We didn't worry about it. Now, we're obviously realising the effect on the environment.*" (P3)

6.2.3.2.3.3.6 *Summary of past factors that influenced the construction sector and the quantity surveying profession*

Similar to findings about the present and future factors, in the past politics and the economy were the two dominant factors that influenced the construction sector and the quantity surveying profession.

Although politics seems to have a much greater influence than the economy. Social factors were once again important in influencing politics and the economy, hence they were ranked second to politics and the economy. The legal framework was effective in spite of its harshness. In the past, environmental factors played a much less important role in the construction sector in the past.

6.2.3.2.3.4 Analysis and discussion of the socio-technological factors likely to influence the current quantity surveying profession and their potential influence on the current role of the current quantity surveying profession using Geels' MLP Framework

The quantity surveying profession's landscape

From the discussion of the factors likely to influence the current quantity surveying profession, and the potential influence of socio-technological factors on the current role of the current quantity surveying profession (using Geels' MLP Framework), the political and economic factors are the two factors most likely to have a greater influence on the quantity surveying profession. Technological and social factors are also likely to have an increased influence on the profession. Environmental and legal factors currently have the least influence on the profession, and are likely to remain so in future. The environmental factors might, however, increase their influence on the profession in future, although that influence might still be less in comparison with other factors. This is because there are other, more pressing issues in South Africa, such as job creation.

The findings demonstrate that changes in the socio-technical system of the profession will be influenced by the landscape's developments. Landscape will influence how the socio-technical regime and the niches respond to the pressure applied from the landscape developments.

The quantity surveying profession's socio-technical regime

How the socio-technical regime responds to the pressure applied to it from landscape development will determine whether there is change in the quantity surveying profession. There is a likely to be pressure applied to the regime from the niches as professionals and firms attempt to survive the landscape developments. The question is will the regime be able to withstand pressure from the landscape and the niches?

The quantity surveyors' niches

Pressure from the landscape might influence the professionals and firms to find ways of circumventing the regime's current standard and norms, in an attempt to survive harsh political and economic conditions. These measures, if effective, might become widely diffused and become the new norms.

Developments in the niches might start pressuring the regime. This pressure might lead to changes in the regime or the replacement of the regime with an entirely new regime.

6.2.3.4 Objective Four: Identify the quantity surveying tasks that are at risk

The literature revealed that the quantity surveying profession is instituted according to its tasks, that is, it follows the trait approach. In South Africa, the work of quantity surveyors is legislated and identified in a document called 'Identification of Work'. The premise of identifying quantity surveying tasks at risk from automation or complete extinction, was to determine whether by losing traditional tasks, the quantity surveying could still be regarded as a profession. What would give quantity surveyors their legitimacy in society if society no longer needs them to perform those original tasks, or if technology strips them of their traditional tasks?

The literature identified traditional quantity surveying tasks that were at risk to automation (Kulasekara et al., 2013). Experts were asked which traditional tasks of quantity surveyors were at risk of extinction, particularly because of technology. The reasons for soliciting this information from experts was to first test the claims by Kulasekara et al. (2013). Second, it was to determine the security of the position of quantity surveyors in society given that their tasks are threatened by technology. Table 6.9 shows traditional quantity surveying tasks experts claim are at risk of extinction or replacement through automation.

Experts were asked to select tasks that will potentially cease to exist in future, that is, be lost to technology or automation. After ticking against those tasks that were at risk, experts were asked to explain their choice. The results were synthesised and are provided in Table 6.9. All experts agreed that all the traditional tasks will still be required in society in future. What experts did not agree on was the extent to which automation of these tasks will be realised. Table 6.9 shows the risk of traditional tasks to automation.

Table 6. 9 Traditional quantity surveying tasks most at most of being automated

	Traditional quantity surveying tasks	**Risk of extinction or automation**
a	Quantities take-off	Mostly at risk
b	Bills of quantities preparation	Mostly at risk
c	Cost estimation	Moderately at risk
d	Cost planning	Moderately at risk

e	Cost reporting	Moderately at risk
f	Cost control	Moderately at risk
g	Material procurement	Not sure
h	Payment application	Moderately at risk
i	Value management (VM)	Not at risk
j	Life-cycle costing (LCC)	Not at risk

Quantities take-off and bills of quantities preparation at most risk of automation

According to P20, P19, P9, P2, P8, P5, P7 and P16, quantities take-off and the preparation of bills of quantities will be completely automated in future. This is because in future, "*You are going to get drawings that are going to electronically spit out your bill, your BOQ , just from the drawing*" (P9). P2 is of the opinion that AI is going to play a big part in stripping away the quantities take-off and bill preparation tasks of quantities: "*…quantity take-off, I think, is going to be computerised. I mean if you look at artificial intelligence and computerisation, that's going to die. Bills of quantities preparation is going to be automated*." Another way of generating quantities and preparing bills will be through CAD, Revit and Excel spreadsheets, "*So I don't think quantity take-offs will exist in the future. I think that those things will be automated out of CAD. You can generate bills of quantities [out of CAD]. Quantity take-off I can already do on Revit. Bills of quantities preparation, I can spit out an Excel spreadsheet...*" (P5)

Other experts (P15, P23, P13) claim that technology will reduce the time it takes to carry out quantity take-off and bills of quantities preparation. For instance, P15 claims that the time spent on all traditional tasks will reduce, with the exception of value management. "*I think the time we are spending [on] these will reduce. I think in all of them, I think they are more likely to be reduced. I think except maybe in value management,*" (P15). This is because ICT will assist quantity surveyors in thinking. Quantity surveyors will thus shift their functions from traditional tasks to client care and other issues. "*The ICT will assist us in thinking, in reducing most of the time that we're spending on this, and then our focus would be more in client care maybe; [also on]other social issues and so on and so on*." (P15)

Traditional quantity surveying tasks moderately at risk of automation

Table 6.9 shows that cost estimation, cost planning, cost reporting and cost control are at moderate risk of automation. Experts claimed that these tasks require some human analysis and interpretation. Some aspects may be automated but not in their entirety.

"*[Cost] estimating. We [QS] are going to have to do [this] because yes, you'll know how many square meters of brickwork but we're going to have to decide, well, what is it going to cost?*" (P9)

"*Cost estimation, I think it's going to stay at an advisory level*." (P2)

"*Cost planning. Yes. That's that will remain. Cost reporting, absolutely [will remain]. Cost control, yes, but some of it will be automated. Automated, but someone has to understand what the answer is. And what's not here, so your cost control, you're using it in end-value type analysis.*" (P2)

"*I mean that [payment application] will remain, but there'll be a lot of automation, [but] someone actually has to sign it in the end.*" (P2)

"*Cost planning, requires a bit of human analysis*." (P19)

"*Cost control, no [it will not be automated] because that's always interpretation*." (P5)

"*Cost planning will be there. Cost reporting, again these are intelligent interpretation of that information. The interpretation is what is defining the QS profession*." (P5)

"*Cost planning I think that's a computer modelling. Computers lack the contextualisation. So in all these, that's why I always apply a percentage [that a certain percentage will be done by humans and a certain percentage by machines]*." (P13)

There were contrary views with regards to payment applications. Some experts claim that these can be easily automated with little human intervention.

"*Payment could be, could be automated*." (P5)

"*So for instance if that [payment] is integrated into something like a BIM system. Then you're able to say," what has been constructed up to the sill ? And that portion we've got up to roof height. And all of that has been integrated*." (P19)

Overall, the majority of experts are of the view that cost estimation, cost planning, cost reporting and cost control require some human intervention, even though some aspects of these tasks can be automated. Hence they were rated moderately at risk of automation.

None of the traditional quantity surveying tasks are at threat to extinction or technology

Some experts perceive that all the tasks will still exist in future, but they will be offered differently. For instance, P22 claims that the bills of quantities will be "*more digital, more interactive*". P21 thinks that tasks will be better managed in future. "*I don't think any of these stages [tasks] are going to evaporate … these are going to be better managed in future*." (P21). P11 shares the same view, "*I think the quantities take-off. I mean already you got your CADs and whatnot. So but what do you mean not existing? It will exist, but it will be done in an efficient manner. It will exist. And the bill will be there and the estimation will be there. All of them will there but they will be done more efficiently*."

P21 and P20 further assert that technology will always require human intervention.

"*The one thing that has come and is obviously influencing our day-to-day is the use or rather the technology that is currently at our disposal, which I still think it's not without a human factor in it. It can't at this stage, we can't leave it to the machines. There [is] still a lot more that is required in terms of how that technology is used. And yes, it has made it slightly easier and slightly, slightly faster for us to do what we can to do. I don't think it's a threat as such.*" (P21)

"*So I just feel that, the artificial, QS have not developed themselves. They are scared. They are thinking that if there's an artificial intelligence to run QS, it will kill the job. But I don't think it will kill the job of a quantity surveyor, because that artificial mind or whatever robot will depend on the QS to be able to do the work.*" (P20)

P18, P1, P6, P12 and P14 claim that the traditional quantity surveying tasks cannot be lost to the profession, as they are the core of the profession or the fundamentals, "*I mean that's the fundamentals… it doesn't matter whether the architect shows you a 3D or what have you. You have got to measure it. Somewhere along the line. But there has to be those fundamentals in place.*" (P18)

"*I'm almost going to be a little mischievous by saying all of them [traditional tasks] will still be required. … the financial advice that you give the client is not really whether you measured it by BIM or whether you measured it with a scale rule. The one might be faster than the other, but at the end of the day, the client couldn't care how you get it. He will say, 'information?' How you get the information, he is not too bothered about that anyway. He just wants some information.*" (P1)

"*Measuring [taking off], measuring has to be there. I might be talking like a QS here. I'll tell you why it should be, it should be there … So I'm saying take-off has to be there. Even accountants, they tick bank statements. You know, there is this thing of being fancy. Actually that's what kills the profession.*

"*And before you are those things [fancy things] you need basic things. So there is this thing [of being fancy], it confuses people. So I'm saying take-off will be there. I think QS will die before take-off. Bills [of] quantities. Of course [will be there]*." (P14)

P3 cites the economic factor as the reason the tasks will remain in future. "*You can't ask for a lump sum. You have to do a bill of quantity of some description because how's anyone going to price? … And the drawings that you get to measure from are getting worse and worse because they [architects and engineers] don't have the time to do it. So you're always going to build. So everything we [QS] do is always going to stay until they [client] change their mind [about how things should be done]… but that's never going to happen because it's all to do with return on money*."

All the traditional quantity surveying tasks are under threat from technology

P10 is of the opinion that all the tasks of the quantity surveying profession will be automated in future. This is largely because quantity surveyors are currently not carrying out these tasks efficiently. Quantity surveyors' measurements are not accurate when compared with actual site measurement and this in turn affects all other aspects of the traditional tasks, such as estimating and cost reporting.

"*Firstly, the life-cycle costing is largely affected, because if any of the ones that you've got on the list fail, this [life-cycle costing] will never be achieved.*

"*Now what we find [is] that the quantities are taken off but they're not ratified. Yeah ratified ... the quantity surveyor would take-off the quantities from the document, but when one arrives on site it could be something less than what has been taken off on the document or it may be different. Then it begins to impact on the bills of quantities. How truthful are they? And then it has a domino effect, the cost estimation becomes wrong. The cost planning becomes even worse. It [quantity take-off] doesn't exist because you're planning on things that are hypothetical. And then it goes further – the cost control doesn't exist because you've got no resources that you can control*." (P10)

P22 is also of the view that traditional quantity surveying tasks will not exist in future. This is because technology is going to substitute quantity surveyors. For instance, there will be no hard copy of bills of quantities. Bills of quantities will be digital and interactive in future.

"'*Okay, I've got my title. I am a professional QS'. You're eventually going to fall behind compared with the new graduates. Eventually, you have to keep yourself running. To catch up on the technology. To catch up on the methods. New methods of measuring or generating cost estimates, for example. No longer the conventional. It is more advanced. Technology is put into operations to facilitate, to reduce*

the time, the cost. You spend the time generating your intellectual property and minimise the risk. Minimise the human factors. The human errors. Remember that was my first statement, 'quantity surveying tasks will not exist in future'.

The core functions will be more different, because there will be the technology that will assist us with the tools. Are we going to have a bill of quantity? Maybe it's a digital one. Let's say more digital instead of having a hard copy, it's digital. More digital. More interactive." (P22)

Traditional quantity surveying tasks not at risk

Even though value management and life-cycle costing is listed as one of the tasks of quantity surveyors in South Africa, it is not currently carried out widely by the majority of quantity surveyors.
"*Well, life-cycle costing, I can take it off [from the list of future QS tasks]… even now, people are not doing it. Currently we don't do those [material procurement and life-cycle costing], they don't feature much in the day-to-day quantity surveying work.*" (P12)

"*So this value management I have not seen that. Life-cycle costing is not happening enough. 'Cause sometimes you request it and you find that people [QS] just don't even know how to do it*." (P19)

Quantity surveyors might currently be avoiding life-cycle costing, as it involves complex calculations (Ashworth et al., 2013). In future, these calculations might be simplified through the use of software. Perhaps this is one of the reasons the majority of experts claim that VM and LCC will be carried out more in future.
"*Life-cycle costing will be the future. Value management will be [the] future*." (P8)

"*So the big push, as well now, is value management on the whole life basis*." (P2)

"*One of the biggest areas where that value is required is in value engineering. Where specialisation is really needed from the perspective of quantity surveyors. Because the designers can produce what is efficient in their lines of competence. But the bottom line, within a life-cycle cost, is being able to look at all the scenarios. I think that's where specialisation can be improved through quantity surveying. So it's not just costing but it is analytical costing.*" (P19)

"*So I think the scope of the QS is going to change. They could well end up broadening it, absorbing other [roles] or being absorbed in project management. I don't see, I think that you're going to get more, certainly on the one side you're going to have the designer and the quantity surveyor is going to*

be interfacing with designer to manage the cost of design. Because that's where you can manage the cost; the earlier you can manage the cost, the better effect you got. So they will be involved there and they will be the one managing the cost through the life of the project. Probably. The thing is that, that is a whole-life approach. I think that's going to change so. Definitely they are there and it will be a broader scope than the narrow focus on capital value." (P2)

Life costing will not only be carried out to a larger degree in future, but it will also broaden when taking into account the additional social and environmental aspects. Humans will carry out 30% of the LCC aspects, while machines will carry out 70% of the LCC functions. It will evolve into value life-costing as creating value will be more important in future.

"*Traditional life-cycle costing is too narrow. In the sustainable development space, life-cycle costing will need to look at your economic, your social and your environmental. So when you talk life-cycle costing, it incorporates sustainable development and you need human intervention. When you talk life-cycle costing you are talking about physical things. Those can't be modelled by machines. So in the narrow definition of the QS role, we'll have limited scope, probably 30%. And the 70% will be done by the machines.*

"*But in the broader role of life-cycle costing, where value [lies in] what you are doing the life cycle of, so this life-cycle costing, maybe we'll need to call it something else, because it gets people to [limit] themselves to costing. But it should be the value over the life of the project. So when you talk about the value over the life of the project, [it] is no longer about life-cycle costing. That's where we [QSs] can add much value*."(P13).

P20 and P19 support the assertion that the life cycle will also be automated in future, with P19 stating, "*Life-cycle costing, if it is based on formulae and that's algorithms, isn't it? So it actually can also be done through technology. Because you've got your variable; as you stick in the variables, the correct figures, 'boom' – there's your answer*."

Experts not sure about material procurement

It is evidence that the quantity surveying profession has evolved, since most experts claim that material procurement is not part of the traditional role of a quantity surveyor, in spite of them at some point in history being regarded as "*brick counters*," (Klein and Dalgeish, 2007).

"*Material procurement? I'm not so sure about it. I don't think it's that necessary. It doesn't happen a lot. In fact that thing to me, QSs can work without it, as far as I'm concerned.*" (P14)

"*Currently we don't do those [material procurement and life-cycle costing], they don't feature much in the day-to-day quantity surveying work.*" (P12)
"*I mean this, this material procurement. I mean, we don't really get in that.*" (P1)
"*I've worked with QSs in doing cost estimation, some cost planning, some cost reporting. Not very much on cost control. Never on material procurement.*" (P23)

P21 claims that material procurement is done by quantity surveyors to a "*very little extent*". Even though material procurement could add value to projects, P22 claims that this task is currently not carried by quantity surveyors because they are not paid for it.
"*Yeah [material] procurement. I've been crying because I cannot shout anymore. Because I need that [material procurement service from QS]… In the NEC, for example, we are trying to ask the QS to assist us [with material procurement]. Some of them refused to do it. Because they don't get paid for it.*" *(P22)*

P14, a quantity surveyor, concurs that they do not generally do material procurement, as clients do not see the effort it takes to do it and they are also not paid for it.

"*Material procurement, I don't think it was there in my opinion. It's [a] fairly new animal because there are few clients now that say, 'I want to build my house. I want to know [material quantities]...' To me. I don't want to offer that service. One is time consuming. And two, people don't understand the value of it. You have to do bills of quantities; after doing bills of quantities, you do this thing [material procurement]. So people don't see that. They only see this [end results] and remember they want to save cost. But who pays for that?*" (P14)

Others (P19, P7, P2) claim that material procurement could be automated because it is, "*Just placing orders,*" (P19). This is a view shared by P13. "*As it stands now, in the automotive industry, no one does that [material procurement]. You go into your computer, you enter your spec. I am buying a Mercedes-Benz. I want this and this. And the car goes through the machine and the right things are put in the right place. So if I've got this thing broken down into smaller components, with [a] delivery date for each component, why do I need a human being? I need a human being to adjust the dates, that's when there are changes. Otherwise, it's automated. It orders for you. You just put [in] times. You set up standard times. 'This one is a lead time of two weeks. This is the lead time of this and this', and when the programme reaches there, it orders, reaches there, it orders that's the beauty of your 7D models. Because it [groups] your procurement, your cost, your schedule and all of that into one. So then you don't need human beings.*" (P13)

P8 claims that it will not be a quantity surveying task, "*… this material procurement, I think it will be gone. It is almost gone now.*" Given the divergent views about whether material procurement is a traditional quantity surveying task or not, material procurement was assigned "not sure".

6.2.3.4.1 New tasks and roles for the quantity surveying profession

Many experts perceive that there will be new quantity surveying tasks in future. Current changes in society and technology will influence the tasks and the role that the quantity surveyor will play in society in future.

Project management or principal agency role

In future, quantity will move into the area of leadership in construction projects. The role of the principal agency and project manager, which was traditionally an architect's role, will be taken on with greater frequency by quantity surveyors.

"*I think this thing of taking the leadership, you know, within the professional team, is going to be more and more. It's going to be taken more and more by quantity surveyors. Architects have failed. So one of the roles will be team leader or principal agency or whatever you call it.*" (P12)

"*So but I just, I feel that at the end of the day, it's just like now, I feel like more than anything in construction, the quantity surveyor is the best project manager. And this is how our profession has progressed. But I feel that more than anything, the project management was a perfect scenario for the QS to becoming [a] principal agent. Because traditionally it's always been an architect. And an architect is because of the look and feel and how these things should do. So I feel – I think that eventually a quantity surveyor is going to be synonymous [with] a project manager.*" (P20)

Quantity surveyors can fulfil the role of project leadership, not only because architects have failed but also because their skills allows them to move into that role, as does the current legislative framework.

"*So I think the nature of QSing as a profession is going to change and I could quite easily see them taking, I mean you'd think that most PM's professions, [their] project management efforts would have come out of the engineering field. They come out of the QSing field, a lot of them.*

"*I see a blurring between the, maybe thePM role, [seeing it] break up a bit. Because the PM role is about delivering the project, on time, on cost, to the right quality. So if you take time and cost and put them together, isn't that a role that logically goes together and then there's a level of planning and control? So I see that there's a blurring of the project management and the quantity surveying roles,*

where the project managers [have] sort of said, 'Oh we manage the cost, time and quality'. Do they? Is that right? So I think that it could be that QS could well be looking to say, 'Hang on that PM function is actually our role and we actually run that'." (P2)

"*Yes, there's an element of acting as [a] principal agency. You may find that people are going to go more in that direction, but there [are] tasks that are [still] there. They are not new. It's maybe an overlap between us and the project manager, [where] we could step more into the project management field and offer a wider service. I think we are well geared as the quantity surveyor to step into that realm. I think so. It's not new to us. I mean we [QS] can act as a principal agent already. Some people choose to do it. Some choose not to do it. Legally we can [become either a PA or PM]*." (P7)

The other reason that quantity surveyors will move into the realm of leadership is that innovation will drive quantity surveying to that role. As clients seek innovation in their developments, they will seek to know the cost thereof from the onset, thereby pushing quantity surveyor towards a leadership role.

"*I don't think it [innovation] will affect the role. It's the role of the quantity surveyor that should actually follow the innovation. So, the quantity surveyor may find himself not being in a team. Like I said, being in the leadership position. And that becomes a very, very important element. I mean the client always wants aesthetics. Wants to know about the model and is this thing viable or not? Do we have sufficient resources?Where do we source resources?Those are the basics. But if you're not leading, then you cannot have that conversation with the client. Because you will have to drive these new innovators.*

"*And QS now sits down with the client in the development. That's how I see it – enable the development. You might have to handle other aspects like town planning. Manage those aspects. Land activation activities. Because this role needs to follow the innovation. And the client needs them. Will always need the QS to model the development. That's how I see it. Unless the client does it himself*." (P6)

6.2.3.4.2 The role of technology in influencing the tasks and future role of the quantity surveyor

As technology substitutes traditional quantity surveying tasks, some experts perceive quantity surveyors as developers of those computer applications. Quantity surveyors will thus, become technology experts in the construction sector

"*Developing apps that would do the work; so rather than gaining income from each job that you [the QS will] do, you gain from each time somebody downloads the app that you have fine-tuned, that gives the best results*." (P19)

"*Like [QS become] technology experts type of things but more into advancing the technological industry side of things. There will be the skills that will fit into the requirements of the tasks of the development. Like we have been saying, they'll find themselves in spaces that are not traditional quantity surveying tasks*." (P8)

While others see opportunities that technology can create for the quantity surveying profession, P23 regards technology as a threat that could make the QS profession redundant.

"*I think you are going to have AI and [the] Internet of Things and things like that. I don't know how you [QS] do your job. I assume you phone up Union Tiles and you say, 'Give us the brands of this, [for this number of] square metres of this kind of tile.' Or you've done it a hundred times and you know, pretty much you just add some things right? But now you could eventually have a database and it [will] work out an average costing. It will update when the price of steel on the international market falls and stuff like that. And so you will get better and better data automatically without sitting and crunching it. I assume. So I don't think you are needed any more*." (P23)

Specialisation in the quantity surveying profession

Not only will technology influence the future tasks and role of the quantity surveyor, but the nature of future projects will require that quantity surveyors expand their role. Many quantity surveyors will be required to specialise.

"*[Construction] will be more complex. They [QS] will need a new approach. We are going to need specialised quantity surveyors. Maybe this quantity surveyor only specialises in concrete. This one is just [working] on new technology, things like that. I think we need more specialised QSs. Before we have a quantity surveyor doing everything, but now we need more specialisation, like on air conditioning, or things like that. We need more specialisation, more speciality in the quantity surveying [profession]*.

"*The construction [sector] has become so sophisticated ... Just to give an example. Now, when we design, we design with 3D dimensions. And then the QS must understand the design. The design has become so complex and the quantity surveyor must understand the design*." (P4)

Quantity surveyors will need to stay abreast of technological change to meet the needs of the clients.

"*There will be a need for them [QS] to keep up with technology. Because systems of how they are doing things will keep on evolving. Evolving in order to match the need of the clients. {the] client's needs. Because I mean, as time goes, the technology of how things [are done], could be material that we are*

using in the construction sector, etc. So, they actually have to know about what's new in the industry and understand those products. So that now they can apply their costing models to changing technology in construction, in building houses, in building properties..." (P17)

Quantity surveyors as data experts

Data in the construction sector will be the ambit of quantity surveyors. Quantity surveyors will not only manage the data, they will also convert it to suit the need of a particular economic outcome. This is because quantity surveyors understand costing better than other professionals within the construction sector. The role of data expert is, however, still contested and if quantity surveyors do not lay claim to the role, others will take it from them.

"*I think the primary role will be the translation of technical information and data into social and economic intelligence. Thereafter it will be turned into economic infrastructure. So we should be able to measure a QS by [their] ability to create opportunities beyond the project. Because those are your economic spin-offs from the project. That would be a strategic role by a QS, because of the fact that we understand the value chain better than others, from a materials' point of view*.

"*But if we fail to play that role, because computers can give everyone the data, others will do the interpretation of that data. So it's not a space exclusive to us. It is a space we need to claim*." (P13)

Information manager

Quantity surveyors will in future play the role of information manager.

"*I think that IT part, the information part of the construction [sector] will be from the quantity surveyor. So the quantity surveyor is going to be an information manager. Maybe it's because of my background, but I see as with mechanical [engineers], you only look at the mechanical [aspects]. With [an] architect, you obviously look for everything, how they work. And at the end of the day, an architect is still going to depend on the structural engineer for all [these] things. But in order to manage the information, with regards to what's [happening] on site, the quantity surveyor's going to be the one*." (P20)

Quantity surveyors can play the role of information manager because the quantity surveyor's role will in future extend to include life cycle costing. To do life-cycle costing, quantity surveyors should collate the data from the construction phase.

"*It will be a QS because he's central to everything. From payments to close out, to [the] future even, when the building is finished, they QS is still part of it because at the end of the day, you still have to make sure that that building is performing according to what [was] planned. So you still [ask] the quantity surveyor to evaluate it. That will be the QS's work to do that. So the QS's future doesn't end*

with the structure being completed. Whereas an architect would finish and that's it. So now you have to do life-cycle costing. All those things are cost related. All those are built from what the QS would have accumulated from whoever has chosen whatever material, or [the] plant and equipment being used to make sure that the building is functional. So the QS has a bright future." (P20)

The other reason quantity surveyors will become information custodians is their costing expertise makes them better candidates for such a position. Architects and engineers' roles are rooted firmly and exclusively within design.

"*Imagine without any sort of grouping of this particular discipline or service, you're not going to be able to manage, because then everybody will do their own thing. I mean an engineer will do their own thing because [they are] an engineer. Doesn't have, obviously an engineer will do the cost management for that particular discipline, because he's more knowledgeable, but then the QS might even become an expert in that particular [area]. Because if you design, you don't design with cost, you design with what you produce, but then the QS, he will be the one who's actually doing that. So that that's basically what I mean … one of the disciplines that will that easily progress into a technology face, in terms of communications [and] the way we do things, because design is design.*

"*So for me, that's why I'm saying that the profession is not a dying profession. It should progress with the technology because of a person who's going to design how the information is going to be managed.*" (P20)

Public-private partnerships (PPPs)

In future, quantity surveyors will become transaction advisors in PPPs. This is because of the need to manage cost effectively in a fast-paced society.

"*But they need to be more, sort of transaction advisors in PPPs. Yeah, like it will link into the organisation, into investor confidence. Like in a PPP set-up, where someone sort of designs and builds. And maybe the State or the developers, the owners will have to have [the] financial plan of repayment investment over a period. So I think if you take QS, we will have evolved to that state because things will be rapid and cost would have to be managed very tightly.*" (P8)

P1 asserts that the PPPs' role will not automatically become a quantity surveyor role in future. The PPP role is still being contested with lawyers and accountants. P1 warns that if quantity surveyors do not step into that role, they will miss an opportunity.

"*In a nutshell, there are so many things in the building industry where nowadays we are having the accountants getting involved. You know the public-private partnerships? The hospitals that are done in*

a similar fashion. In the old days, the Government would pay the whole booming lot and then you just manage it in the old way. Now when they don't have the money, you have public-private partnerships and you've got to run the hospital and make money at the same time. And you charge them R20 million a month for the next so many years, but the Government didn't have to pay money up front [for] that sort of thing. That's where (for example) the architect, the accountants are getting into these and these legal firms that sort of, are moving into that sector to a certain extent. And I think that's a sector that if we're not careful, we're going to miss an opportunity there. So those PPPs, I think is a market that we have to move into. I think as far as tax advice is concerned, life is getting more and more complicated, and the tax man is getting more and more clever. And if you can give advice that is helpful to the client in terms of tax breaks, tax benefits, these sort of things, cash flow obviously is a big one and how to fund and who to fund, and by whom etc., if you get involved in that sort of side, I think that could be invaluable information and of assistance to future employers." (P1)

Property and investment

Other experts perceive quantity surveying as becoming more and more involved in property development in future. The reason for moving into the role of property and investment is because quantity surveyors are not cost and financial experts, but they do also understand the technical side of development.

"*Look [at property] development. Some QSs are doing it, but I'm not sure to what scale. But I think [it] is another area that we can do as an added service*." (P14)

"*See if we, if we go with a trajectory that we have now, where we all have developed systems in place that are able to interpret a human mind as we understand it today then our role would gravitate largely to what I'd explained to you. Our role would be the proper financial consultant of the built environment. That is where we should be. That is what we are there for. Together with our finance colleagues from the FS [financial services sector]. There would be [greater] gravitation towards that. But [we would] still maintain [the technical side], because there is also the technical input that we possess. As QSs, we're in the best of both worlds within the built environment. Because we understand how the things come together in terms of that cost. As a purse holder, we understand how they are sequenced from start to finish and we understand the financial impact of any change, whether up or down, [and what that] may do in terms of the money that we are investing. I like this phrase. We, we are entrusted with the purse that is full of money, [and] we must make sure that we use that money wisely in terms of furthering [the] investment appetite [of] a particular client. That is your role. So by virtue of you holding a purse for somebody else, being entrusted with that – 'Hold this for me for this project or for*

this work'. [This]suddenly speaks volumes. And I see us not only having a project life. Project life [has] got an end.

"*I see us having much more advisory input into the economic [aspects of a project], into the technical obsolescence of a building, which brings in another dimension in terms of what everyone had described as life-cycle costing or the life cycle of the building. That is what this thing called quantity surveying is supposed to be appraising. We see a lot of us relied [up]on in terms of investment criteria, in terms of the pricing of certain assets in the marketplace, by the financial institution.*

"*For example, there is going to be much emphasis, in my view (and I know I've been largely opposed on this), on watching briefs on project, on lenders' consultancies, on project appraisals, on these services that are not traditionally what people think of as quantity surveying*." (P21)

In order for the quantity surveyors to move into property and investment, tertiary institutions should offer investment courses.

"*[A QS] can lead. And also, I think the quantity surveying profession at [an] academic level, might introduce courses in investment tailoring or you know investments, you know, at the end you can go and tell somebody who's got money to invest in something and now [it becomes] a different role. It's [an] advisory role in investments or something like that. Because look everybody comes to you and says, 'I want to build townhouses' But you can see that this man has got money but townhouses is not going to give him enough money. But you know what? There's another opportunity, but only if you have done investments as a course and so on and [know] how to finance those investments. If you've got that background, you are able to advise on that before you come with quantity surveying techniques.*.

"*So a person can come to you and say, 'Look I want to build an office block in Menlyn, blah blah because ABCD'. And you say, 'But instead of building it here, I've done an analysis of investment opportunities in the country. It is not as lucrative as when you build the same office in Dubai. And I've done that, I've done an exercise and this is the yield. You compare. If we can do that type of course, we will be in a better position to add on [to] our roles*." (P12)

When asked if this property investment role is not competing with other built environment professions such as property consultancy, P12 said, "*Yeah [it is], but if you don't grow you die. Because they [property consultants] can grow into quantity surveying*." (P12)

Asset management

Not only will quantity surveyors become involved in property and investment, but they will in future move into asset management. As quantity surveyors move into life-cycle costing, they become better suited to become asset managers, which is "*cost management over the whole life cycle*".

"*I mean, we know that [the] RICS is looking at broadening all over the place, when we bump into [the] RICS, doing facilities management. Facilities management has nothing to do with QS. So I think it wants to look at the role of the whole-life cost. Then suddenly you say, 'Okay, but that's not just a planning function. That's a planning, control and monitoring function, over the life of the asset. We are changing the concept of what a QS does, because a QS is only there for the development, construction and planning development, and then they [leave]. But you're left with 50 years of life [of the building]. Who is monitoring that? I think that the role of the QS is going to change, and that they're going to need to change to stay relevant. They need to be at asset management, [at] cost management over the whole life. To be an asset manager. Management basically is cost management of an asset. And that's all they do. So I think there's a shift that's going to happen there. They got to replace it [asset managers], not that it's going to happen. It needs to happen. The QSs will step up and take it or someone will, someone else will step in. So the question is you've now got the association of asset managers. So what the hell do they do? Oh they do a whole life costing of an asset. Really?*" (P2)

Other industries

Quantity surveyors have not explored all the industries where their skills could be applied. In future, quantity surveyors will apply their tasks widely. This is to remain relevant. As technology takes some of their tasks, quantity surveyors will need to move beyond the construction sector into other sectors, such as engineering.

"*Chances are we [QSs] will increase until we have exploited the whole industry. Because right now what we figured out is that quantity surveyors, I mean they started only in one sector. Looking after buildings. But as time evolves, then they realise that but we need that skill in other environments as well. So they move also into engineering and whatnot. Some engineering. And they haven't exploited all of that. So, there is still that gap that is not yet closed – that the quantity surveyors will still move in and close before there is saturation and an optimum level. And then because of technology then we'll start seeing decreases. But while this is happening, this increase moving into all other sectors, there is already reductions that are happening like we've just discussed.*" (P11)

Quantity surveyors will take tasks that are currently done by accountants. Accountants and other occupations are currently doing quantity surveying tasks. Quantity surveyors will in future take those tasks from accountants as they are the domain of quantity surveyors.

"*So because accountants were doing it [S-curves], it doesn't mean it's their job. They were doing it because there was a time when there was no QS in this environment. But now we are here and your skills are the ones that are most suited for this thing. Because it's cash flow. You know, how do they know? What do they know about S-curves and those things?*" (P11)

Banking and insurance sector

Quantity surveyors can work in other sectors, including banking. Their cost analysis skills allow them to apply their skills beyond the construction sector.

"*There are roles beyond that. They work in banks. They work anywhere else. Anywhere you do this [construction] thing, you need a cost estimate. You need someone there to do cost analysis. They are the pay master. There is nothing that you will get paid [for] without it being approved by a QS, and only [a] PrQS-registered QS. Because he takes the responsibility, 'I am making sure that this is fine'. The architect and the engineer we don't worry because you must manage the cost. That's how it goes.*" (P7)

"*But what I have found recently, over the last 10 to 15 years, is that quantity surveyors are going into other fields more than [they did] in my day. So previously you did your quantity surveying; you stuck to quantity surveying, but now there's definitely the people who will go and work in the banks, who'll go and work for insurance companies. So it's a more general degree and they are now going wider. Maybe they still call themselves quantity surveyors but they are working for the banks. Engineers are the same. You have engineers and then they go and work for the banks and they never actually work as engineers. So that's happening more. So that's a good thing. I think.*" (P16)

Property valuation

In the future, quantity surveyors will shift from their conservative role into other roles, such as property valuation. This is because if quantity surveyors can do valuation for work done on site, they can do valuation for property.

"*Right now as a QS obviously you do the estimates then you measure and that's it. And then you just make sure that you manage the costing and cost. I feel like the material costing of what material should cost should be a quantity surveying job. The way we do things should change from there, otherwise we [are] basically going to still use the conservative way of doing quantity surveying … Not only valuations. As a QS, you also would do the valuation in terms of property. So you get some sort of basic accreditation, in terms of being [more than] just a quantity surveyor.*" (P20)

Law

Others are of the view that quantity surveyors will in future move into law, particularly dispute resolution. This is because technology will take most of the traditional tasks of a quantity surveyor and the practice of law cannot be conducted by robots.

"*We'll [QS] become more involved in the law stuff.*" (P16)

"*I think many years ago the likelihood was that the quantity surveyors used to spend quite a lot of their time inputting the bills of quantities and stuff. But then you and I will usually do it over such [a] shorter period of time, which means that we are likely to move towards more of [a] value add, rather than maybe necessarily the bureaucracy and whatever, as the computers and the software assist us in maybe lessening the time that we used to do the traditional stuff. Which means we will maybe be able to get into other avenues, where we might be able to add value. And I think that's what is likely to happen in the profession. Because when disputes happen, they will have to be disputed by people. I don't think we'll be able to give that to the robot and whatever*." (P15)

Procurement, planning, programming

Procurement, planning and programming will become quantity surveying roles. This is evident in the fact that some quantity surveyors have already started performing these functions. Quantity surveyors' skills sets allow them to move into these roles. They already employ planners in quantity surveying firms.

"*I mean we're looking at doing procurement. So it's biting the pieces of cake – what's that got to do with quantity surveying? Absolutely diddly diddly, nothing. We can get into programming. I mean we have got procurement people working for us. We've got planners working for us but their specific planners and specific procurement people, but when you look at what they do, we're seeing that these people can train quantity surveyors to do what they do.*

"*So yeah, we're saying that we can add more and more value. I mean when we do a feasibility [study] it used to be that the engineer would go and get quotes for the equipment. We can do that for them now. And you start building the relationships of both the suppliers and whatever the case may be. So it's just a matter of added service*." (P3)

Another reason why quantity surveyors will move into procurement, planning and programming is that clients prefer an independent person to fulfil these roles rather than an employee. An independent person is perceived to be impartial.

"*Because the clients like an independent person looking after their money. Because if you're independent, you're supposed to look after the money more than if you're just working for a salary. So as long as we remain independent [we] will be fine*." (P3)

Maintenance work

Another area that quantity surveyors will move into is maintenance, which is an area they have yet to move into.

"*So you need a QS to do that. And the QSs in most cases are looking for renovation work and new work, but nobody is doing that. Can [you] imagine now having a small office in Menlyn Shopping Centre, doing preventive maintenance? QSs are not doing that*." (P4)

Town planning

The leadership role of quantity surveyors in a project might propel them to move into town planning in future.

"*And [the] QS now sits down with the client in the development [phase]. That's how I see it - enable the development. You might have to handle other aspects like town planning*." (P6)

Diversification

Quantity surveyors will in future diversify into other disciplines. For instance, quantity surveyors might issue standard drawings with the costing thereof. This is because some architects are issuing standard drawings with costing. Quantity surveyors can in future do the same.

"*Remember the diversification I'm talking about is that when I started the profession I was told that, 'You cannot make money out of the profession. It will make you live comfortably'. So the number of things [you do is diverse]. You can have [a] few buildings that you [work on] to survive. Maybe, [in order to] diversify, we need to say, 'What is it that we do to supplement what we do?*

"*For example, some architects, most architects, they live [and work] out of their houses. The little diversification they do is they don't only design houses. They end up standardising their bills of quantities. They are actually doing what you [the QS] are doing.*

"*[As a QS], what stops you now is saying, 'We're going to get standard drawings and we do houses but we come from the QS side'. We say, 'Mr Client, we're going to give you this service. It's packaged with this little drawing, whatever standard house'. Why can't we do that?*

"*Sometimes we are so narrow-minded that the opportunities are going [one] way, you are going [the other] way. I always make an example that you check it out. I don't know the car you drive but the*

chances are if you driving a Toyota, you see all the Toyotas on the road. That's how QSs think. You get it? That's what you are. So we don't see the other opportunities." (P14)

Multi-disciplinary firms

The diversification of quantity surveying services will influence quantity surveying firms to morph into multidisciplinary firms. Many large quantity surveying firms are already diversifying.

"*And I'm telling you now, if you can, start QS work [in] a multidisciplinary [firm]. You need a little bit of engineer there. You must remember there is this thing [concept of multi-disciplinary] that is not tapped in . You can create a lot of work.*" (P14)

"*XXX started off as a quantity surveying practice. If you go into XXX's website, you don't find the words 'quantity surveying' anywhere. That's just one of the services that they provide but they do all sorts of other stuff as well. So they've seen the value add that the quantity surveying company can do. So they changed. They provide a holistic service, project management everything, and quantity surveying is just one of those pillars in there.*

So they've seen that opportunity and quantity surveying companies that are going forward. That's what's going to have to happen, because if some new technology does come in, that makes quantities obsolete. That sort of a model automatically has detailing; that would kill us. But if you're now still involved, we do other things. There's other things to fall back on that you can still do. In the building industry, you have specific quantity surveying companies and that's all they do. What you're going to find is that quantity surveying companies in the engineering field don't just [offer] quantity surveying services. That's just one of the services that they provide, the project management, the cost control, the procurement, the planning and all those sorts of items that you can do." (P3)

Bigger development and bigger scale

In future, quantity surveying professionals might apply their current skills to developments of greater magnitude and scale. Up to now, quantity surveyors' role has largely been limited to construction projects.

"*The new tasks? The future will be sort of like town development… It will be happening on a bigger scale. So, you'll be combining a lot of skills. Currently we have a project manager, but then a project manager is limited to the projects, whereas quantity surveyors will sort of be the economic drivers*." (P8)

"*Quantifying cost and benefits and value propositions ... but not only at the scale of the building, but at bigger scales. Because at the moment your [the QS's] unit of measurement is wrong. So you [the QS] have to transform your scale. But you haven't calculated the cost to the environment. The cost to the person. And quality and all sort of things. So there's a great job for you to do. The rest – you don't need that.*" (P23)

Quantity surveyors working in-house as consultants for clients

P17 perceives quantity surveying as working in-house for clients in future. This will save them the cost of having to appoint quantity surveyors on a project-by-project basis.

"*So as a developer, I'll probably have a quantity surveyor in-house. Instead of me going to a firm of quantity surveyors*." (P17)

Quantity surveyors as CEOs of parastatals

In future it will be deemed best practice to appoint a quantity surveyor to lead big organisations, such as Eskom.

"*Which means that they need to start moving out of that [traditional QS]. Because if you look at maybe, let's say, company chief executives it is usually the attorneys and CAs. You hardly [ever] find [an] architect: 'Oh the Eskom CEO is an architect'. And then also the engineers and also the quantity surveyors have not run these firms [all that much]. I think we need to start looking [at] that angle. Because, strangely enough, even companies like your XXX, one of our largest construction firms, they didn't have a professional quantity surveyor in their old divisions. Which means is a bit of a crisis. But then while as much as maybe no firm is instructed to hire a CA as the finance manager or director, it is good practice for them to acquire one. Same with maybe the head of legal.*" (P15)

In order to move into those spaces, however, quantity surveyors need to market the profession widely to politicians and society.

"*We need to develop politicians. Social and society activists, politicians, [we must say to them], 'We are quantity surveyors'. The business managers and business administrators who are managers. That's one of the space we need to start looking into, rather than people getting out and practising without [considering] other options. And I think that's where our future lies.*" (P15)

There will not be new tasks

P10 claims that there will not be any new quantity surveying tasks in future. This is because nothing has changed and quantity surveyors have failed to master their well-conceived traditional tasks. Another reason for their thinking is quantity surveyors will still be needed to carry out traditional quantity

surveying tasks, as software could potentially hold embedded errors. Quantity surveyors still need to use their calculators.

"*No, life hasn't changed. It simply just got accelerated. So there will be no new tasks … Because the old tasks have not been achieved. They may change the name or the complexion or the strategy but these [traditional tasks] were well-conceived and they've been very successful over the years. I don't think they'll change.*

"*Even now with the new technology, whereby I mean quantity surveying is done by software more than by the brains of the people behind [the machines]; but software can have [its] own faults and nobody would want to account [if something goes wrong]. I spoke to someone who [had] issued a document [at some point]. When I raised the question on the document, they said, 'no but that's the software'. 'Yeah, the software was programmed by a person and I ask you to do the following. You need to know when it's going wrong. That's all.' I almost fired the person. That was the only [feasible resolution]. I said 'Do not rely on the software. Go to the basics. If you need to do accounting, do accounting – first by your own calculator. You understand? Because if there's an error embedded in the software, you'll always [blame] the software'*." (P10)

Same tasks, different approach

P6 concurs with P10, saying that there will not be new quantity surveying tasks, but rather that innovation will influence current tasks and how they are approached.

"*The QSs have to innovate, to create. I don't think they will be new. I think the modelling and all that will remain the same, but it's basically the approach in terms of innovation. You're just going to take a building, let's say it's a 3D model [of a] building. How are you going to quantify it? Are you going to do it cubic metres? In the future, we will see a lot of modular buildings, which [will be] based on innovation. It will be [focused on] sustainability, material, [the] structural rigidity of it. It will be fabric and the aesthetics*." (P6)

New quantity surveying tasks may not be quantity surveying tasks

While there might be new tasks carried out by quantity surveyors in future, these may not be classified as quantity surveying tasks.

"*There will be tasks done by quantity surveyors, but they may not necessarily be quantity surveying tasks. But as I said, with the knowledge that we've got, you can do other things as well. So that's what has been happening and what will happen. That we will become more and more involved in other things outside quantity surveying*." (P3)

New tasks will not affect the role of QS

P16, a quantity surveyor with over 40 years' experience, claims that new quantity surveying tasks will not influence the current role of quantity surveyors in the future. Quantity surveyors will continue to remain in their core services in spite of some quantity surveyors venturing into new opportunities.

"*When I was at university all those years ago [we had] the same issues. There were the same opportunities. And the other ones were costing and all that. It was talked about all those years ago. But what happens is, it's [new tasks and opportunities], [but they're] not at the core of quantity surveying. It's like an added service that you can provide.*

"*So now if you are a busy quantity surveyor and you are making money and you're happy with your job, then you say, 'Well I don't need to do this'. I've got the skills to do them and there is a demand but I don't get to do it, you know what I mean? Because I'm too busy doing my core job, which is a quantity surveyor but I think the profession will become more generalised. So there will be quantity surveyors that do that, you see?*" (P16)

6.2.3.4.3 Future of the quantity surveying profession

Since (according to its current institutionalisation), the existence of the quantity surveying profession hinges on the tasks that it offers, experts were asked, given the changing nature of their tasks and the encroachment of technology, whether they think the profession will exist in future. The findings reveal that the majority of experts perceive that the profession will continue to exist in future.

The quantity surveying profession will exist in future

Many experts believe that the quantity surveying profession will still exist in future."*I believe it [QS] will always exist*." (P6). This is because quantity surveyors are not mere "*brick counters*".

"*I don't see that [QS] going away. The perception that some people have – that all we do is count bricks. It is but one small element of what [a] QS does. The actual measurement of getting the tender document out, etc. etc. [that is also part of our role]. Different ways with different contracts all that sort of thing is starting to add to the benefit [of having a QS in a project]. But, the perception that all we are is brick counters, I think anybody that argues like that doesn't know what we do really.*" (P1)

P16 claims that in future there will be quantity surveyors required in society, but they will doing fewer technical tasks. "*So you [are] doing less of the technical side, more of [the] expertise side*". (P16) "*So yes, it [QS profession] will exist. [But] it will be different.*" (P3) The main reason the majority of experts believe the quantity surveying profession will exist in future is their cost expertise.

"*Because project goes together with the costs. Project goes together with cost control. Everything goes together. [They] will still need the quantity surveyor.*" (P4)

"*Yes [the QS will still exist]. Because the service [costing service] still has to be provided. Nobody else is going to [provide the service]. The architect is not going to take [on] that role. The project manager is not going to take [on] that role. So there's nobody who's going to step in and do it. It still needs to be done.*"(P7)

"*Yeah, yes [it will still exist]. Because of the demand [for cost].*" (P17)

"*If you're going to build anything, it's going to cost money. There's always got to be somebody that works out costs and [whether] it makes sense. Anybody that argues that the QS is going to become irrelevant, my question [to them] would be, 'Well then who is going to do it?' Is it going to be the architect? Is it going to be the accountant? Is it going to be 'I think I am so clever engineer?' Who is it going to be?*" (P1)

"*They are the principal agents. They are construction managers and they control the cost. They are able to say, 'No. No, you can't go beyond this cost'.*" (P7)

"*So we do need people. We need people who can actually administer contracts. That is absolutely critical. And we need people who can add wisdom and who can manage costs. Costs are very much related to resources, and that's going to be a profession forever. To be able to predict how much something costs with accuracy. To manage something. To extract value. Those are skills that are transferable. Those are skills that have been required since [ancient times]. I'm sure that the pyramid [builder] had a guy managing quantities. Managing materials, logistics, procurement and keeping an eye on being an honest broker. Being an honest broker. You always need that. As long as people have materials and whatever. Yeah, you're going to need that.*" (P23)

"*So I think the nature of the profession will still be there, because at the end of the day, the focus of the delivery of infrastructure is cost-driven, [it's] financially driven. So people are putting up money, they need returns and to be able to do that they have to do to manage their costs. And the quantity surveyor is the person who is there, (a) to develop the cost for the contractor or the supplier and (b) to then manage and be able to report on that cost. And be able to manage the cost against it.*

But I think yeah, absolutely. Because if they are not looking at the cost, which fundamental to the thing. I mean, I think with any infrastructure there are two things. One is the functionality. Does it work, whatever it is? And secondly, the cost. So someone has put up the money, be it government or [the]

private sector, and against that there's an expected return, be it financial, social, whatever, but an expected return. [And] the person [in the] position to monitor the performance of the asset's delivery is the quantity surveyor. So at the moment, not necessarily looking at time, I think that is something, so I see the project controls being a way they [move] forward." (P2)

In spite of their potential future demand for the reasons mentioned, quantity surveyors will need to become more proactive because other professionals are starting to encroach on the quantity surveyors' territory.

"*I said yes [it will exist], you kill accountants before you kill us. You must remember people spend a lot of their money and they need to know where it goes. So you need a QS. That's why I say when you think QS, think of an accountant. I think we add more value to these things than an accountant. This is another thing. QSs need to be more proactive.*

"*Remember there was a hospital that collapsed in Joburg. You know what Government did? Because lawyers are always first, they went to employ a lawyer. What [did] the lawyer do? He employed an engineer. It could have been an engineer or a QS. So I'm saying we just need to get out of this conservative mood. When something happens with the building, the first person they [should] think about is a built environment professional. It's not happening. Why do they get a lawyer?*

"*No to investigate. No, the building came down. Because the lawyer, the only thing that they should go investigate there is whether a contractor had some legal requirements, whatever those legal requirements [were]. Not to say, 'why did the building fail?' So I am saying, get out of the cocoon. Let's be known*." (P14)

P11 claims that quantity surveyors will be required in future because they will need to assist the system to group cost items together.
"*Remember, you still need somebody who can think and group things together in such a manner that they can be costed. Yes, the system can take-off quantities but those quantities have to be taken off in a systematic manner. So somebody needs to drive the system. So instead of now maybe needing five quantity surveyors working on an airport project, you might just need one, because you still need somebody who thinks like a quantity surveyor and who helps the system. And say, ' No, No, don't mix that with that. There's now rough plaster ... Don't take all [that] stuff'. Are you with me?*" (P11)

P5 aaerts that the professional status of the quantity surveying profession will keep the profession alive in future.
"*I think it [QS] will exist because of its professional status.*" (P5)

Number of quantity surveyors set to reduce

Even though the quantity surveying profession will still exist in future, owing to technology, the number of quantity surveyors required in construction projects will reduce in number.

"*No. No, it [QS] will still be there. But the number will reduce*." (P7)

"*Technology is taking over in some areas, but it's bringing in efficiencies. So there will be reductions because of efficiencies, but at the same time and because of that, it [now] keeps the quantity surveyor of the future on their toes. To think, where do they get their next [bit of] 'bread'? Because if they don't think like that, then technology will wipe out most of them. Of [the] five that [would normally] work on a project, technology [will] wipe out four. Only one [will] stay. And now the other four, [they] need to think on their toes. And that's why then this expansion [occurs], your cost engineering type of thing [is expamding]*." (P11)

6.2.3.4.4 The future professional status of the quantity surveying profession

Experts were asked whether the quantity surveying profession will retain its professional status in future, given the current changes in society and the construction sector. There were divergent views, with some claiming that it will retain its profession status.

6.2.3.4.4.1 Reasons the quantity surveying profession will retain its professional status in future

The role of the quantity surveyor is entrenched within the current construction structure

One of the reasons the quantity surveying profession will retain its professional status is its role is entrenched within the current structure of the construction sector.

"*Quantity surveying is an area of speciality in the built environment. It deals with money. Architects don't deal with that. Engineers don't deal with that. So there is no way you are going to relegate somebody very prominent, with a very important [role] in the built environment to a lower status. No.*

"*You can take town planners to that status. But a quantity surveyor, in terms of construction, there is no way. The very first question that the client will ask, architect sitting here, he will ask, 'Okay, here is the scheme, how much is it? How much is it going to cost me?' Then [the] QS comes in*." (P12)

"*It will be a profession. It will be a profession because why is it a profession? It is because [it] is structured in a particular way. I believe. The structure will remain because it will still need to be regulated, otherwise there is room for people, you know, exploiting stuff or not doing what they're supposed to do. The room for QSs will still be there*." (P11)

"*Because of the essentiality of it, the economic context of a development will remain a critical aspect of the decision to proceed or go ahead or resource a development. And that's sitting on the QS.*

"*I think it will remain because it has it has gone very far into the entrenchment. It's deeply embedded. And if you look at the RICS. It is all over the world. It is basically dominating. I think if it was only in Europe or some parts of the world you would say it would die, but it cannot die.*" (P6)

The current quantity surveying position is legislated

Another reason the quantity surveying profession will keep its professional status in future is because it is currently legislated.

"*In our country, the model is totally different. Unless the country changes the whole [profession] through legislation. You understand? But the built environment itself, in terms of professional councils can't change that. There has to be an Act that says, 'No a QS can no [longer] be independent'. So you must start it first from the regulatory status. You just don't relegate people.*

"*You have to apply [to] Parliament and say, 'No, we no [longer] need these guys as independent'. Then they say, 'Okay, then we have to scrap their Act'. But as long as there is an Act, you can't take out these people. You see, that is why I'm saying in the UK [it] is different.*" (P12)

However, P6 argues that legislation cannot protect the quantity surveying profession, and indeed that it is killing the profession. Legislation and current policies can be overcome. How the profession is structured is therefore not cast in stone.

"*Legislation is not going to protect anyone. Everybody is going to die because legislation is driven by policy and competitiveness. Once people can find themselves a way around those two, which is easy, all you have to do is remove leaders and bring other leaders. And then they dictate your own agenda. So it's really not cast in stone. But what is cast stone is the fact that innovation is helping you, like it or not.*" (P6)

P2 also doubts if the current legislative framework will withstand the changing landscape within which the quantity surveying profession operates.

"*And I think that because of the nature of them, I'm not sure that the council for the built environment is going to be as agile or quick to respond to the [increasingly] changing built environment landscape.*

So they are probably lagging. So what you probably got is, you've got the companies, the big companies and in the various fields leading their functional councils and associations, which will then lead the overall council. So, certainly in the near future I don't see too much change coming through from that point of view [councils]. You [are] still going to have the PrQS, whatever it is. They might try and tighten down but they [are] also getting challenged by, for instance, by others coming in. So the real estate people are coming in and are looking to take over the facilities manager. And on that basis, are they then going to start to impact into where the QSs sit, because it's about money and cost? So I don't know there's going to be some playouts there to come. And I don't even think those guys have seen each other on the horizon yet. And it's come." (P2)

Standards and ethical reasons

Professionalism is an important aspect for maintaining standards and ethics, hence it is important for quantity surveyors to retain their professional status.

"*I would like to think so [that the QS will keep its professional status]. I think it's imperative that we do. Because it's like in the hospital, if you have qualified as a doctor. That's your professional status. That's what you're capable of doing. When it comes into the construction industry as a whole and working with government as a whole, then you would help to maintain those professional standards. When I think about the ethics that should actually be driven right the way through, from private through government and the QS and certainly the ones that I do through the RICS. They put them into dodgy situations [hypothetical scenarios] in their interview.*" (P18)

Importance of regulation

Professionalism is important for accountability and control, hence the profession must retain its status and continue to be regulated.

"*Somebody must go and say this profession must be regulated. Otherwise, everybody will do it. You must remember regulation means exactly that. That you need to control the situation. It's like the taxi industry. Because it's not regulated, look at it. Those guys, they can come and shoot us all here. Because it is not regulated. There are no consequences."* (P14)

Other occupations want to be professionalised

The quantity surveying profession will retain its professional status because professionalism is highly regarded in society. Other occupations, such as facilities managers, are seeking professionalisation.

"*The professional status? Yes I mean, I think the answer is yes. Yes to professional status. Will they keep their current service profile? No, it'll be an evolved service profile. I think that what you are finding is more and more professions are trying to professionalise rather than not professionalise. So FM is*

Facilities Management; we [are] trying to get recognised professionally and registered and all that sort of thing." (P2)

To de-professionalise will be a mistake

The Government of South Africa is seeking to de-professionalise the quantity surveying profession, as it considers the way the profession is institutionalised as anti-competitive. P7, however, perceives that the profession's de-professionalisation will be a mistake, especially as quantity surveyors manage other people's money.

"*I think so [QS will keep its professional status]. I think the politicians will realise at some point that by opening it [up to everyone]... because that's what they're trying to do. They are trying to open it up.*

"*I think they will at some point realise that it's a big mistake. They may try but they will soon realise that is a mistake. They need to have a profession. It needs to be a professionally registered person. They may think they're going to go that route [of opening it up], but I think ultimately they will revert to making it a profession, keeping it as a profession. Tendencies as we as we see it now is that they're trying to get away, to do away with it.*

"*Because they feel it's anti-competitive, which is crazy. You can't just open it up to the whole world. You are managing people's money but they don't see that, they just seeing it as anti-competitive. They don't see the competence that it is being provided by the profession. That's what I think. At some point I hope they will realise that this whole argument [is a mistake]. It's in a legal process as we speak, where the councils don't know what to do*." (P7)

A need for professional advice

Clients need the quantity surveying profession to retain its professional status, as they fulfil the role of someone who can verify information, even when you use technology.

"*It's important [QS keeps professional status]. I can't do anything without a QS. I mean I, even, even if I'm going to use a robot, I will still need, probably a view from a person. You still want to make sure this thing knows what it's doing. That's why*." (P17)

Certain clients, such as banks, will not offer loans unless there are professional quantity surveyors involved in projects. This is because of the element of best practice that quantity surveying supposedly brings into construction projects.

"*Let's say, maybe in the Black communities, the [consumption] of professional services was never there but now we are starting to see Blacks who are building houses, and they kind of need this advice. Sometimes [it] is the banks that tell them, 'No, where did you get the quote?'. 'My cousin'. And they*

look at it and say, 'No, you need to get someone called a quantity surveyor'. And this is the only way they will fund the building." (P15)

6.2.3.4.4.2 Uncertainity of professional status

Quantity surveyors will become part of the contractor

Even though many experts believe that the quantity surveying will retain its professional status, there nevertheless remains some uncertainty around the issue. P2 perceives that quantity surveyors might in future become part of the contractor's workers. This will be caused by the change in the nature of construction.

"*Computerisation is going [to] impact that [professional status]. I think the traditional method [of doing things], which is already in some of the bigger European practices, has fallen away. Taking up bills of quantities and whatever. So the QS profession will move to either assisting in design, in computerising the bills of quantities and costs and that sort of thing. They will be held responsible and liable for the cost they produce, for which they're not [currently responsible]; at the moment [they're] largely on a fixed-price contract, which is a huge risk. So they're basically going to become part of the contractor because they can't handle that risk on their own. The other thing is that they will become part of reporting and certifying – reporting and control will be a major part of their future role.*

"*So, I think that the challenge is that the role is going to change from the detail planning and taking off and bills of quantities, to producing costs, [for] which they [will] still need a bill of quantities type thing tied to the programme. I mean integrating the cost of the programme and the procurement, so that it all arrives at the right time on site, and then again from a contractor point of view, managing cash flow. So I think it's [a] more integrated approach. So I think the question is, can you see where the contractors are. The contractors are spreading. So the contractor is to deliver. So the question is how does the contractor deliver? Do they use PrQS? Or do they use internal quantity surveying competency and capability? I think that's where the challenge comes. So I think that the nature of the industry could change*." (P2)

"*Look. I think that would become increasingly difficult [to keep professional status]. People are looking for value. They are not looking for papers. In the old era, you needed papers to gain access anywhere.*" (P13)

Value add versus paper

P13 shares the same view with P2, regarding the uncertainty of the profession's future status. This is because people will be looking at the value added by quantity surveyors, more than their paper (educational) qualifications.

“In the era we[‘re] in now, your education matters less. It's your value that you add. So you can have an entrepreneur, without formal education, developing computer programs. People will be using them nonetheless. They don't say, ‘Because you have not gone to school, we don't use your product’. So the era will be the era of human development.

“*You see, education over time measures the person's level of development. But we measured it[education] using a certain measure. The measure will change. The measure will be against the person's God-given potential.*

“*What I mean by that is the superior understanding of systems and sustainability. Because what is significant, which makes up the wisdom of man, is the ability to build things that are eternal, [which] can last for a very long time. So your ability to make the right judgement will take precedence over skills. Skills can be bought. So it is in that area that I think, and that goes beyond QS.*” (P13)

Quantity surveyors might change their title

In future, quantity surveyors might need to change their title, as they redefine themselves in response to the changes developing in technology, and as their landscape itself is redefined.

“*Like I said, whether it will be called ‘quantity surveyor’? Yeah, so I think that's [the] question the quantity surveyors need [to answer], given all these challenges and the way the world has changed and the niche that they need to establish. Do they still want to remain rigid, or redefine [the] QS [profession] within the changing landscape, improved technology, and [an] environment [that] is also changing?*” (P8)

“*There are going to be tools [that will] make people think they are quantity surveyors, or [will at least] enable them to do things [the QS does] themselves. So that's fine. It means two things. That you [the QS] can redefine your role and call yourself something else. It's also a good thing because of simplification. It reduces your competitive edge. That means you earn less, but then it gives access and inclusion to other people. If we can make our [architects’] job easier, I think that will be really, really good. So I don't know if you'll still be called quantity surveyors. But those skills will always be very valuable*.” (P23)

“*So there's different, different models. But you know, whether you're going to call him a QS or whether you call him something else in future, I don't know. But I would argue that somebody needs to be trained to be able to do that work. And it's not the architect in South Africa. It’s not [the] engineer in South Africa. I mean, the engineers are probably closer to it than the architects. But again, they've got their focus in their field, which is different. I mean, they're not into ironmongery and plumbing. It's not their*

field. They don't want to be there. They want to put concrete down. Excavate. Tar roads, bridges, and let them [do] that. That's great. So, if your question was, 'Is there going to be a QS in the future?' the answer is definitely yes. It may be in a slightly different form, and it may come out of some other offices in future, but I can't see it go." (P1)

"*They may change the name or the complexion or the strategy but these [traditional tasks] were well-conceived and they've been very successful over the years. I don't think they'll change.*" (P10)

"*There is potential for the profession to grow [to] even greater heights. And at some stage, I believe they won't even call it quantity surveying. Ii is either, you are an accountant, cost engineer, construction accountants … It is an important profession that will always be there. I don't see it ever dying. But it will evolve and change names like all these things.*" (P7)

And it should be noted that quantity surveyors are not alone in this change. Technology and landscape changes are also causing other professions to redefine themselves.
"*Every profession is getting to a point where they have to define or redefine themselves. So I don't know what that means to the QS. I know for architects, your creativity is actually your licence, not your CAD. It has almost become a function of that, but some people are better at it than others.*" (P5)

6.2.3.4.4.3 The quantity surveying profession will not keep its professional status

Any unethical behaviour will almost certainly lead to the quantity surveying profession losing its professional status in future.

"*No, no, it may not [keep its professional status]. I'll give you an example: we're doing a project. Instead of the quantity surveyor doing what [his] core mandate [dictates he do], to account for the project, he is creating, or [has been] influenced by the client to create, an environment that suited the client's perspective...This quantity surveyor was expected to report falsely about the cost of the project to be able to impact on the fees. So until those unethical practices are corrected, [the profession] will die. The other professions have no regard for the quantity surveying [profession].*" (P10)

6.2.3.4.4.4 The quantity surveying profession will not exist in 30–40 years

P3 concurs with P10, in that the quantity surveying profession will may not exist in future, although not within 20 years' time but will rather become obsolete in 30 to 40 years' time.

"*Look, I personally think it's going to change. But yes, I mean, you can see the way that the industry is changing, and it will change so I think that yes, you won't have quantity surveyors as a profession in 30–40 years' time per se. You'll be part of a multidisciplinary set-up that provides the service.*" (P3)

6.2.3.4.5 Past traditional tasks of the quantity surveying profession

Experts were asked to identify traditional quantity surveying tasks that were not carried out by quantity surveyors in the past. This was done to compare past traditional tasks to present and future tasks. Another reason was to test claims about potential future tasks and the role of quantity surveyors. If certain past factors shaped the current quantity surveying factors, will certain current factors shape the future of the traditional tasks of quantity surveyors?

6.2.3.4.5.1 Traditional tasks that did not exist in the quantity surveying profession in the past

6.2.3.4.5.1.1 Value Management and Life-Cycle Costing

The majority of experts cited value management and life-cycle costing as the current traditional quantity surveying tasks that did not exist in the past (P3, P12, P2, P4, P14, P15, P5, P4, P13, P19, P7, P18, P11, P6). Some argue that these tasks are still not carried out in South Africa at present. Many were divided on material procurement.

"*Life-cycle did not exist. Value management is a new concept. Maybe it was called something [else] then. But all existed except material procurement. Because what happened was, there were material lists and all that. We eliminated those things.*" (P12)

"*Okay, so life-cycle costing is still not done by [many] – value management on a life-cycle basis. Look, they always did [tend to] value engineering, but not always. I don't know whether they did material procurement. The big one is cost reporting and controlling. Now, they'll say that they always did cost control and reporting but it's really taking it, what's happened is, it's being developed into, I think, project controls, which is basically taking cost reporting to a more understandable level. So, project controls is the big one.*" (P2)

"*Payment application was there. Material procurement, I don't think it was there in my opinion. It's a fairly new animal, because there are [a] few clients now that say, "I want to build my house. I want to know [material quantities]...' To me, I don't want to offer that service. One, [it] is time consuming. And two, people don't understand the value of it. You have to do bills of quantities; after doing bills of quantities, you do this thing [material procurement]. So people don't see that. They only see this [end result], and remember they want to save costs. But who pays for that? So I'm saying this to me it was not there.*" (P14)

"*I can't think that life-cycle costing was an issue. People just use the best of what they could. And I suppose value management may not have been. I don't perceive it to have been a big thing, but people are the same. Whether it was a hundred years ago or now we worried about the same things.*" (P5)

"*Maybe value management, life-cycle [costing] was not there. Because they used to take [a] whole 50 years to put up these buildings. So you didn't really do life-cycle costing*." (P4)

"*Look, I think we still don't do value engineering. And we still don't do life-cycle costing*." (P13)

P20 claims that value management was done in the past, although it is possible it was known by another name. "*Value management in the past – it was there. Just didn't have a name*." (P20)

6.2.3.4.5.2 All traditional quantity surveying tasks were there in the past

All traditional quantity surveyors were there in the past. Technological advancement has influenced how these tasks are carried out currently, but they have existed within the industry since the start. P22 describes the traditional tasks as the "*genesis*" of the quantity surveying profession.

"*Quantity surveying, I think it's kind of kept its status. It hasn't changed, really. I don't think other than [witj] obviously technology, but essentially our services has remained. From estimating through to the full process, I don't think it's changed.*" (P7)

P16 agrees that all traditional tasks have always been present, but performed at a slower pace.

"*They were less, you know, so these four – cost estimation, cost planning, cost reporting, cost control. We didn't spend much time on them. Payment application [was] the same. [Value management and life-cycle costing] I would say the same. So there was more [BOQ and quantities' take-off] in the past*." (P16)

P18 claims that all the traditional tasks were there, but currently possess more emphasis.

"*The majority of the things that I've been involved in [are] far more prevalent now than [they were in the past]*." (P18)

P10 also agrees that all the traditional quantity surveying tasks existed in the past, but were not accorded any respect – an attitude that still persists today.

"*Well, they all existed but it's only that [they] are never taken seriously. When we talk about life-cycle costing, in truth it [referred to] the longevity of the project; of the product itself. That is the value that has been placed in it. It can sustain [itself for] a particular period of time. In France, they call it the estate planning. Not this thing.*

"*The estate planning was about the life cycle of the project and its value. So that if we spend so much time, so much money now, would it be any different in 50 years' time, [in terms of] rectifying anything? Would it draw so much from what we spent or would [it] be of lesser value to make it a better product?*

"*But then it became a scientific calculation. That's when you needed a quantity surveyor to do all those calculations. Those were projections about the life-cycle costing. [Currently] it's projections*." (P10)

P10 explain that the reason why LCC is not taken seriously (even today), is because "*nobody's interested*" in the lifespan of the construction output.

"*[LCC] doesn't exist now, because nobody's interested [in] whether the project or the construction output should last for five, fifteen or twenty years, because in five years' time [it] is going to change anyway. I'll give an example. You see those buildings standing in Sandton? Very soon, there'll be some alterations. They will change. I have argued that none of those buildings are going to withstand the test of time. For the same reason that the resources used in those buildings are not local. As soon as those [materials], wherever they come from, [become] depleted, then you['ll] need to do alterations on the building. It's no longer the same building. It'll never be the same building. It may not be the same building in 25 years*." (P10)

6.2.3.4.5.3 Two traditional quantity surveying tasks: quantity take-off and bill preparation

P3 claims that the two most prominent traditional quantity surveying tasks are quantity take-off and bill preparation.

"*Value management didn't exist, or sorry, life-cycle costing didn't exist. Okay and material procurement per se didn't exist; the payment, the cost control, the cost reporting, the cost planning, estimation, didn't exist. But the rest [did]. So what we've basically done is we've kind of added these because as I say [with] the engineering, it was very much we know we've got a problem – that we do things wrong. So what they did is they said well, how can we help? So that's when ;we started to do the normal bills of quantities, you did the cost reports and stuff like that. And then as they [saw] the value, then you start saying, 'Look, we can do this for you. We can do this for you, we can do that for you'.*

"*So, the services that we provided have increased [and] that's why I am saying they can't, and they made the mistake of coming to one profession to do all of this stuff. That's why I am saying, I'm very confident that we don't have a problem because we do that much*." (P3)

P11 concurs that quantities take-off and bills of quantities are the two traditional quantity surveying tasks (including estimation) that are regarded as the backbone of the profession. Payment application was also done in the past. All other traditional tasks are more recent in execution, with value management and life-cycle costing the newest quantity surveying tasks.

"*You can go, 'Take-off is old. Bills is old. Cost estimation, I mean, that's the backbone. Cost planning is [somewhat] new. Now you are planning more, thinking of cost planning. Now, we are working with a client and all those things with the design guys. Cost reporting, perhaps it's newer than that because the original was the BOQ and the quantities take-offs. Cost reporting is newer. Cost control I'd say [is] newer [also]. And that material procurement? I don't know. Payment application? Well, you needed that guy from the beginning. Value management, definitely new, and life-cycle costing, definitely newer than the other. But as far as I'm concerned, if you compare me [to] my age when I [started], they [VM and LCC] were already here. Yeah, so actually, they [VM and LCC] are new. All of them [VM and LCC]. Yes, they are newer than the others. Yes. They came from the evolution of the others. Yes, they are not the traditional [QS tasks]*." (P11)

To some degree, P6 agrees with P11's assessment, in that most quantity surveying tasks are more recent additions to their stable of responsibility, with the exception of bill preparation, quantity take-off, payment application, material procurement, and cost estimation.
"*They were not done, like value engineering or value management, life-cycle costing. It came almost late in my professional life. I think cost control was also not there. It also came in a bit late as well. Okay, the material procurement. Yeah payment application was always there. Cost estimation was also there. Yeah bills and take off were there*." (P6)

P7 claims that the only two traditional tasks that existed in the past were quantity take-off and material procurement. There were no bills of quantities issued, people worked from the plan. Estimation was just that – a 'thumb suck'.
"*There was no bills of quantities. People were just doing something. Just look at the plan and take over. And then, 'I need so many bricks [or whatever]'. Take-off was there. Quantity take-off, we'll just say, 'How many bricks do you want?' But there was not structured bills of quantities. Write a bill here. There was no[thing] formal, like bills of quantities, to say 'excavations, how many quantities,' whatever. There, you've got a plan, you work from the plan. Once you've got the plan, you say, 'No, I need 20 000 bricks'. You just order. Do you understand? So the bill wasn't there.*

"*There was no cost planning. Cost reporting was not there. Estimation, you were estimating. It was more like a thumb suck. There was no cost control. It wasn't there. That one is there [material procurement]. I mean, you can't build without material*." (P7)

6.2.3.4.5.4 Reasons for past traditional quantity surveying tasks

Slow-paced society

The reason quantity surveyors carried out certain tasks previously, was influenced by society and technology. Society was slow paced, and technology was nowhere near as advanced as it currently is. Currently, clients expect work to be carried out at a much faster pace because of technology.

"*So because of technology, the turnaround times have become much quicker. So your clients' expectations of everything has to happen now. They're not prepared to wait, but that's as a result of technology. So that's the systems. The systems have allowed us to be more efficient in doing [the] work we do. We are producing a bill of quantities, estimating much more efficient[ly] now than [was possible] without technology*." (P7)

"*As I say, in the past, they would have lower expectations because they weren't exposed to all the technology. So now, with the technology they [the clients] have higher expectations*." (P16)

"*In the past, you wouldn't be able to build with the same speed that you can today*." (P22)

"*Maybe value management [and] life-cycle [costing] was not there. Because they used to take [a] whole 50 years to put up these buildings. So you didn't really do life-cycle costing*." (P4)

Less complex projects

Another reason for quantity surveyors carrying out certain traditional tasks is that in the past construction projects were less complex than they are now.

"*Okay, maybe the complexity of the project now. The project has become more complex and then this has affected the quantity surveyors as well. [Because] the task is becoming more and more complex, [you need] research, more new things that were not done before*." (P4)

Political landscape

P6 argues that the change in the political landscape influenced the services that quantity surveyors offered. The new South African Government was more interested in dealing with the infrastructure backlog and the societal needs left by the apartheid legacy, than with cost savings through measures, such as value management or life-cycle costing.

"*How many dams and clinics [do we need]? So it is meeting up with a backlog, infrastructure backlog. So the money had to be found [in] some way to meet all those challenges. So it's things like feasibility studies to establish whether there's a need for that [dams and clinics] were not a big thing. The need*

was already established, you know? So now there was a question of saying, 'Hang on, but we have developed some of these things. Some of them we don't really need. Was there a thorough study done?"

"*So that's when now, the profession [has] sort of found a niche to say , 'The financial constraint. People need to know what the impact is, because the value that you are going to derive, what is it? [What will it] be in 20 years time? Can I sell off?' So those investment decisions came in later, when people [realised] that people don't want to spend. They need to have a full picture of this infrastructure that we are building. 'What is its lifespan? How [much] is it going to cost us to maintain it. To operate it and to dispose [of] it?'*

"*So now the figures had to be established, to make decisions up front and really be clear [as to] whether the investment is a wise one or a bad one. So it was just easier to decide on paper before any construction goes ahead. So back then, most of developments were mainly the need. The need was there. It was just more of, 'We're going to develop a road and we are going to need officers here. We are going to need...' But now when you have roads almost developed, cities almost developed. So now every space, it's a niche space. People need to know what type. You can't put [just any] infrastructure that's not going to meet the [clients'] needs. So the more we evolve, the more we find better ways of ways of utilising these techniques to advise the client to help them make informed decisions*." (P6)

6.2.3.4.6 Summary of the findings on tasks at risk

The findings regarding the future tasks of the quantity surveying profession reveal that all quantity surveying tasks will exist in future, in spite of some automation. Quantity take-off and bill preparation are the two traditional tasks most at risk of automation, because they involve quantification, which, according to Acemoglu and Autor (2011), can be easily automated.

While expects do not unanimously agree, the majority view is that some aspects of cost estimation, cost planning, cost reporting, cost control and payment application can be automated. These tasks require some human interpretation and analysis. They are therefore only moderately at risk of automation. What is unclear is material procurement. Experts are divided on its survival in the future, particularly as some do not regard it as a role specific to quantity surveying. There is consensus that technological encroachment on quantity surveyors' tasks will lead to changes within the profession. For instance, the number of quantity surveyors required in a project might diminish. Quantity surveyors might need to diversify their service offering or apply their skills in economic sectors other than the construction sector. Some quantity surveyors might diversify, while others might become part multidisciplinaries. There might be new tasks that quantity surveyors develop in order to remain relevant in the future, but these may arguably not be quantity surveying tasks. In adding new tasks and offering skills outside of

the construction sector, this might lead to contestation for certain roles both within the built-environment professions and outside it, in professions such as accountants and lawyers.

Technological advancement has created somewhat of a fast-paced society that requires work to be carried out efficiently and swiftly. These are the main factors that are influencing the change in the tasks of the quantity surveyors. Other factors influencing the change in the tasks and role of quantity surveyors, include the complexity of buildings and innovation. A client's change in needs or values has also adapted the place of the quantity surveyor in the construction sector, thrusting them into the position of leader.

Even though quantity surveyors do not regard technology as a major threat to their profession, the findings reveal that technology will have a major influence on the role of the current quantity surveying profession. Value management (VM) and life-cycle costing (LCC) will be the only two tasks that might not be affected by technology even though there are divergent views on this.

Changes in the tasks of quantity surveyors might lead to a materially different profession, which could necessitate a name change. Some experts claim that technology might make the profession become extinct in future, although this is a view both refuted and hailed as the truth by others. Those who refute the assertion claim that there will always be a need for a human interface with technology. Those who acknowledge the assertion argue that the profession will only become extinct if the profession remains passive and does not take advantage of the new opportunities brought about technology and the changes in society. To a degree, the findings do corroborate claims by Kulasekara et al. (2013) – that technology is a threat to the traditional tasks of the quantity surveying profession.

6.2.3.4.7 Analysis of the tasks at risk using Geels' MLP Framework

The quantity surveying profession's landscape

Similar to the findings of the current state of the quantity surveying profession, the influence of the quantity surveying profession's tasks largely emanates from the landscape's development. Technological advancement with associated societal needs will have an influence on the quantity surveying profession's socio-technical regime and its niches in future.

The quantity surveying profession's regime

Landscape developments will influence the work that quantity surveyors will carry out, their tasks, and how they fulfil their role in future. With current work protected by the identification of work, it is not clear how the current regime will respond to these changes. The relevance of the legislative framework governing the profession might be made redundant, as most of the traditional work identified in the

scope of work might become automated. Will the profession seek to protect new tasks and roles that may be contested by others? With some of the tasks and fees already considered anti-competitive by the current Competition Commission, will the profession be successful in its efforts? Evidence shows that it might be difficult to continue to keep the profession in its current regulated form.

The quantity surveyors' niches

Evidence shows that as the technology and societal needs threaten the current quantity surveying profession, quantity surveying firms and professionals are likely to seek means of survival that may mean deviating from current practices. New tasks and new roles carved within the niches might redefine the profession, necessitating a name change, although this might be unlikely (Ashworth et al., 2013). Changes in the niches might eventually lead to changes in the current regime, which will create a new quantity surveying socio-technical system. The next section looks at how these scenarios were constructed, based on the findings of the interviews, the workshop, and the focus group.

6.3 Objective Five: Provide scenarios for the future quantity surveying profession

This section discusses the data findings and analysis of the workshop and focus group. It also shows the process followed to construct the scenarios for the future of the South African quantity surveying profession. In Chapter 7, the scenarios constructed from the findings and the analysis of the data are presented. Since the scenarios are the major contribution to the study, it was deemed necessary to separate them from Chapter 6, to make them more distinct from one another. The process followed to construct the scenarios is explained below.

From assessing the current state of the construction sector and the quantity surveying profession, findings show that there are many factors influencing both the construction sector and the quantity surveying profession. These factors are causing uncertainty within the construction sector and the quantity surveying profession. The influence of these factors might cause change in the construction sector and the quantity profession.

The scenario planning undertaking followed the five-step process advocated by Kosow and Gaßner (2008), and Cronje (2017). Step 1 of identifying the needs of the client within a specified time was partly achieved by assessing the current state of the construction sector and the quantity surveying profession. The views of the experts provided somewhat of a basis for understanding what an ideal future for the construction sector or the quantity surveying profession might be.

Step 2 of identifying key factors was achieved through interviews with experts. Step 3 of the analysis of key factors and ranking was achieved through the workshop and the focus group findings, which are

presented in the next section. Scenario generation was achieved from the synthesis of data from steps 1 to 3. Step 5 of communicating the outcome of the scenario planning process and the scenarios to clients or the relevant stakeholders was not necessary, given that this study is basic research for academic purposes. In the next section, steps 3 and 4 of the scenario planning process are discussed.

6.3.1 Workshop findings

Only findings from three groups were deemed fit to be used in the study. Some group results were not returned to the facilitator and some other results were not captured according to the instructions, hence they could not be used. Tables 6.10–6.12 show the findings of Groups 1 to 3. Workshop participants reduced the 39 factors likely to influence the quantity surveying profession to six, through discussions, and then reduced them further, to two factors, using the impact factor analysis matrix.

After the process of identifying the six factors likely to influence the current quantity surveying profession in future was completed. Group representatives were asked to present their results. All groups had similar findings. Ethics (T), few projects (M), corruption (C), the collapse of the (private) construction sector (N), procurement policy (PP), high competition (I), sustainability (NN), and software (AA), were identified as the factors most likely to influence the quantity surveying profession in future.

Table 6.10 shows that Group 1 identified corruption (C), ethics (T), few projects (M), the collapse of the (private) construction sector (N), procurement policy (PP) and high competition (I) as the six factors most likely to influence the current quantity surveying profession in future. Corruption (C) and high competition (I) had the highest active sum and passive sum, which means that they are the critical factors in the future of the quantity surveying profession.

Table 6. 10 Group 1 factor ranking

Impact On → Of	Factor T	Factor M	Factor C	Factor N	Factor PP	Factor I	**Active Sum**
Factor T		3	3	1	2	3	12
Factor M	3		3	3	0	3	12
Factor C	3	3		3	3	3	15
Factor N	3	3	3		0	3	12
Factor PP	2	0	3	3		3	11

Factor I	3	3	3	3	3		15
Passive Sum (PS)	14	12	15	13	8	15	

Table 6. 11 Group 2 factor ranking

Impact On → Of	Factor C	Factor AA	Factor T	Factor N	Factor I	Factor PP	**Active Sum**
Factor C		0	3	3	3	3	12
Factor AA	0		0	0	0	0	0
Factor T	3	0		2	0	0	5
Factor N	3	0	0		2	3	8
Factor I	3	0	0	1		2	6
Factor PP	3	0	1	3	2		9
Passive Sum (PS)	12	0	4	9	7	8	

Group 2 had software (AA) instead of few projects (M) as one of the six factors likely to influence the current quantity surveying profession in the future. Corruption (C) and procurement policy (PP) were identified as the critical factors (refer to Table 6.11).

Table 6. 12 Group 3 factor ranking

Impact On → Of	Factor C	Factor AA	Factor T	Factor NN	Factor N	Factor M	**Active Sum**
Factor C		1	3	3	3	3	13
Factor AA	1		2	2	1	0	6
Factor T	3	1		3	3	3	13
Factor NN	3	2	0		3	3	11
Factor N	3	1	2	2		3	11
Factor M	3	1	3	3	3		13

Passive Sum (PS)	13	6	10	13	13	12

According to Group 3 (see Table 6.12), corruption (C), software (AA), ethics (T), sustainability (NN), collapse of the (private) construction sector (N) and few projects (M) were identified as the six factors that were likely to influence the current quantity surveying profession. Corruption (C) and few projects (M) were identified as the critical factors.

6.3.1.1 Summary of the findings of the workshop findings

Table 6.13 shows the combined active sums and passive sums of critical factors identified by Groups 1–3. The findings of the workshop reveal that corruption (C) is a factor that will have the most influence on the future of the quantity surveying profession. High competition (I), procurement policy (PP), few projects (M) and the collapse of the (private) construction sector (N) are some of the critical factors that will influence the quantity surveying profession, Although not critical, ethics (T), sustainability (NN) and software (AA) are amongst the top factors likely to influence the current quantity surveying profession in future.

Table 6. 13 Combined active sums and passive sums of critical factors from workshops

Critical Factors	Group 1	Group 2	Group 3	Total Score	Ranking
Factor C	30	24	26	80	1
Factor I	30			30	2
Factor M			25	25	3
Factor N		17		17	4
Factor PP		17		17	4

6.3.2 Focus group: findings

From the 11 participants of the focus group, six pairs emerged. One of the scribes formed a pair with one of the participants. In identifying key factors, a similar process to the workshop was followed. The process of reducing the 39 factors to seven factors was followed by discussions in pairs, the results for which were then explained to the rest of the groups.

Through robust discussion and consensus, the following factors were identified as the seven factors most likely to influence the status of the current quantity surveying profession: ethics (T), procurement policy (PP), high competition (I), life-cycle costing (MM), ICT (GG), government policy (B), inefficiency (G) and indecisiveness (F) in the public sector.

Table 6. 14 Pair 1 findings

Impact On → Of	Factor T	Factor PP	Factor I	Factor MM	Factor GG	Factor B	Factor G	**Active Sum**
Factor T		3	2	1	0	3	3	12
Factor PP	3		3	2	2	3	3	16
Factor I	1	1		1	3	3	1	10
Factor MM	2	3	1		1	1	1	9
Factor GG	1	2	3	1		1	1	9
Factor B	3	3	3	2	1		1	13
Factor G	3	3	3	3	2	3		17
Passive Sum (PS)	13	15	15	10	9	14	10	

Table 6.14 shows that Pair 1 ranked the procurement policy (PP), government policy (B) and inefficiencies (G) in the public sector as the critical factors in the future of the quantity surveying profession.

Table 6. 15 Pair 2 findings

Impact On → Of	Factor T	Factor PP	Factor I	Factor MM	Factor GG	Factor B	Factor F	**Active Sum**
Factor T		3	3	1	1	2	1	11
Factor PP	3		3	0	1	3	0	10
Factor I	3	1		2	3	0	0	9
Factor MM	1	0	1		3	0	0	5
Factor GG	2	1	3	3		0	0	9
Factor B	3	3	2	1	0		3	12
Factor F	0	2	0	0	0	3		5

Passive Sum (PS)	12	10	12	7	8	8	4

According to Pair 2, ethics (T) and high competition (I) are critical factors in the future of the quantity surveying profession (refer to Table 6.15).

Table 6. 16 Pair 3 findings

Impact On → Of	Factor T	Factor PP	Factor MM	Factor GG	Factor B	Factor F	Factor I	**Active Sum**
Factor T		3	1	3	3	3	3	16
Factor PP	3		3	2	3	3	3	17
Factor MM	2	2		3	3	3	3	16
Factor GG	3	3	3		3	3	3	18
Factor B	3	3	3	3		3	3	18
Factor F	3	3	3	3	3		3	18
Factor I	3	3	3	3	3	3		18
Passive Sum (PS)	17	17	16	17	18	18	18	

Government policy (B), the public sector's indecisiveness (F) and high competition (I) are critical factors in the future of the quantity surveying profession, according to Pair 3 (refer to Table 6.16). Pair 3 had high scores for most factors. This could be an indication that all the seven factors are critical.

Table 6. 17 Pair 4 findings

Impact On → Of	Factor T	Factor PP	Factor I	Factor MM	Factor GG	Factor PP	Factor F	**Active Sum**
Factor T		2	3	3	1	3	1	13
Factor PP	2		3	3	3	3	2	16
Factor I	3	3		3	3	2	2	16
Factor MM	3	3	3		3	3	2	17
Factor GG	1	3	3	3		1	1	12
Factor PP	3	3	2	3	1		3	15
Factor F	1	2	2	2	1	3		11

Passive Sum (PS)	13	16	16	17	12	15	11

Table 6.17 shows that Pair 4 ranks procurement policy (PP), high competition (I) and life-cycle costing (MM) as critical factors in influencing the current quantity surveying profession in future.

Table 6. 18 Part 5 findings

Impact On → Of	Factor T	Factor PP	Factor I	Factor MM	Factor GG	Factor B	Factor F	**Active Sum**
Factor T		3	3	1	1	2	3	13
Factor PP	3		3	3	2	3	3	17
Factor I	3	3		2	3	3	3	17
Factor MM	1	2	1		0	3	3	10
Factor GG	1	2	3	3		1	1	11
Factor B	2	3	3	1	1		3	13
Factor F	3	3	1	3	0	3		13
Passive Sum (PS)	13	16	14	13	7	15	16	

Pair 5 ranked procurement policy (PP) and high competition (I) as critical factors in influencing the current quantity surveying profession (refer to Table 6.18).

Table 6. 19 Pair 6 findings

Impact On → Of	Factor T	Factor PP	Factor I	Factor MM	Factor GG	Factor B	Factor F	**Active Sum**
Factor T		3	3	2	3	3	3	17
Factor PP	3		3	2	3	3	3	17
Factor I	3	3		3	3	3	3	18
Factor MM	2	2	3		3	3	3	16
Factor GG	3	3	3	3		3	3	18
Factor B	3	3	3	3	3		3	18
Factor F	3	3	3	3	3	3		18

Passive Sum (PS)	17	17	18	16	18	18	18

Table 6.19 shows that high competition (I), ICT (GG), government policy (B) and the public sector's indecisiveness (F) were ranked as critical factors by Pair 6. Similarly to Pair 3, Pair 6 had high scores for all factors. This could be an indication of the importance of all these factors in influencing the current quantity surveying profession.

6.3.2.1 Summary of the focus groups findings

Table 6.20 shows the combined active sums and passive sums of critical factors identified by Pairs 1–6. From the findings of the focus group, high competition (I) is ranked highest (and first). Government policy (B) is ranked second, procurement policy (PP) third, indecisiveness (F) fourth, ICT (GG) fifth, life-cycle costing (MM) sixth, and ethics (T) seventh.

There are some similarities in the focus group and workshop findings. High competition (I) and procurement policy (PP) are both identified as critical factors by all participants. Although identified as some of the important factors, technology such as software and ICT are not regarded as critical factors in the future of the quantity surveying profession. These findings support the findings of the interviews that technology or the Fourth Industrial Revolution are not regarded as a major threat to the current quantity surveying profession, as the literature purports. The findings further support the claim that politics and the economy are the two factors that will influence the quantity surveying profession.

Table 6. 20 Combined active sums and passive sums of critical factors the focus group

Critical Factors	Pair 1	Pair 2	Pair 3	Pair 4	Pair 5	Pair 6	Total	Ranking
Factor I		21	36	32	31	36	156	1
Factor B	27		36			36	99	2
Factor PP	31			32	33		96	3
Factor F			36			36	72	4
Factor GG	27					36	63	5
Factor MM				34			34	6
Factor T		11					11	7

6.3.3 Experts' perceptions about the future of the construction sector and the quantity surveying profession

6.3.3.1 Landscape developments

From the finding of factors likely to influence the construction sector and the quantity surveying profession, experts perceive that the political and economic factors from previous discussions will remain the two factors that will continue to have a major influence on the construction sector and the quantity surveying profession in future. This means that if the uncertainty that currently exists as a result of the political system does not change, the future will look rather bleak for both the construction sector and the quantity surveying profession.

Corruption, and policies such as the expropriation of land without compensation, if not addressed, will continue to contribute towards a drop in investor confidence. Currently the construction sector and the quantity surveying profession have adopted a "*wait and see*" approach, hence the current low level of activity and fewer projects.

"*Well I think there is a certain amount of uncertainty related to these last elections. I think that there's been a 'wait and see' [attitude]. People are waiting on some kind of positive projection coming out of this. I think the ANC is under a lot of pressure. The governing party has to sort out issues within its party. The corruption is not helping. Those things have to [be] sorted out. They're looking for job creation. Unemployment is a major problem and it affects the construction industry before any other industry*.

"*There's a lot of things that Government needs to do to create a positive environment and I think once that happens, they will get investments and once there's confidence and investment, I think then infrastructure will begin to develop and on the back of that, the construction industry as a whole will begin to pick up*." (P5)

Experts expressed a combination of optimism and pessimism about the political future of South Africa. Some experts do not see the current governing political party relinquishing its current political position of leadership to another party. This means that if there are no changes within the ANC, the current trajectory on which South Africa is running is likely to continue. What this means for the construction sector and the quantity surveying profession is that the current issues and challenges besetting the sector and the profession are likely to persist.

"*I don't see, for example, [the] ANC coming out of power in the next 10, 15, 20 years. So in the next 20 years, I don't see the status of how we do business changing. No, I don't. Because politics will always be number one*." (P14)

"*There will be no changes in the very near future. Because remember this is affected mostly by the political environment. As I have said, if the political environment doesn't change, such that we don't have this outright ruler [similar to a dictator] of the place [country], then things are not going to change. In fact, they are going to get worse before they change, because people will realise that,'okay slowly we are losing these votes. So there comes a time when we're going to be out'. And so they will start looting even more. To say, 'Hey, I need to take my chunk before this majority gets finished and then we start bringing competition in to this thing'*." (P11)

Unless there are other political parties to challenge the current governing party, it does not seem likely that a change is on the horizon for the construction sector and the quantity surveying profession. Currently, some experts do ot expect to see the major changes in the political system, at least for the foreseeable future.

"*Well, it [an improvement in the economy] will depend on the outcome. Where are we going with our politics in South Africa? At the current pace it's not going to go so well because we need drastic improvements in this space. Because we are still doomed by the past. Like, you cannot have a prospering nation that is being ruled by one political party for life. Because that brings in [a] whole lot of nonsense, complacency and whatnot. And then again, cause now it takes out the element of competition. We know that for better performance there must be competition. In order for us to have a great market price of [a] good, the principles of economics says, 'There must be competition'. Otherwise, you're going to get a monopoly type of an environment, which is ineffective. Because you know,'I'm the supplier of this thing'.*" (P11)

Some experts expressed optimism about the future, especially given the change in government brought by the May 2019 elections. They expect Government to deal with corruption and to assist in creating opportunities for both Blacks and Whites in the economy. Some were cautiously optimistic about the future. A "*better*" future is predicated upon major decisions being made within the current political system.

"*On a political [note], I think that there is a will to fight against corruption. There is a will. And then this will affect the process to get the appointment [or government projects]. And then at least maybe the people will improve a little bit. It will improve construction, [especially] for the majority of South*

Africans who can't access the private sector. The political will must [also] improve the BEE factor in big and private projects; the Government must intervene. Just look at Sandton. Who is the Black architect who was [appointed for] a small building in Sandton? It's all the private [consultants]. We want the political will to improve our people." (P4)

"*I don't know that things are going to get better or easier. I mean I said better but I don't think they're going [to] get easier. There are some extremely tough decisions that need to be made. And if the political leadership has the courage to take the decisions that need to be made to turn the economy around like I said getting rid of the environment that makes [corruption] rife, to allow [it] to thrive.*

"*I believe that it will, I believe that in this current political term, there should be less corruption progression. There definitely will be a lot exposure of corruption, I hope they continue to expose more. But that exposure, is exposure of what has passed. So if we can, as a nation, can see that and not see the exposure as, 'Oh my gosh, this is how huge the problem is', [but rather what] a problem [it] was. Then you know what you're dealing with, that's when you're empowered to actually do something about it. When you don't know, then you are just floundering.*

"*So it's good to expose it. It's good to start eating that elephant one bite at a time, because that's what it is. And I am hopeful*." (P19)

"*Six years of bad leadership, corruption, all, you know, you know why and all these things have not been good for our industry. And yes, they've done a U-turn and things are better. Things will turn but it will take time. They [are] coming out of the dip. It will take time. They'll build it. I mean, I've got a lot of faith in the new president, Cyril. I think he will. He will. If that never happened in that changeover, we would have collapsed. We would have been as other failed countries because it would have just continued. It would have continued and I mean you can only steal so much until there's nothing left to steal*." (P9)

"*We just had the new president being sworn in. The sixth parliament. We all hope that he is going to [make] miracles, because I can tell you the past 10 years, [has] been a mess. We all hope that when the leadership comes in, [thing will improve], because they promised during elections 'They'll be able to create the growth'. They are talking about growth strategy. They are talking about decreasing inequality among the people*." (P7)

It is not only national developments that will influence the South African construction sector and the quantity surveying profession. Geo-political developments will always influence the South African

construction sector and the quantity surveying profession. What is not clear is the extent to which these will influence South Africa, the construction sector and the quantity surveying profession in future.

"*There is as a lot of political changes happening around the world. For instance, one of them is this BRICS thing, then the[re] is Brexit. It's affecting a lot of businesses, sectors, you know construction, property. People have invested overseas and now they've come back with nothing. So it's affecting a lot of what we do here. So those are the dynamics. The whole Trump economics of blocking everyone outside and basically bringing American firms back into America. It's a huge factor. So a lot of politics are affecting the industry*." (P6)

Plan for a smart city

The new president of South Africa, Cyril Ramaphosa, has plans to build a city in the province of Gauteng in South Africa, which one expert (P23) deems unrealistic, given the current factors facing the country. In spite of the negative perceptions about a smart city, there might be potential positives from the construction of a smart city.

"*So I think we need to actually put a lot of energy to get to the situation of being in the nice place. We actually have to put a lot of energy into making, not [simply accepting] these endless gated communities and people who say that they have smart cities and things like that. That's a disaster [that] actually exacerbates the problem. What we need then is to get into a situation where people become less dependent on waiting for somebody else to do something. Waiting for the Government to do something. Waiting for Cyril Ramaphosa to make jobs happen or whatever*." (P23)

The next sections look at how experts believe the landscape developments will influence the socio-technical regime and the niches.

6.3.3.2 Socio-technical regime

A move towards a more socialist approach in politics is likely to greatly influence the current socio-technical regime. However, if the political system in South Africa does not change, the regime within the current systems in the construction sector and the quantity surveying profession will remain unchanged.

"*So unless you have somebody that decides that you now want to change to a socialistic approach, unless we change the way the country is run then it [the politics] isn't [going] to affect us at all*." (P3)

Even though experts do not expect to see a major change in the socio-technical regime given the landscape developments in South Africa, one of the ways the socio-technical regime could possibly

change will be when stakeholders start thinking out the box, that is, construction principles must change. A change in principles will assist in making the construction sector more sustainable.

"*Well, the principles have to change. The construction sector is currently failing. It is failing. The principles have to be like thinking out of the box. Because the reliance on the private and the public sector in terms of guarantees to get work is not going to count, not in bringing jobs any more. So the principle is to make the construction sector more self-sustainable.*

"*I don't think anybody's talking about a self-sustainable construction sector. That is able, in those times of recessions, to be stable. Is more stable because there is a vision, a clear vision, and the principles are very solid to navigate those waves. I think that's my opinion.*

"*The principles has to be changed. No longer conventional principles, i.e. tendering. They [contractors] have to create their own projects. They have to go beyond, 'I'm the contractor sitting here waiting for a client', or they need to be more aggressive, more sustainable to generate income to survive. To maintain the industry*." (P22)

With regards to the current framework governing the sector, and the professions (including professionals bodies such as CBE, SACQSP and similar), the majority of experts perceive that the framework will still exist in future. Others see the councils growing stronger and the CBE weakened. Others see the councils growing stronger without weakening the CBE, instead believing the CBE might get stronger. The continued need for regulation is based on the need to control human behaviour and maintaining standards. This need was expressed, in spite of accusations of the current bodies' gatekeeping and ineffectiveness in ensuring compliance. The framework is also necessary for organising the professionals.

"*The questioning of the existence of the CBE, very, very important because you put an overarching body, but people you have appointed there don't know what they are doing. And now you've got professional councils [that] know what they are doing and now, they must report here (CBE) and this person asks them irrelevant questions.*

"*With time, the CBE will be absorbed by public works. That's what I foresee. And now if they are observed. Now it goes back to where we were because councils were put into public works. Yeah, because public works is doing oversight, you know*." (P12)

"*I think the Council for the built environment will probably end up running the various functional councils, engineering, quantity surveying, and they will take over that role. The Council is very much*

project-based and project-focused, and whether they gain huge value or not is open for debate. I am not sure. So I think, certainly for the foreseeable future, the various associations and councils will run themselves and then have to play along with Government, which is basically the council for the built environment." (P2)

"*Not that I'm trying to water its [Council] existence. It is relevant. You see even that has been influenced by a lot of incorrect beliefs – that if the Councils or the structures that govern the professions are deemed to be gatekeepers, therefore the standard needs to be lowered to allow everybody else [entry]. And then the performance becomes dismal. It becomes less and less as it continues. Do you understand? So then it begs the question, are those structures needed? Because everybody would do anything any time, because the floodgates are open. That's what has happened and it's driven [largely] by politics.*" (P10)

"*Yes, we must always have those (councils) because people need to be regulated. Where there's a person involved, there must be rules and regulations*." (P11)

"*I think you [are] always going to have that because it's part of what defines the professionalism of the body. You don't exist as a profession without some kind of oversight. And oversight is always about policy. It's about the definition of who or what you are. That's what makes us a profession.*" (P5)

The main reason the current framework exists is because it is legislated. To change the current structures in place, requires a change in legislation, which become a cumbersome process.

"*But the built environment itself, in terms of professional councils, can't change that. There has to be an Act that says, 'No a QS can no [longer] be independent'. So you must start it first from the regulatory status. You just don't relegate people. You have to apply [to] Parliament and say, 'No, we no [longer] need these guys [to be] independent'. Then they say, okay, then we have to scrap their Act'. But as long as there is an Act, you can't take out these people. You see, that is why I'm saying in the UK [it] is different.*" (P12)

Some experts question the current legislative framework's ability to withstand developments from the landscape and the niches.

"*Legislation is not going to protect anyone. Everybody is going to die because legislation is driven by policy and competitiveness. Once people can find themselves a way around those two, which is easy, all you have to do is remove leaders and bring other leaders. And then they dictate your own agenda.*

So it's really not cast in stone. But what is cast [in] stone is the fact that innovation is helping you, like it or not." (P6)

"*And I think that because of the nature of them, I'm not sure that the Council for the built environment is going to be as agile or [as] quick to respond to the (more and more) changing built-environment landscape. So they are probably lagging. So what you['ve] probably got is, you've got the companies, the big companies and in the various fields leading their functional councils and associations, which will then lead the [overarching] council. So, certainly in the near future I don't see too much change coming through from that point of view[councils]. You [are] still going to have PrQS. They might try and tighten down but they [are] also [being] challenged by, for instance, others coming in. So the real estate people are coming in and are looking to take over [from] the facilities manager. And on that basis, are they then going to start to impact into where the QS sits, because it's about money and cost? So I don't know, there's going to be some playouts there to come. And I don't even think those guys have seen each other on the horizon yet. And it's come*." (P2)

Some experts see a greater integration among the councils, and the private and the public sector. This integration will ensure there are same standards in both the public and private sectors. It will ensure that resources are not wasted, especially in the public sector.

"*I think yeah in the future, there will be sort of an integration. I can't see all this kind of councils and institutions operating in silos anymore. Because what used to happen was the architectural profession would revise their policies then everyone sort of follows. Or the engineers will come up with new ways of doing things, [e.g.] charging fees. So there'll be those people that are leading in terms of adapting to how these things are done and other professions are sort of catching up to them.*

"*On the State side, they need to be (because they are the custodians), upgraded or there must be a sufficient level of skill within [the] State. At the moment, the private sector or private investment would operate in a certain way. Whereas the State is still stuck into all the documentation. Like the JBCC. They don't even use the current JBCC. So there's no equal level of operating. Both [in] State infrastructure and private infrastructure. Whereas private companies would just come in and quickly do things with ease and speed, the State is lagging behind. There [are] cost overruns because there is no sort of consequences. In the private, you fear a developer. You open it late. You've already lost.*

"*So in the state, you know, no one takes final responsibility for delays and cost overruns. So I think, in future, at the policy level, [we] will have to ensure that there is the same level of accountability and discipline and consequences. Because there's huge spending, especially in the State, as compared to*

the private spend on buildings. So if there's no tight management of costs, of design, of policies, of documentation, then we'll continue experiencing their losses that we see. As much as we like, it will be a country of two states. I think in the future the policy level, there needs to [be] a lot of alignment, especially at the higher level. A lot of engagement and that comes with the State having the relevant people in the institution." (P8)

The next section discusses how experts perceive the niches' response to landscape developments and the socio-technical regime.

6.3.3.3 Niches

There is consensus among the experts that the future of the construction sector and the quantity surveying profession will differ from one another in future. Experts were asked how the construction sector and the quantity surveying profession may appear in future, given the current and potential factors that are likely to influence them in future. Experts were divided about the future. Some were optimistic in their outlook, while others took a more negative approach.

6.3.4 Experts' perception about the future of the construction sector

6.3.4.1 Positive outlook

Self-sustaining

P22 foresees construction companies becoming more self-sustaining, that is, initiating their own projects rather than depending on the government.

"*The principles have to be like thinking out of the box. Because the reliance on the private and the public sector in terms of guarantees to get work is not going to count, not anymore in bringing jobs. So the principle is to make the construction sector more self-sustainable. I don't think anybody's talking about a self-sustainable construction sector. That is able in those times of recessions, to [remain] stable. [That] is more stable because there is a vision, a clear vision and the principles are very solid, [when it comes] to navigat[ing] those waves. I think that's my opinion.*" (P22)

Integration of the public and private

P18 expects the public and private sector to become more integrated in future.

"*You still have to make [a] profit because that's the engine room of any business. You don't make a profit you can't expand. So that's it. But I do see that there has to be this integration between the public and the private.*" (P18)

An enabler

P23 and P19 expect the future to see the construction sector become an enabler in the development of South Africa.

"*Oh, I am feeling so miserable at the moment. Well, I don't know [how the future will look]. I don't think the future is determined, it's indeterminate. So it's possible that it [construction sector] starts to develop some momentum and in fact I suppose in the best-case scenario, it can become a lead and an enabler because if the construction sector gets going, it can be a major employer. It would be nice if that employment transferred to decent and good jobs. So maybe more industrialised building processes in general, especially for things like informal settlement upgrades and things like that.*

"*So in the best-case scenario, we would have a situation where we got population stability and we got people housed in decent accommodation and with good access. If spatial planning was much more integrated. That's the trajectory we are on, right?*" (P23)

"*So if there is political will in changing the corruption, oh my gosh, that will have such a positive impact on the construction sector. And in fact, it will have a positive impact on the business sector, of which construction is one.*" (P19)

6.3.4.2 Negative outlook

Foreign takeover

What might be regarded as a negative development is foreign construction companies potentially assuming control of the construction sector, at South Africa's expense.

"*Suddenly China comes and they see opportunities and they are throwing money at Eskom. They see opportunities. The rest of the world comes in and they see now, when you are weak, the rest of the world comes in and they'll take advantage. China does that all the time. They going to Africa. They going to Zimbabwe. Zimbabwe is desperate. They throw money at a problem and the next thing they take control. That's what China does. So the rest of the world, some countries, America, they give us the same. They'll come in. They'll see, take advantage of weakness and for their own benefit. "* (P9)

6.3.5 Experts' perception about the future of the quantity surveying profession

6.3.5.1 Positive outlook

A positive future

As the people best equipped to deal with construction cost, quantity surveyors can probably expect a positive future.

"*Well, I think we [QS] are the best skilled out of the professional team [in terms of taking] advantage of the technological [aspects]. Architects as well. But to use all the data that's available – we are the best people to use that data. So like there is a BIM drawing now; there's so much data just a click away and architects don't know what they're doing. They know what they're doing when they're drawing, but they don't know what they're doing with cost. So we are the skilled people to take advantage of that data. So I think it's [the future] very positive. I think you'll [QS]still have the same role in the team, and you'll still have the same broad functions. But the way you [QS] produce them with technology is different*." (P16)

A rosy future

Technology will enable the quantity surveying profession to experience a rosy future.

"*[The QS future will be] very rosy. It [QS profession] will always be required. It's one of those that technology just enhances in the way things are done, but it can never be written off by technology.*

"*It will never be wiped out by technology, but technology [will] assist it to function in a more efficient manner and make sure that it [the QS profession] does exactly what it's supposed to do, which is providing value for money. So technology just comes in and enhances the way you do things. Brings efficiency onto the table. So now you perform so well and then you are reaching the target. And the target remember is not to make money for yourself actually.*

"*Your target was from the word go, your target was to bring efficiencies into the industry. To say, 'no look we need to know whether you can finish the project or not. And that's why I come in. And so I'm bringing in efficiencies here.'*

"*So we are in there to make sure that there is value for money. And actually our payments come from the value for money that we provide. So by bringing technology, that means we are enhancing the value that we provide [even more]. So, actually, we should be seeing in real terms fees coming down, not in nominal terms, but in real terms. Fees are coming down in what manner? In a manner that now, for example, the project was going to cost, using the traditional methods of quantity surveying and whatever, your fee in the project was going to cost 10 billion, now because of efficiencies that are on the table, now the project cost itself comes down. Which means you have now saved perhaps another 20%. So R2 billion is now down and that's the value that we have brought in. Don't mind your R200 million that you come out with or R10 million or whatever. It's nothing. What is that per cent from that saving that you have brought into the whole market, the industry? Which then (because of the saving) the client can invest even in more projects, create more jobs. It's for the benefit of the whole society.*

The whole society benefits because of us, [the] QS [profession] and our efficiencies. As long as we pass those efficiencies to the relevant parties." (P11)

P12 claims that the current quantity surveying profession will, however, continue to be challenged by technology in future. "*The QS profession is going to be challenged. We've just said now there's going to be this revolution that is going to take place. People, particularly on the ICT side, are thinking on how to fast track.*"

Bright future

By shifting more into life-cycle costing, quantity surveyors are building longevity into their future and creating a bright future for themselves.

"*So the QS's future doesn't end with the structure being completed. Where an architect would finish and that's it, [a QS] now has to do life-cycle costing. All of those things are cost related. All those are built from what the QS would have accumulated from whomever has chosen whatever material or plant and equipment being used to make sure that the building is functioning. So the QS has got a bright future*." (P20)

"*It will look bright because there are a lot of projects coming, and then the need of QS is still there, especially a QS who specialises in one sector*." (P12)

A completely transformed profession

Current and possible future changes in the current socio-technical system might cause the quantity surveying profession to experience transformation, which could necessitate a change in name.

"*The future, it's very hard to tell by the way things are happening that I don't know whether we should call ourselves quantity surveyors anymore because now things have moved so drastically that you know, that [the] specialized field of a QS is just one but part of that. I think maybe 'built environment specialist' or an 'advisor'. It has to move to a level where we have to take the thinking out of the bucket.*

"*Like for instance now, in the US, you know, you'll be like cost engineers. It will be everything. It will be anything that has to do with economic advice, costing advise. Like mining should be automated. Things will be done differently. So it must a technological specialist. He must be an environmental specialist.*

"*So there is a lot of skills accumulation that a future quantity surveying, would not just be the construction budget, but a sort of an economic advisor. Someone who would have assembled all the knowledge. Taking care of the environment, the technology, sort of an all rounded person.*" (P8)

Quantity surveyors will be running with the horses

Quantity surveyors will in future need to be resilient and innovative to survive.

"*We really need to look [at] ourselves and see how best we can respond to the challenges that we have. So until we come together, especially the quantity surveying profession and say this is the climate, nobody is going to hand it to us on a plate. But if you come up with innovative ways, like we've been to the last conference called, 'Running with Horses'. So I think that is the future.*

"*We need to be resilient. We need to be innovative. To put our best foot forward. Otherwise, we face extinction. Other professions will somehow absorb the skill into their own thing, which is not their speciality. But if you come up with new ways of doing things like we've been doing [then we'll survive]. Now we need to jack up on our technological skills. We need to incorporate our skills in terms of the environment.*" (P8)

6.3.5.2 Negative outlook

Rubber stampers

Unless, the quantity surveying profession exercises its independent professional judgement, it will lose its credibility in society and become a mere 'rubber stamping' profession.

"*Because the quantity surveyors have allowed themselves to [simply] tag along [with] the whims and the desires of the people who control the purse or the source of the finances. It is going to [compel] the QS [to] be [more than] just [part of] a rubber stamping process.*

"*It [the construction sector] will not be better until the players, in particular the quantity surveyors, take charge of their role to advise the client on all the elements we spoke about in taking off of the quantities, quantifying them and doing cost reports, etc., which are very essential to know where the project is going to land.*" (P10)

The quantity surveying profession will not exist in future

Technological advancement, unethical behaviour, lack of innovation, and changes in legislation regarding the process, are the greatest threats to the survival of the profession in future. Continuous training is regarded as one of the ways to remain relevant in future.

"*So until those ethical things are corrected it [QS] will die. The other professions have no regard for the quantity surveying [profession]*." (P10)

"*And if you can add value then they'll get you to do it. Everything is about value add and that's what makes a practice, a QS practice, survive or fail. If you don't upskill your people all the time, then you become a dinosaur and you die because somebody else then comes in with ways of doing it*." (P3)

"*If you don't adapt you die. And the QS has to do exactly the same. If the way you do things out there has changed, then clearly the pricing of the contractors will [follow] accordingly. And it will be judged accordingly. And we need to understand what the market is doing and keep up with it. If you don't understand that or you keep on saying, 'But we didn't do it like that 30 years ago'. Well, guess what? That's old technology. You've got to move.*

"*If you don't understand that, eventually you just become less and less relevant as you go along because you are not at the cutting edge. And I guess BIM is a typical sort of example. I mean, if you don't acknowledge that it is there and will be there [going forward], eventually the really successful people [will be] the ones that really take that on. If you refuse to do that, you are not going to be the leader of the industry, are you?*" (P1)

"*[QS] We need to be resilient. We need to be innovative. To put our best foot forward. Otherwise, we face extinction*." (P8)

"*Out of five that were working in a project, technology would wipe out four. Only one must stay*." (P11).

"*Look I think to me, you need to protect the professions. Otherwise, the profession is going to die. I think so because how can you get an architect doing QS work?He doesn't know. He is not trained to do that. Look let's take this thing to the extreme. If you look at Africa: if [the] head of state of Zimbabwe is sick, he is treated elsewhere because the doctors were not protected in their country. So when you protect the profession, there's a reason why those professions are there. If you don't protect them, protecting your profession, I'm not saying you babysit them. There are laws regulating who should practise as what. There's a reason for that. So now if you put laws [in place] and then you don't implement them? What's the point? Why don't you scrap them?*" (P14)

Currently, some clients do not recognise the need for a quantity surveyor's services on projects. For this reason, it is likely that in future they will adopt technology as an acceptable substitute.

"*So even today we find it difficult to recommend professionals to the client. The client understands that he must have an architect. The client understands that he must have an engineer to keep the building up, but they never understand why they should have a QS... And often I've said to the client – as recent as last week – I said, please you must appoint a QS to verify the information that we've given in terms of the cost.*

"*They may not exist. Because the very same client is the one who's going to buy your software.. I'm positive that he'll ask the architect [to] work out the quantities [in order] to start building*." (P10)

6.3.6 Experts' perceptions about the construction sector and quantity surveying profession's past

In order to test claims about the possible future of the quantity surveying profession, experts were asked about the initial state of the construction sector and the quantity surveying profession, in the early stages of their existence.

6.3.6.1 Landscape developments

There was consensus that in the past, the construction sector and quantity surveying profession were largely influenced by the political machinations, which influenced the wider economy, which rippled down to the construction sector and the quantity surveying profession.

"*C'mon, in this country politics definitely affected everything. I would definitely say, South Africa you can't get away from politics. Politics affected the economy, it affected where we were getting money from, what we did with that money, where we were spending [that] money*." (P5)

Pre-1994, the political system favoured Whites in the construction sector and the quantity surveying profession, with greater opportunities provided to them.

"*The National Party was the [apartheid] Government. And that Government was racist. In the private sector mainly, there are still serious issues; there are discriminatory issues, preferential issues as well … Before 1994, you couldn't find a Black contractor to build, let's say, a R100 million project or a R40 million project in South Africa. Difficult to find. Maybe one, I haven't heard. I doubt. When was the first black quantity surveyor graduate in South Africa?*" (P22)

"*I mean the politics favoured all those quantity surveyors who were there at that time. But I don't think politically there were challenges. People were given work. People were favoured. So whether the economy at that stage was okay for a certain group of people, they never had problems. I mean remember this, people used to go to university. Their university [tuition] was paid [for] by the State.*

From military, he goes to university, which was State funded. When he finishes, he starts working. So there were no problems." (P12)

6.3.6.2 Socio-technical regime

Strong legislative framework

Even though the legislative framework that existed pre-1994 favoured the Whites, experts believe that they were nevertheless effective in meeting their objectives. The legislative framework that existed pre-1994 is regarded as more rigorous than the current one.

"*You see those ones are difficult. Then things were not structured properly politically. The whole system was lop-sided towards one group of people and so on. So the whole thing was meant to favour White people. To protect the interests of Whites. I mean quantity surveying was also used to exclude certain groups of people. I mean if you look at the profile at X University, only one Black person used to qualify at a time. Sometimes no [one].*

So I would say that the legislative framework then was meant to introduce something that was very important in the built environment, but with serious shortcomings in terms of the political environment in the country. Only certain groups of people were allowed to do a course in quantity surveying and to be a professional QS. Not everybody. Very few people. Engineering had more people. So I would say that legislation at that stage was effective but to a particular set of people." (P12)

"*So that made us stronger [as did] the regulatory framework. I think [it] was strong at the time, which I don't think it is now. Look there was order in the old days. Just be honest about it. There was order. I mean you could hardly even see potholes and that. There were systems*." (P14)

No tendering for professional services; services not compromised

In the past there was no tendering for services. This helped to improve the quality of service clients received from quantity surveyors.

"*My [experience in the] past [came] before tendering for services. It was a good profession in the sense that you didn't have to have marketing costs. Maybe yeah, we didn't have marketing cost. But one would say, 'You want to be relaxed'. I'm not saying that but you didn't have to waste resources. And that was saving a client as well, because the client would get a full-service, a good product. Things finish on time. So you must remember those three things. It's cost on time. I can't remember the third one. Build on time. Quality and cost. Now these days. You hardly get those three*." (P14)

The legislative framework responsible for upholding the quantity surveying profession

Even though the continued structure is challenged by many factors, including the Competition Commission, the current legislative framework is the driving force in making the profession what it is today.

"*The Council really has been the driving force. The fact that that the politicians realised that they needed to make a profession by having a Council. The Council in turn realised that they needed to put policies in place to decide who can and cannot register. So I think that's really the factors. The politicians realise that you need at least profession[al status]. Therefore, we need to have an Act. With the Act comes the Council. With the Council comes a whole process of control and a mechanism. So if they didn't do that, then we wouldn't be where we are.*

"*By law, even today, if you call yourself a quantity surveyor and you're not registered, you can go to jail; [you] pay a big fine and go to jail. So that's the barrier to entry, which is good. Whether that exists, continues into the future, I don't know*." (P9)

The construction sector of the past was informal and less organised

Unlike the professions, there was less organisation within the construction team. Contractors were not organised. Currently, the Construction Idustry Development Board (CIDB) registers and grades contractors who want to participate in public projects. In spite of its poor organisation, the contractors were genuine constructors in comparison to current contractors, who are more business oriented.

"*But the issue is it was an informal business. Now it's been formalised. You get [an] organisation forming bodies to try manage [things] so that there is control. There is control. But in the past, the industry was not running like a formal business. You didn't have to go to school to do construction and it was predominantly, Italians and the Portuguese [people]. I mean, I've got a Portuguese friend. He doesn't look at the plan. For them, it was like they are born constructors. So you don't have contractors now. You got business people. We call them business people or tenderpreneurs*." (P7)

"*Post-1994, we have set up in the construction sector, where we've ranked contractors for government projects and so on*." *(P12)*

Structured

P10 argues that the construction sector was more structured than it currently is. The desired outcomes were always achieved.

"*It was very structured and whenever you got involved in a construction project you knew that the desired outcomes would be achieved with less bruising*." (P10)

6.3.6.3 Niches

There does not seem to be a significant difference in the current quantity surveyor and their past counterpart, at least in how the profession is structured and its tasks. What seems to have changed is that technology has assisted the quantity surveyors to carry out tasks much more quickly and more efficiently. The opinion towards the quantity surveyor seems to have simultaneously diminished.

6.3.7 Experts' perceptions about the construction sector in the past

6.3.7.1 Construction sector: positive outlook

Buoyant

P17 described the construction sector as buoyant. This buoyancy was fuelled by the boom around the 2010 FIFA World Cup.

"*The construction sector in the past? No, it was still buoyant. I mean 2010. There were things that were happening. I mean, yeah. There was a boom in construction. There was a boom in construction around 2010. The stadiums, infrastructure developments, roads, yes that*." (P17)

Fit for purpose

The construction sector of the past was fit for purpose.

"*I think it [the construction sector] was fit for purpose. Its efficiency was based on its time*." (P5)

Less litigious

The past construction sector was less litigious than the current construction sector. Construction projects are based on lies regarding IRR.

"It was very structured and whenever you got involved in a construction project you knew that the desired outcomes would be achieved with less bruising. Currently, there are a lot of litigations regarding the construction industry because people have not been truthful in the internal rate of return (IRR) process. And in their untruthfulness, they've tuned their mind to believe that they're telling the truth. So they repeatedly lied to themselves to a point that the lie becomes the truth in their heads and they cannot tell the difference any longer. That's what the problem is." (P10)

6.3.7.2 Construction sector: negative outlook

Unfit for purpose

According to P23, the construction sector of the past was unfit for purpose, as it did not meet its purpose of delivering infrastructure.

"*No. I do think that in the past the construction sector was much better geared for its purpose and its purpose was to deliver infrastructure. So I think that seen in isolation, each one of the processes and*

principles is what makes sense. But when you take them together and the greater drivers, the whole thing has become dysfunctional." (P23)

Shortage of skills

There was also a shortage of skills. This led construction companies to carry out in-house training. "*Well, we did mention the skills training. We did have a problem [with] skills. A lot of it was done in-house. And the construction companies would do their own training whereas, well as you know, we used to have trade, trade colleges. I don't know the latest [about] where we are. They did say that they were going to revitalise these*." (P18)

6.3.8 Experts' perceptions about the quantity surveying profession in the past

The quantity surveyors' profession was well respected in the past

Quantity surveyors were respected in the past, mainly because they remained loyal to the basics. "*Like many other professionals, they (QS) were well respected. It's like in the past we didn't have accountants. We had bookkeepers. And these people were very thorough about the piece of paper and what's written on the piece of paper. They've [bookkeepers] been replaced by accountants who look at the holistic thing and try to give guidance, or control the very same bookkeeper.*

"*Similarly, then with the quantity surveying as I've mentioned earlier ([at the risk] of repeating myself, they're trying to deal with the bigger thing but the basic thing is just to estimate. That's the basics*." (P10)

Some attribute the respect the quantity surveyors were accorded in the past to a scarcity of quantity surveyors in the market.

"*Okay now in terms of my environment the QS was [more] respected than it is now. Maybe because there was still a shortage of them. So there was still a very high regard [for] the QS, [more] than now.*

"*I think the shortage also contributed to that [opinion] and also things like corruption had not [been] blown out of proportion like it is now. At that time, you know, people were still strict. Like you say, the 'good old days'. It was something like that. Because of the number [of] people, that there were [only] a few, and they were respected [in] their own profession. Everyone who was in that line wanted to be a professional. Because of that dignity that went with it*." (P11)

Limited scope

Quantity surveyors had a limited scope of services in the construction sector.

"*But what I have found recently, over the last 10 to 15 years, is that quantity surveyors are going into other fields more than in they [did] in my day. So previously [when] you did your quantity surveying, you stuck to quantity surveying, but now there's definitely the people who will go and work in the banks, who'll go and work for insurance companies. So it's a more general degree and they are now going wider. Maybe they still call themselves quantity surveyors, but they are working for the banks*." (P16)

"*Remember in the past. I mean, [the] QS profession used to be sort of a service that was provided not only to builders but to clients that wanted to understand the quantities, in terms of materials and financials for the project*." (P6)

QS were previously more professional

Quantity surveyors were more professional in how they carried themselves and the work they did in the past than they are currently.

"*They [QS] were professional. They were outstanding. They had a lot of experience. They were confident and then yeah. They were more ethical*." (P12)

"*They have always been professional. It's a function of being left-brain[ed]*." (P5)

Quantity surveyors did not exist in the past

P9 claims that the quantity surveying profession did not exist in the past. This is because the construction sector was less organised and more informal in the past. This could be the reason that quantity surveying was regarded as a relatively 'obscure' profession.

"*[The] QS profession did not exist in the past. There were no QSs at that time. Mr van Vuuren , he will write everything on the box of cigarettes on site. There was no QS. The QSs were not there. As much as I know. QSs started developing. I know the industry has been there… that is why there was an informality [about the process]. Because of the informality, people can't even estimate. Like you ask someone to give you a quote. He can't even finish the job with what you got. Because nobody was there to do estimates.*

"*It is like project management. There was no profession called 'project management'. Nobody was looking at it like that. They used to say, 'I am a builder'. The used to call them builders. These guys are builders, whether it's a road, [or] whatever. They are builders. They didn't say construction. They say builder. You are building something*." (P7)

More ethical

In the past quantity surveyors were more ethical than they currently are. Things such as corruption within the profession were uncommon. The new generation of quantity surveyors is regarded as largely unethical.

"*The new generation of quantity surveyor now, they are coming in the sector where [there is] corruption, [in] the way the appointments are done, they are more interested in getting money and less ethical. And this is affecting them. But the old generation they still, they have got the name, they [have] got the experience*." (P4)

A boring profession

The past was boring because the profession lacked innovation in comparison to today.

"*I think it was boring. Because ... The emphasis was not on the 'hip and happening' of what I see today, because everything else largely was box-ended. You had a trajectory of, 'this is your path'. This is what you walk. There was not much innovation to it.*

"*I'm not saying boring as in, it was not a good profession. But there was nothing much happening. [In] this day in age there is just a lot. I mean I came out of a meeting today and I was being told about these boards that you can do as an infill panels to portal frame. It takes about a couple of minutes to dry out lightweight concrete. Bang! You've got the wall. In two weeks' time you're done. I thought, 'Hang on. But this thing I'm not sure of, the curing levels, the sound, the audible things as compared to a brick'. That is now the old me, saying, 'How durable is this?' But you drive out of it, you are excited because you can roll out this design in four projects in different geographic locations. Because we're dealing with bog standard stuff isn't it? So, and if I'm giving this guy four it means if it's worth R5 million, for example, I can potentially shave off 20% or 30% of this. Wow, I would like to work with this guy because I can then say to my client, 'Listen I've got a story for you, I've got good news for you. There is this thing that we can use now and forget about that conventional approach.'*

"*I add value because it's something that I've been investing in on my own time and now I'm able to sell it together with the contractor who is going to do it. And I'm able to say to the contractor, 'Work with me. Let's formalise this structure because I want to invest in your technology'. It's no longer just about quantity surveying is it? It's about longevity of stay. You get what I am saying? So, the past was boring*." (P21)

Factors that upheld quantity surveying in the past

Experts were asked to comment on what upheld the quantity surveying, to test the durability of those factors, in light of their potential support to the future of the quantity surveying profession.

Accuracy of estimates

The accuracy of estimates is one factor that held up the quantity surveying profession.

"*Of course it was the accuracy of the estimate. That's one thing. So the estimate itself, that capability to come up with an estimate and then be accurate and contain costs to stay within that estimated cost. That's what made it respectable. To say, 'Wow, I can work with that guy again'. Or it showed the client, made them realise that, 'I really need a guy like that'*." (P11)

Training processes produced the right skills

In the past quantity surveyors were more thoroughly trained.

"*I think it was the skills. PrQS and the institutions that governed ensured that the best of the professionals were produced. And there were thorough processes to ensure that to be given that responsibility you [had] to satisfy the profession itself.*" (P8)

High regard for the profession

The quantity surveying profession was more highly regarded in the past than it is today.

"*Regard.[It was more esteemed.]*" (P21)

Uncommon and unique skill

A critical factor, in sustaining the quantity surveying profession in the past, was the uncommon and unique skills specific to the profession.

"*If you look at what a QS does, it is a skill that was not common at the time. Just to be able to transmit a drawing, the technical know-how [of that took real skill]. People can look into a drawing and not know what is happening. You needed to able the transmit the [information from the] drawing into what we do. It's a unique skill.*" (P13)

Value for money

By using quantity surveying in construction project, clients derive value for money and this is what has upheld the profession. Resources are used efficiently.

"*I believe it's basically the aspect of materials, budgeting, integrity, legal. We had the formalisation of contracts. I think those are the drivers, because remember the whole aspect of materials contributes to structures and developments. And that is where there's a lot of waste. And having a QS has always been regarded as the best way of ensuring that you do not waste on any development. You've got accurate*

quantities and at the end of the day you don't have leftovers, which are just a lot of waste. Financial management has been a key driver in that accurate monthly evaluations could be achieved.

"*Budgeting, it's a big one. First, because before any development is funded budget should be established accurately and then finally formal contracts and governance [are ddressed], [which] creates governance for the project. Things that QSs churn out. And finally, I mean value for money [must] be established at the end of every programme.*" (P6)

"*Yeah. I think as I said before the issue about, you know, attainment of value is the one. Everybody wants value. Though you don't define it like that sometimes, not saying value. But it is important. I mean you also want value every time. When you buy a car you want value for money. So value is something that is a driving force, you know?*" (P12)

Fewer quantity surveyors and a strong regulatory framework

Having fewer quantity surveyors and a strong regulatory framework also contributed to the previous position of strength enjoyed by the quantity surveying profession.

"*There were few QSs. They had a lot of work. So they were making money. That to me that what was making it. And the country was not as developed at the time and also. Look at [the] guys who did the Union Buildings. I'm sure those guys never even tendered for that thing. They did it. They made money. So that made us stronger and also the regulatory framework, I think, was strong at the time, which I don't think it is now.*" (P14)

Belief in the professional

In the past there was belief in the professionals. This belief was mainly based on ethics and professionalism.

"*I think without any question that there was a belief in the professional, in your ability. Architects were like rock stars. Not just musicians and even today we have in Europe or America you have a culture where you bring in a famous architect on a particular project so that you can make the project feasible. It has feasibility.*

"*So that was the thing. Whether you were Herbert Baker who came to South Africa, had an office in London. And all the Herbert Baker properties are still very famous. But there were two or three properties which were [those properties'] contemporaries. Were they as good? I think they might have been better. But, you know, it definitely had to do with your professionalism of art.*

"*I don't know if the QSs had that. I don't know if there were QSs rock stars, but, I imagine I don't want to call it an 'old boys club', because I don't think it was that. I definitely think that when we were [fewer] people, less highly qualified people, things were a little bit easier. And I think it was because people were more professional.*

"*I think for me professionalism is about ethics, it's about your integrity, about how you do things and how you conduct yourself. And that proliferates. You will know people come to you because they trust you. They trust your judgement because they know that there's no stories and that's a good thing.*" (P5)

Clients do not learn from their mistakes

Most clients do not learn from their past mistakes and as long as this continues, quantity surveyors are going to hold their jobs for life.

"*If they spent the time and the knowledge properl,y you wouldn't need a QS. But they don't. They don't learn from their mistakes and I think that's just a human thing, because it's like you are an engineer, okay, you do your job and whatever the case may be and you're quite good at it you then move to being a project manager and then you move up and you move. So what happens is that people move up levels and you get new people coming in and there's no 'Lessons Learned'.*

"*What happens is the mining houses make the same mistakes over and over and over again. They don't look to themselves and say 'How can we improve ourselves?' As long as you keep doing that and I think they always will because if that's the way you do business, that's [the way you] do business. When they're making that much money, they don't worry about this. When things are tight, then they start looking at doing things properly, then you can start to suffer, but as long as the mentality doesn't change then we're going to be in jobs for life.*" (P3)

6.3.8.1 Summary of the findings on the future of the construction sector and the quantity surveying profession

6.3.8.1.1 Landscape

As in the past and the present, it is evident that political and economic factors will continue to influence the construction sector and the quantity surveying profession. Poor political decisions will have a negative influence on the economy. This will then have an adverse effect on the construction sector and the quantity surveying profession. Positive and progressive policies, on the other hand, will have an encouraging influence on the construction sector and the quantity surveying profession.

Experts are divided about the future political and economic landscape. Some experts do not expect the current negative status quo, which is marred by corruption, to change in the next 20 years. In fact, some expect conditions to worsen. There are, however, some experts who perceive that the new government will bring reforms and deal with corruption decisively. What is common in the findings is that history will repeat itself, in that the political and economic landscape will continue to have a major influence on the construction sector and on the quantity surveying profession. Change in the socio-technical system of the quantity surveyor is likely to be from the top down in future.

6.3.8.1.2 Socio-technical regime

Findings reveal that the socio-technical aspect is regarded as the apex of the structures upholding the quantity surveying profession. The socio-technical regime has currently been somewhat challenged and weakened by various factors, such as the Competition Commission, and its ability to keep the profession ethical and technology. While some experts expect the structures to exist in future, some question their ability to withstand negative pressure applied by the landscape and the niches. Some experts, such as P6 and P3, believe that professionals are able to find ways around legislation. P3 states this assertion succinctly, "*Entrepreneurs are entrepreneurs. They'll find ways of doing things*." (P3)

If the socio-technical regime buckles under pressure in future, this will open itself to challenges from the niches, which might lead to it eventually being replaced. If it is replaced, the current structures and roles in the construction sector might be redefined, including that of the quantity surveying profession. The profession might even consider changing its name to reflect its changed role and tasks. Changing the legislated profession through parliamentary processes might prove cumbersome; the behaviour of professionals and landscape development, such as technological advancement might render the legislative framework governing the profession redundant, to the extent that the regime changes without changes to the legislation.

6.3.8.1.3 Niches

Landscape development will continue to elicit a response from the niches. Some experts predict a 'bright and rosy' future for the quantity surveying profession, while others envision the profession's extinction. Those quantity surveyors who are able to adapt and innovate to accommodate changes will be 'running with the horses', while those who fail to adapt face possible exclusion from the market. It is this adaptation to change that might challenge the regime.

As quantity surveyors seek to survive and remain competitive, they might consider introducing new practices and technologies that differ to current practices. As the new practices and technologies gain diffusion, they will become the new norm, thereby replacing the current regime. Quantity surveyors will, however, need to be ethical to keep and expand their position and role in society. Ethics seems to

be one of the primary principles upholding the profession. Unless they remain ethical quantity surveyors will be replaced by others professionals and/or technology. New professionals and/or technology will then challenge and eventually replace the current regime. The next section uses the findings from the interviews, workshop and focus group to generate scenarios for the quantity surveying profession.

6.4 Summary of Chapter 6

In this chapter, the findings of the data collected from the interviews, workshop and focus group, was presented and analysed in accordance with the MLP Framework, the 5Ps model, the research questions, the research objectives, as well as the literature review. Findings from the interviews reveal that experts hold divergent views about the future of the quantity surveying profession. There are those who hold a positive view, those who hold a negative view, and those who hold neither a positive or a negative view. Various reasons were advanced for holding those views.

Findings from the interviews also revealed that not all quantity surveying tasks are at risk of being lost to technology. Tasks that seem to need human interpretation, such as value management and life-cycle costing are thus regarded as the quantity surveying tasks of the future. As certain tasks are taken by technology, the role of the quantity surveying profession in society might change, bringing with it a possible name change. There is uncertainity with regards to the professional status of the quantity surveying profession, with some experts unsure of its continued existence, others of the view that the profession is likely to keep its professional status, and others of the belief in direct contradiction: that the profession might not retain its professional status.

Current political and economic factors were cited as possessing the most influence on the quantity surveying profession. Corruption and high competition were ranked as the two most critical factors influencing the quantity surveying profession in the workshop and the focus group. The findings and analysis of the data from the interviews, the workshop and the focus group were used to construct future scenarios for the quantity surveying profession. The next chapter provides futures scenarios for the quantity surveying profession.

Chapter 7: Future Scenarios

7.1 Introduction

This chapter provides possible future scenarios of the quantity surveying profession, based on the findings and analysis of the data from the interviews, the workshop and the focus group. Following the intuitive logics scenario generation method, four possible scenarios for the quantity surveying profession are presented and discussed.

7.2 Objective Five: Provide scenarios for the future quantity surveying profession

The findings of the workshops and the focus group identified corruption and high competition as the factors with the greatest impact, and most likely to breed uncertainty in the future of the quantity surveying profession. Corruption and high competition were plotted on a two-axis graph. Figure 7.1 shows a graphic representation of the four scenarios that were developed for the future of the quantity surveying profession for the year 2040.

Following the intuitive logics scenario generation method, interesting descriptive titles were used to name the scenarios. The scenarios were named 'Bright and Beautiful', 'Strong and Unsteady', 'Doom and Gloom', 'Murky and Fuzzy'. Geels' MLP Framework is used in explaining the possible future scenarios of the quantity surveying profession. From the findings of the interviews, workshops and focus groups, it is evident that the landscape developments will influence the socio-technical regime and the niches. Change in the socio-technical system of the construction sector and quantity surveying profession will likely be top–down rather than bottom–up. Politics and the economy are the two major landscape factors that will influence the profession.

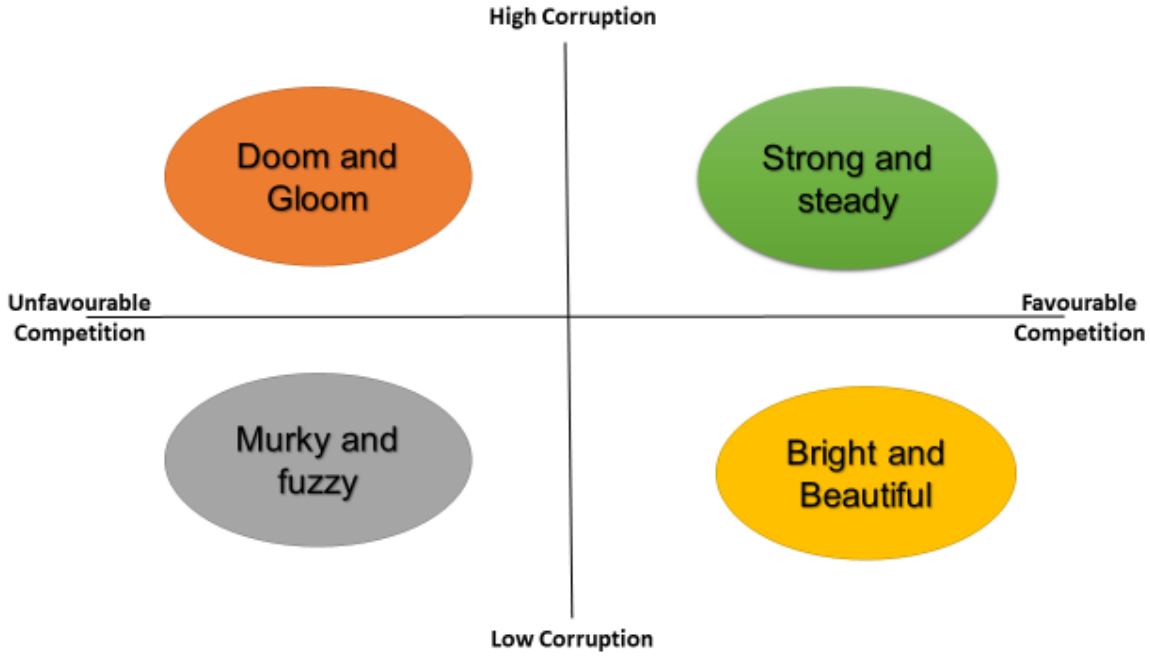


Figure 7. 1 Four scenarios for the quantity surveying profession in 2040

All scenarios are written with a similar assumption about the future. Evidence from literature (WEF, 2016) and interviews suggest that the world, including South Africa, will be fast paced. The fast pace will be due to the advance in technology. In 2040, the world will be more urbanised and more globalised. The Internet and e-technology will drive the interconnectedness within and between nations.

Where in the past sustainability was not at the forefront in construction, it will be a major factor for consideration in construction projects in future. Sustainable construction methods and materials will reside firmly in the front burner. This means construction will focus more on the whole-life cost of the building, rather than only on the initial capital cost. In addition, there will be wider adoption of technology in construction. Construction methods, materials and processes will take into account sustainability and OHS. ICT and other information-sharing platforms will dominate communication and information sharing between the stakeholders. Real-time reporting and monitoring will be the order of the day.

7.2.1 Scenario 1 – Bright and Beautiful

7.2.1.1 Landscape developments

The ‘Bright and Beautiful’ scenario represents the best possible future scenario for the quantity surveying profession. In this scenario, corruption is low and competition is favourable. There are effective systems in place to deal with corruption. The procurement systems and policies in place set a platform for favourable competition. Government invests in infrastructure projects, thus creating enough projects in which quantity surveyors can compete.

7.2.1.2 Socio-technical regime

Purpose

The legislative framework has been changed to promote fair competition. This means the built environment professions are no longer legislated. A similar model to the RICS is followed (where the professional bodies are also not legislated). Instead of enforcing rules and laws on quantity surveyors, the purpose of the regulatory bodies has changed to regulate the behaviour of quantity surveyors. There is no identification of work and no recommended fee scale. Quantity surveyors are able to determine their services and fees, unlike in the current legislative framework, which is restrictive and inadvertently promotes unethical behaviour. Policies in place are effective in meeting their objectives. There are no parallel structures that support the interest of certain groups of people. Members pay their fees, and the funds are used in the promotion of the profession. Research and development (R&D) of the profession is prioritised. As a result of this investment in the profession and in R&D, the profession continues to grow.

The relaxed policies enable quantity surveyors to take advantage of projects in the market. Corruption and unethical behaviour is likely to be less, as there are many projects in the market. Encroachment is minimal as the economic conditions are unfavourable for encroachment. As government spend stimulates the economy, there are likely to be many other economic opportunities in the country to keep encroachers at bay.

Principles

The code of conduct is revised to promote fair competition. Quantity surveyors are guided by high moral standards, and the need to attain the best value for the project and all stakeholders, instead of working for the interest of the clients and the fulfilment of their own interests.

Processes

The professional bodies continue to set standards that promote best practice for the profession. Quantity surveyors who follow the standards set have a better advantage of winning against other competitors. The process for becoming a professional quantity surveyor is still followed; however, it is not legislated. The high failure rate of candidate quantity surveyors is attributed to stringent standards rather than gatekeeping measures.

As membership to professional bodies is voluntary, professional bodies can only act against its own members. Attaining professional registration and the need for clients to be protected from unscrupulous behaviour encourages quantity surveyors to become professional and to register with the relevant professional bodies, as clients seek quantity surveyors who are professional and registered with the relevant professional bodies.

People

In this scenario, principles of a free market, of willing buyer and willing seller apply. Thus government involvement in the profession is minimal. The sustainability agenda and the whole-life cycle costing cements the role of quantity surveyors as principal agents or project managers in construction projects. Although the traditional procurement system still exists, procurement systems that promote collaborative practices are also widely used. The wider application of collaborative procurement systems is the result of political and economic conditions that support a variety of systems used. There are a variety of firms in the profession, that is, big firms, small firms and one-man firms. The favourable landscape developments support the existence of a variety of firms.

Immigration and the number of people leaving the profession is minimal because of the number of the jobs available in the market. The favourable economic activities increase the demand for quantity surveyors. This demand makes the profession attractive to young people, thereby increasing the profession's reputation in society. More institutions start to offer quantity surveying studies. Accessibility to the profession is thus increased. Amongst the courses offered in quantity surveying is ethics.

Performance

The favourable landscape conditions promote the adherence to standards, rules and regulations in place within the profession. Since all the systems in the 5Ps model are in place and effective, the performance of the profession at the socio-technical level is therefore satisfactory.

7.2.1.3 Niches

Purpose

Instead of being regarded as merely cost and contract experts of the construction sector, quantity surveyors are also regarded as value creators and investment advisors, both in the construction sector and society in general. In 2040, quantity surveyors' value add in the construction sector will no longer be that of cost cutting or cost saving only, but will also be that of value creation and advising in infrastructure investment. Relaxed policies, the sustainability agenda and technology will be the main drivers of this shift. Clients and society will demand construction that is environmentally friendly. To achieve the sustainability agenda, smart design, smart construction methods, and smart material will be used. Quantity surveyors, with their knowledge of construction and construction cost, often fulfil this role of advisor in sustainability, although other professionals contest for this role within the built-environment professions.

Principles

Through education, ethical behaviour is inculcated as a value in quantity surveyors. In this scenario, some of the major driving principles of quantity surveyors include integrity, impartiality and best value for all stakeholders in construction. Issues, such as undercutting fees and poor service due to under-pricing are almost unheard of. There is almost no falsifying of numbers and 'wheeling and dealing'. Quantity surveyors uphold high moral standards in carrying out their duties.

Processes

The favourable landscape conditions make it possible for quantity surveyors to diversify their services and charge fees in line with the services rendered, based on a 'willing seller, willing buyer' principle. Since there is no identification of work, quantity surveyors are able to create a niche for themselves through the services and market that they offer. Specialisation based on services and/or markets increases as a result. Other new tasks and new roles for the profession are created as a result. These new tasks and roles can be applied beyond the construction sector.

In a fast-paced and technology based society, quantity surveyors are using technology to gain a competitive advantage. Traditional quantity surveying services, such as quantities take-off and bills of quantities preparation is automated. Technology is used to enhance other traditional quantity surveying services, such as cost estimation, cost planning, cost reporting, cost control and payment application. The sustainability agenda drives life-cycle costing and value management to become the core services of the quantity surveying profession. Life-cycle costing and value management, thus, become widely offered. Other quantity surveyors specialise in aspects, such as sustainability.

People

Quantity surveyors and all stakeholders in the construction sector are generally satisfied with the quantity surveying profession. The training and education of quantity surveyors meets the market conditions, making it possible for all sizes of firms to exist. Instead of closing shop, there are more firms and quantity surveyors entering the market. Immigration and transfer to other sectors of the economy are also reduced. Quantity surveyors enter other markets and sectors of the economy to expand their clientele, not only to survive. Technology and globalisation has assisted many quantity surveyors to expand beyond their shores. Labour broking is minimised as it is usually promoted by opportunists. Favourable economic conditions opens up opportunities in a wider spectrum of society, making opportunists consider other markets as a way of benefiting from favourable economic conditions.

Performance

Low levels of corruption and favourable competition conditions drive quantity surveyors to providing excellent services. Their excellent services and specialisation become their main selling points. Prevailing favourable landscape conditions promote excellence and innovation within the profession. In this scenario, there is no threat of the profession dying or losing its professional status in society. The quantity surveying profession is looking 'Bright and Beautiful'.

7.2.2 Scenario 2 – Doom and Gloom

7.2.2.1 Landscape developments

The 'Doom and Gloom' scenario represents the worst possible scenario for the quantity surveying profession in 2040. In this scenario, corruption is high and competition is unfavourable. Systems in place to deal with corruption are ineffective. The high level of corruption renders current procurement systems and policies redundant. Construction projects are used as vehicles for driving corruption and siphoning funds. Quantity surveyors, as the 'pay master' in construction projects are part of the corruption value chain. Government investment in infrastructure projects is minimum, as it is driven by a narrow political agenda and settling scores with political rivals. There are few projects in the market in which quantity surveyors can compete.

7.2.2.2 Socio-technical regime

Purpose

The current legislative framework governing all the professionals withing the construction sector continue to exist in 2040. Built-environment professions continue to be regulated through the current ACTs. Work to be carried out by the various professions within the built environment is demarcated through the identification of work. In a harsh competitive environment, these continue to cause friction between the professions, both within and without the discipline. Recommended tariff of fees are used as a basis for determining fees. As quantity surveyors have to compete on the basis of the same services and similar fees, this is regarded as anti-competitive and tantamount to collusion by clients, the Competition Commission and civil society as a whole. The regulatory bodies spend most of their limited resources in meetings and legal battles, in an attempt to prove that the identification of work and fees is not anti-competitive.

The unfavourable competitive conditions, exacerbated by restrictive laws and policies, and the limited projects, drive quantity surveyors to corruption and unethical behaviour. Incidents of bribery and falsifying numbers increase. Undercutting of fees and poor service are systemic. Hard economic conditions, fuelled by Government's lack of investment in infrastructure attracts encroachment from other built-environment professionals and opportunists in society.

Professional bodies spend most of their minimal resources in legal disputes relating to professional territory instead of promoting the profession. Many quantity surveyors are not satisfied with the professional bodies' seeming inability to keep away encroachers. Some of the disgruntled members begin reneging on their membership fees, while others withdraw their membership entirely and establish parallel structures that represent their own interests exclusively. Investment in the promotion of the profession and R&D is a pittance. The legitimacy of the existing professional bodies and structures is questioned. In this scenario, the quantity surveying profession is swiftly dying.

Principles

The codes of conduct are not worth the paper on which they are written. Most quantity surveyors are driven by a need to survive in a harsh environment. Quantity surveyors are willing to do what it takes and 'pay any price' to survive.

Processes

In spite of the standards set out by the professional bodies, the need to survive pushes quantity surveyors to circumvent the standards set by the regulatory bodies. Those who win tenders are those who can bribe the most successfully and/ or undercut their competitors in fees. The process for becoming a professional quantity surveyor is still followed and legislated. However, a high failure rate of candidate quantity surveyors leads to perceptions in society that the process of registration is a gatekeeping measure and a way of controlling competition. This perception is used by 'dropouts' to gain sympathy from the Government and to cause friction between the existing structures and the Government. As a result, Government monitors the processes followed by the professional bodies (in registering candidates), with suspicion. Tensions between Government and the professional bodies breed an unhealthy environment for the professions to partner with Government in infrastructure development for the country.

The legislative framework and the regulatory bodies that govern the professions are regarded as ineffective and toothless. Disputes between clients and quantity surveyors are settled through the legal system or alternative dispute resolution (ADR) methods, rather than through the professional bodies. Clients have more confidence in reaching an outcome favourable to them through the legal system and ADR methods, than through the professional bodies.

People

Government involvement or interference in the professions is rampant. This is because of the suspicion that exists between the two sides. Quantity surveyors are still jostling with other professions, such as engineers and architects for the leadership position of principal agency or project management. There

are accusations that quantity surveyors are in leadership positions in construction projects through insidious means, such as falsifying numbers and misrepresentation. Instead of stating the true facts concerning cost of construction projects, quantity surveyors provide false information in order to secure work for themselves, at the expense of what is best for the whole life of the project.

In spite of the existence of other procurement systems, the traditional procurement systems still dominate the public procurement system. Other systems of procurement are disregarded because the traditional procurement system is a better vehicle for corruption than other systems. In the traditional systems, information sharing is restricted. The contractors are only involved after the tender is awarded. It is during the tender stage that most corrupt practices take place. As beneficiaries of the prevalent corruption, quantity surveyors continue to advise their clients to follow this system regardless of whether this system is suitable for the project at hand. In the belief that they are getting value for money through the traditional procurement system, clients heed the advice of quantity surveyors.

The unfavourable macro-economic conditions continue to cause the closure of firms. There are no big quantity surveying firms, only big multi-disciplinary firms exist. This is because, with the identified work that quantity surveyors can offer , the fee scale used as a basis for fees and their discounts, they cannot compete with the one-man practices. Big projects, which are few, are carried out through joint ventures and temporary partnerships.

Emigration and the number of people leaving the profession is on the increase. High levels of corruption and few jobs in the market are driving quantity surveyors to seek opportunities in other markets and sectors. The unethical behaviour of quantity surveyors has eroded the reputation of the profession. Not many young people are attracted to the profession, and few join it. There is a decrease in enrolments in universities and other institutions of higher learning. There are not many sponsorships for people wanting to pursue the profession. Many universities and other institutions of higher learning are considering closing the quantity surveying departments or schools because of this.

Performance

The unfavourable landscape conditions promote corruption and unethical behaviour. In spite of all the systems in the 5Ps model being in place, quantity surveyors, in their quest to survive the harsh conditions, resort to corrupt and unethical means. The performance of the profession at the socio-technical level is well below the required standard.

7.2.2.3 Niches

Purpose

The restrictive regulatory framework has limited the quantity surveying role to one of mere cost-and-contract experts. Instead of protecting the profession from encroachers, the regulatory framework has inadvertently imprisoned the profession and sentenced it to death. In spite of the opportunities created by technology, globalisation and the sustainability agenda, quantity surveyors are not able to take advantage of them to increase their role and market share, because of territorial laws governing the profession. Instead, others have seized these opportunities and created new positions and roles for themselves.

Quantity surveyors are in a battle with other professionals over the role of sustainability and life-cycle costing. Fierce rivalry is emanating from the property professionals, particularly the facilities managers who claim that it is their role to take charge of the building once construction is complete, hence the sustainability role should be their role. Quantity surveyors claim this role as their own, as they are the cost expert in construction. This dispute has been often been referred to the CBE for adjudication, with no resolution to date. The CBE does not have capacity to deal with this issue due to a lack of relevant skilled people. Others suspect the delays in resolving this issue relate to political pressure and corruption.

Principles

Survival, self-interest and greed are the driving principles of quantity surveyors. Quantity surveyors who cannot emigrate justify their unethical behaviour by the need to survive. All manner of corrupt and unethical practices pervade; undercutting fees and poor service because of under-pricing are common. Falsifying of numbers, and 'wheeling and dealing' are the order of the day. The quantity surveying profession is becoming known as one of the most unethical professions in society. There is no ethics courses in universities or institutions of higher learning.

Clients are becoming more and more reliant on technology to determine cost for construction projects, especially in small and less complex projects. Where the magnitude of the project necessitates a need for a quantity surveyor, two quantity surveyors are appointed. One quantity surveyor is hired for the project and the other is hired to audit the work of the other. Even though the code of conduct prohibits such behaviour, desperate clients and desperate quantity surveyors are left with few options in the harsh conditions in which they find themselves.

Processes

In these unfavourable landscape conditions, many quantity surveyors are finding it more and more difficult to win tenders based off identified work and recommended fee scale. As there is no competitive advantage offered through uniform or standard services, those who win tenders are those who offer

enormous discounts and/or bribes. Specialisation is limited. Quantity surveyors are limited by the identification of work and the fee scale. This has opened the market for encroachers and opportunists who are not bound by the Quantity Surveying Profession Act (No. 49 of 2000) and the identification of work. These encroachers and opportunists hire quantity surveyors to do the traditional quantity surveying work, while also offering other services specific to the needs of the clients. In this way, they create a niche for themselves in the market. Clients tend to be pleased with their services as they go beyond the confines of the borders created by identification of work and recommended fees to meet their needs.

Instead of using technology to enhance their role and increase their market share in a fast-paced and technology based society, quantity surveyors have lodged a complaint with the Minister of Public Works regarding the diffusion of technology in the built-environment space. Quantity surveyors claim that technology is making them redundant in society. Most of the traditional role of quantity surveyors, such as quantities take-off, bills of quantities preparation, cost estimation, cost planning, cost reporting, cost control and payment application are now done through technological application. This has resulted in other built-environment professionals, such as engineers and architects, extracting quantities from software or a BIM model. The threat of the use of technology to extract quantities has not only come from the built-environment professionals but it has also come from contractors, suppliers and others. Quantity surveyors want the Minister to pass a regulation preventing the sale of such software to non-quantity surveyors and to take action against anyone who issues quantities or provides quantity surveying work without being registered.

People

The quantity surveying profession has lost its reputation. Stakeholders, society and the quantity surveying professionals are generally dissatisfied with the profession. The training and education of quantity surveyors is hampered by a lack of funding and investment. Corruption has created an artificial demand. In spite of the few projects in the market, there are not enough ‘ethical’ quantity surveyors to meet demand. Government is looking at attracting foreign skills through immigration. Technology is also considered as an alternative to close the shortage of skills.

Emigration and transfer to other sectors is on the increase. Technology and globalisation is seen as a threat to the quantity surveying profession. Quantity surveyors, through regulatory bodies, are lobbying Government to enact laws that will limit technological and foreign encroachment on the profession. Labour broking is on the increase as current unfavourable economic conditions promote its presence.

Performance

High levels of corruption and unfavourable competitive competition conditions drive quantity surveyors to shoddy services and corrupt practices. The profession has failed to take advantage of opportunities that technology, globalisation, sustainability and a fast-paced society present. The restrictive legislative framework that governs the profession is partially to blame for this failure. The profession has become ingrown and tunnel-visioned. Fighting over territories has diverted the limited resources of professional bodies from R&D and innovation. In this scenario, the profession is losing its professional status and dying a fast death. It is all 'Doom and Gloom' in the quantity surveying profession in this scenario.

7.2.3 Scenario 3 – Strong and Unsteady

7.2.3.1 Landscape developments

In the 'Strong and Unsteady' scenario, competition is favourable but corruption is high. Although there are systems in place to deal with corruption, they are ineffective. Corruption is rampant. Quantity surveyors, through current leaky procurement systems and policies are also involved in corruption. Construction projects continue to serve as vehicles for driving corruption and siphoning funds. Government's objectives of investing in infrastructure are hampered by high levels of corruption. In this scenario, government's investment in infrastructure is satisfactory and there are many projects in the market in which quantity surveyors can compete.

7.2.3.2 Socio-technical regime

Purpose

The restrictive legislative framework has been changed to promote fair competition. There is no identification of work and no recommended fee scale. Quantity surveyors are able to compete based on services and fees that are not set by the regulatory bodies. The 'willing seller, willing buyer' principle applies. Although there are policies in place to deal with corruption and unethical behaviour, they are effective as corruption continues to thrive.

Disgruntled members, unhappy with how issues of corruption are handled within the profession, form bodies parallel to established organisations to support their interests. As a result of these parallel structures, payment of membership fees for recognised structures drops. This in turn has a negative effect on the promotion of the interests of the profession's R&D. The drop in investment in R&D hampers the profession's growth.

Although relaxed policies allow quantity surveyors to take advantage, corruption hampers many quantity surveyors from doing so. Quantity surveyors who do not wish to participate in corruption often have to abandon participation in certain projects in order to protect their brands. Unfortunately this has left many of these quantity surveyors with only a few projects to remain afloat. If their economic

conditions were to change for the worse, these quantity surveyors would not survive. Encroachment is prevalent, although it is mainly carried out by other quantity surveyors who are willing to indulge in corruption and other unethical behaviour.

Principles

The codes of conduct have been revised to promote fair competition. Many quantity surveyors are guided by high moral standards, set out in the codes of conducts, although there are a handful who are guided by self-interest and greed. These greed-driven individuals, focused on their self interests, are the ones promoting corruption in the construction sector. The efforts of professional bodies in curbing corruption are ineffective.

Processes

The standards set by the professional bodies that promote best practice for the profession are adhered to, generally by quantity surveyors, unless their livelihoods are threatened or under duress. Winning tenders is based on services offered, discounting of fees and/or bribery. Quantity surveyors have to consider carefully the projects for which they tender, as some entities are becoming known for being corrupt. Quantity surveyors who are thriving and expanding are suspected of unethical behaviour and corruption.

Even though the process for becoming a professional quantity surveyor is unlegislated, it is still followed. Being registered is regarded as a great marketing tool. This is because quantity surveyors are – to a certain degree – vetted as professional by a recognised professional body. Clients often seek quantity surveyors who are registered with the professional bodies, as they can hold them accountable through the professional bodies. In a corrupt environment, registered quantity surveyors are sought after as they are considered to be more ethical than unregistered quantity surveyors. A high failure rate of candidate quantity surveyors continues to plague the process of registration. Some ‘dropouts’ from the system opt to practise without registration, but many find it difficult to do so as clients prefer registered quantity surveyors. Those who succeed in winning tenders are often suspected of corruption. Government’s involvement in the regulation of the professions is minimal, as they are voluntary associations.

People

In this scenario, government’s involvement in the profession is minimal, as the profession is not legislated and the professional bodies regulating the profession are voluntary. The principle of ‘willing buyer, willing seller’ applies. Even though the sustainability agenda and the whole-life cycle costing have promoted quantity surveyors to the role of principal agent or project manager, there are suspicions that some quantity surveyors have attained this role through corrupt and unethical practices.

In spite of the landscape conditions supporting the use of a variety of procurement systems, the traditional procurement system is still preferred, as it the most suitable vehicle for corruption, in comparison with other procurement systems. Although landscape conditions are conducive for all types and sizes of firms to exist in the market, those that dominate the market and win tenders are those that can offer the highest discounts and bribes.

Quantity surveyors who are unhappy with current corrupt and unethical practices are beginning to emigrate. A few are leaving the profession, in spite of favourable economic conditions. The economic activities are driving the demand for quantity surveyors. This demand is not adequately met, as many quantity surveyors who are unwilling to participate in corrupt practices and unethical behaviour continue to leave the market or the profession. A limited number of young people are joining the profession, as there is not much investment in education. Funds in the sector are used for corrupt practices. Only a few firms, and the professional bodies, are investing in education and training. There are limited institutions that offer quantity surveying studies. Accessibility to the profession is thus limited. A handful of institutions offer ethics as part of their quantity surveying courses.

Performance

In this scenario, the favourable landscape conditions are conducive for the advancement of the profession; however, corruption is impeding this. Some quantity surveyors are bringing the profession into disrepute through corruption and unethical behaviour. The 5Ps model systems are in place, but are made redundant by corruption. The performance of the profession at the socio-technical level is thus somewhat unsatisfactory.

7.2.3.3 Niches

Purpose

In this scenario, quantity surveyors are not just cost cutters, but are value creators and investment advisors in the construction sector, and society in general. Their role as construction cost-and-contract experts has expanded to include value creation and investment advice in construction projects. Without restrictive territorial laws, quantity surveyors are able to expand their services beyond the ones legislated in the identification of work. Shift in societal needs and values on issues such as sustainability create a platform for quantity surveyors to increase their offering to society. Fuelled by a fast-paced society, quantity surveyors are able to create a niche for themselves in society through technology. Although quantity surveyors are most suited to advise on issues of sustainability in construction projects, this role is often contested with other professionals through corrupt and unethical behaviour.

Principles

In spite of the revision of codes of conduct to promote fair competition, a handful of quantity surveyors (out of self-interest and greed) continue to be involved in corruption and unethical behaviour. High levels of corruption in society are also conducive to encouraging corruption in the construction sector. The behaviour of just a handful of quantity surveyors is bringing the profession into disrepute.

Processes

Although favourable landscape conditions make it possible for quantity surveyors to diversify their services, and charge fees in line with the services rendered (based on a 'willing seller, willing buyer' principle), corruption is making this free market system ineffective. Some clients require huge fee discounts and /or bribes to do business. Some quantity surveyors comply out of greed and or under duress.

In an environment where there is no identification of work, many quantity surveyors have created a niche for themselves, through the services and market that they offer. Through these initiatives, ass well as specialisation, some have been able to escape the corruption that is most prevalent in the traditional quantity surveying role. In the niche they have created, there is no competition and these quantity surveyors are able to set their own rules and standards. Some have created new tasks and new roles for the profession, which can be applied beyond the construction sector. In this way, some have escaped participating in the corruption most prevalent in the construction sector.

Technology is used to enhance the profession and to gain some competitive advantage over competitors. The fast-paced and technology driven society is the main driver. Driven by the sustainability agenda, life-cycle costing and value management are now core quantity surveying services, and are widely offered.

People

Although quantity surveyors and all stakeholders are generally satisfied with the quantity surveying profession, there are pockets of dissatisfaction, as corruption and unethical behaviour are starting to taint the profession. The training and education of quantity surveyors is not able to meet the demands of the market. Prevailing favourable landscape developments make it possible for all sizes of firms to exist but corruption separates those that continue to exist and those that close shop.

Quantity surveyors who are unwilling to participate in corruption find it difficult to continue working in these conditions, resorting to emigration or transferring to other sectors of the economy. The number of quantity surveyors entering the market is low to meet demand. Corruption is discouraging new

entrants into the market. Some quantity surveyors are using technology and globalisation to create clients outside their borders and to escape corruption.

Labour broking continues, but on a much more smaller scale. It is largely driven by corruption rather than the prevailing economic conditions.

Performance

A high level of corruption erodes the benefits brought by favourable competitive conditions. Excellence and innovation brought by prevailing favourable landscape conditions are also hampered by corruption. Quantity surveyors who do not wish to participate in corrupt practices are limited to a few projects that keep them on survival mode. Others emigrate or leave the construction sector altogether. Those who are able to specialise carve a niche for themselves, thereby escaping corruption. In this scenario, the threat to the profession is corruption. On its own merit the profession is still relevant in society and has been constituted in such a way that it can add value to society. If high corruption levels are not dealt with, corruption might taint the quantity surveying profession. The future of the profession is uncertain. In this scenario, the quantity surveying profession is 'Strong and Unsteady'.

7.2.3.4 Scenario 4 – Murky and Fuzzy

7.2.3.4.1 Landscape developments

The murky and fuzzy scenario is a scenario where corruption is low but competition is unfavourable. In this scenario, there are effective systems and policies in place to deal with corruption. Government investment in infrastructure projects is low and thus insufficient projects are in the market, in which quantity surveyors can compete. Government spending decreases economic activities in other sectors of the economy, creating unfavourable economic conditions in the country in general.

7.2.3.4.2 Socio-technical regime

Purpose

In this scenario, the current legislative framework and professional bodies (as currently instituted), still exist. The Acts of 2000 that govern the built-environment professions. Demarcation of professional boundaries is done through the identification of work. Prevailing landscape developments and an unfavourable competitive environment cause fights over professional territories between the built-environment professionals. Professionals use the recommended tariff of fees as a basis for determining fees. Since the tariff of fees is based on the principle of the same services and similar fees for all professionals, they create no basis for a competitive advantage, thus further contributing to unfavourable competitive conditions. Furthermore, these have been deemed anti-competitive by clients,

the competition commission and society. Most of the regulatory bodies' limited resources is spent on legal battles over the issue of fees and services.

Some quantity surveyors, in an attempt to create some competitive advantage for themselves, offer clients excessive discounts, which not only compromise their services, but also remove some of their competitors from the market. In hard economic conditions, opportunists abound. Thus the levels of encroachment from other built-environment professionals and opportunists in society is high. This leads to more tensions between built-professions' disciplines and the professional bodies. The limited resources of professional bodies are diverted from R&D to fighting territorial battles. Not all professionals are satisfied with the professional bodies' ability to keep encroachers away, so they start their own parallel structures alongside existing structures and they withdraw their membership and stop paying fees.

Principles

The codes of conduct are not revised to promote fair competition. Although most quantity surveyors are guided by high moral standards and the need to attain best value for the project, the need to survive in a harsh environment is starting to affect their behaviour. Quantity surveyors are willing to live by high moral standards, inculcated through education, provided that their livelihood is not at stake.

Processes

Standards set by professional bodies are used to gain a competitive advantage over other competitors; however, fee discounting has become the determining factor in winning tenders. The path to professional registration is still legislated. Candidate quantity surveyors' failure rate continues to be high. Some attribute the high failure rate to stringent standards. Others claim it is a gatekeeping measure. Parallel structures to existing bodies formed by the system 'dropouts' mushroom, causing government interference in existing structures. Confidence in existing structures starts to wane as a result. This leads to defaults in membership fee payment. The drop in fees further hampers the work of the professional bodies and renders them ineffective. Questions of the legitimacy of the professions and the professional legitimacy begin to dominate public discourse.

People

The tension between Government and the professions is exacerbated by Government's rampant involvement or interference in the professions' affairs. Tensions between the built-environment professions are fuelled by the dispute over the principal agency or project management role. Quantity surveyors claim that their cost-and-contractual expertise makes them best suited for this position, while engineers and architects claim that it is their historical role and are therefore entitled to it. The CBE is

yet to adjudicate on the issue. The delay in adjudicating on this matter is blamed on the lack of skilled people within the CBE.

The traditional procurement systems still dominate the public procurement system, in spite of the existence of other procurement systems. Clients prefer the traditional procurement system because of the perceived benefit of value for money they can derive. Although the traditional procurement system favours the existence of the quantity surveying profession, unfavourable competitive conditions make their position in society shaky. This situation is not helped by encroachers and labour brokers. Some despondent quantity surveyors close shop. Big quantity surveying firms have been forced to scale down or to diversify their offering. Many of these big firms have become multi-disciplinary firms. One-man practices dominate the market as they can afford huge discounts in fees. Joint ventures and temporary partnerships are formed to handle big projects.

A number of quantity surveyors are emigrating, seeking opportunities in international markets, while others are leaving the profession completely. In spite of the good reputation the profession still holds in society, many young people are not attracted to the profession. This is because in comparison with other professions, the salaries and fees of quantity surveyors are lower. Thus the number of enrolments in universities and other institutions of higher learning is on the decrease. Hard economic conditions have also dried up sponsorships. This has made universities and other institutions of higher learning consider closing the quantity surveying departments or schools.

Performance

The unfavourable landscape conditions, coupled with restrictive professionals laws and policies are driving the quantity surveying profession to survival mode. This in turn might lead to a creep in unethical behaviour and corruption. In this scenario, all the systems in the 5Ps model are in place. However, because of the unfavourable competitive environment and harsh macro conditions, quantity surveyors are battling to survive. Restrictive professional laws and policies are partly to blame. Thus, at the socio-technical level, the profession is battling to remain healthy.

7.2.3.4.3 Niches

Purpose

Quantity surveyors have not been able to take advantage of opportunities created by technology, globalisation and the sustainability agenda, as a result of the restrictive regulatory framework. The identification of work has confined them to the limited role of mere cost-and-contract experts. This has created room for other disciplines and people to seize these opportunities and create new roles for themselves within the construction sector.

Quantity surveyors are contesting the role of sustainability and life-cycle costing with other professions particularly the facilities managers. The contestation has led to the intervention of the CBE. Quantity surveyors claim that sustainability and life-cycle costing is part of their core services, while facilities managers claim that the role is based on the fact that they are custodians of buildings for the life of the building. The CBE is yet to adjudicate on this matter, owing to lack of relevant skilled people.

Principles

Most quantity surveyors are guided by high moral standards and the need to attain best value for the project. However, the need to survive in a harsh environment is starting to affect their behaviour. Some quantity surveyors are cutting their fees to an extent that it is starting to affect their services.

Processes

The need to survive makes quantity surveyors cut fees at the expense of quality work. Tenders are won by those who can undercut their competitors. Many big firms have taken a knock as a result. One-man firms, with low overheads, are dominating the market. In spite of technological advancement, globalisation, urbanisation and the sustainability agenda, specialisation is limited. This is because the identification of work and the fee scale have limited the quantity surveyors' role in society and in the construction sector.

Other people, encroachers and opportunists, not bound by the Acts of 2000 governing the built-environment professionals and the identification of work, have seized opportunities created by technological advancement, globalisation, urbanisation and the sustainability agenda. Traditional quantity surveying tasks still dominate the profession, cementing the role of quantity surveyors as cost experts or cost cutters, rather than value creators and investment advisors.

People

The quantity surveying profession is still held in high regard in society. This has been boosted by the education and training, which includes training in ethics. As a result, stakeholders, society and the quantity surveying professionals are generally satisfied with the profession. Quantity surveyors participate in unethical behaviour or corruption only when their livelihoods are at stake. Those who do so are only a handful, as current systems and policies in place are effective in minimising such acts.

The number of young people entering the profession is limited, as current prevailing unfavourable macro conditions and competition are making the profession unattractive to young people. This has created some consternation within the profession regarding the survival of the profession in future. The

lack of funding of the education and training of quantity surveyors is regarded as another indication of a dying profession. Foreign skills and technology are considered as alternatives to close the shortage of skills in future.

Quantity surveyors frustrated with prevailing conditions are emigrating or transferring to other sectors of the economy. Unfavourable economic conditions have increased the prevalence of labour broking. Technology, globalisation, urbanisation and the sustainability agenda have had no positive influence on the profession. Restrictive territorial laws enforced by regulatory bodies have limited the scope for growth for the profession.

Performance

Harsh macro conditions and unfavourable competitive conditions are driving quantity surveyors into survival mode. Many have had to sacrifice quality for huge discounts in fees. This is starting to affect their reputation in society negatively. Professions are constrained from taking advantage of opportunities that technology, globalisation, sustainability and a fast-paced society present, partly because of the restrictive legislative framework that govern the profession. Fighting over professional territories is prioritised over R&D and innovation. This restrictive legislative framework is impeding the profession's growth and setting it on the path of a slow death. In this scenario, there is uncertainty about the future of the profession. The quantity surveying profession is in a 'Murky and Fuzzy' position in this scenario.

7.3 Summary of Chapter 7

The Fourth Industrial Revolution is set to cause unprecedented and fundamental change in the construction sector and the quantity surveying profession (Kulasekara et al., 2013; Susskind and Susskind, 2017). What is unclear from literature is the extent of the impact of change on the quantity surveying profession. Previous studies of the professions are diagnostic in their analysis of the effects of the Fourth Industrial Revolution. They do not provide direction for the professions. Hence, scenario planning was used as a methodology to provide future direction for the quantity surveying profession. The findings suggest that there are four probable futures for the quantity surveying profession in South Africa in 2040.

Chapter 8: Conclusions, Recommendations and Further Work

8.1 Introduction

In Chapter 1, the background and justification for the study was provided. Based on available literature, Chapters 2 and 3 provided a literature review on salient issues pertaining to the quantity surveying profession and the construction sector. The theoretical framework of the study was discussed in Chapter 4. Chapter 5 discussed the research design and methods, including the shortcomings of the chosen research's design and methods. Findings of the interviews, workshop and focus group were provided in Chapter 6. In Chapter 7, four possible scenarios for the future of the quantity surveying profession are provided.

The main purpose of this chapter is to draw conclusions and make recommendations based on the main findings of the study, in light of the literature review, the research questions and the research objectives.

8.2 Conclusions on the research questions and objectives

8.2.1 What is the current state of the quantity surveying profession?

Findings from the interviews reveal that the current quantity surveying profession is relatively secure. This is in contradiction to the literature findings (Kulasekara et al., 2013; Luksha et al., 2015; Susskind and Susskind, 2017), which suggest that the professions, including the quantity surveying profession, are likely to be replaced by technology. The two main factors that seem to be keeping the profession secure is the need for cost expertise in society and the Quantity Surveying Profession Act 49 of 2000. There is, however, evidence that this apparently secure position is being challenged.

Current harsh landscape conditions, including technological advancement, are beginning to challenge current quantity surveying practices. A highly competitive market in a corrupt environment has started to change quantity surveying practices. This is evidenced by an increase in unethical behaviour, corruption, undercutting of fees, poor services, diversification of services, and an increase in one-man practices. This is evidence that the quantity surveying profession is currently in the process of evolution, just as the literature claims (Ashworth et al., 2013). The quantity surveying has evolved and continues to evolve. What is contrary to literature is that it is unclear whether it will be able to withstand the current pressure exerted upon it. There are divergent views on this aspect.

8.2.2.What are the socio-technological factors that are likely to influence the current quantity surveying profession? How are the socio-technological factors likely to influence the current role of the quantity surveyor?

Findings reveal that the socio-technological factors that are likely to influence the quantity surveying profession are related mainly to politics and the economy. Legislation or policies related to issues, such expropriation of land without compensation, tendering in the public sector, and corruption, are some of the main issues facing the construction sector and the quantity surveying profession. There is uncertainty in the construction sector, because investors are concerned about the security, given the proposed legislation related to expropriation of land without compensation. This has also led to fewer projects in the market. Some quantity surveyors have had to find ways to survive, such as diversification of services and downsizing. Some have had to close shop or move to other markets or sectors of the economy.

The policy of tendering for quantity surveying services in the midst of poor political and economic environment has made tendering highly competitive. This has led to the undercutting of fees, which has led to an increase in corruption and unethical behaviour. Quantity surveying services have in some instances, been compromised as a result. Corruption in the public sector has infiltrated the quantity surveying profession. Funds are siphoned through documents and reports that quantity surveyors

prepare, such as payment certificates and final accounts. Figures are inflated in order to include money intended for corrupt behaviour.

Findings from empirical data are analogous to the findings of literature. For instance, WEF (2016) and Harty et al. (2007) claimed that government policy will influence the construction sector in future, which in turn influences the quantity surveying profession. Literature findings also revealed that corruption is more prevalent in developing countries than in developed countries. Furthermore, public officials and quantity surveyors are more likely to be engaged in corruption than other stakeholders (Bowen et al., 2015; Yap et al., 2020). Empirical findings thus corroborate the literature findings.

8.2.3 What are the tasks of the quantity surveying profession that are at risk?

Findings reveal that quantity take-off and bill preparation are the two traditional quantity surveying tasks that are most at risk of automation. Traditional quantity surveying tasks that require some human interpretation and analysis, such as cost estimation, cost planning, cost reporting, cost control and payment application are moderately at risk of automation. Findings on material procurement are inconclusive, as experts do not all agree that this task is a quantity surveying task. Value management (VM) and life-cycle costing (LCC) are currently not at risk of automation.

As per literature findings, quantity take-off and bill preparation, are likely to be automated in future (Acemoglu and Autor, 2011; Kulasekara et al., 2013). Where there is some contradiction, is with regards to cost estimation, cost planning, cost reporting, cost control, payment application, material procurement, value management (VM) and life-cycle costing (LCC). While the literature revealed that all traditional quantity surveying professional tasks are at risk to automation, empirical findings reveal that only quantity take-off and bill preparation are most at risk of automation. None of the traditional quantity surveying professions' tasks are, however, at risk of extinction.

8.2.4 What are the likely future scenarios for the quantity surveying profession in South Africa?

Four possible scenarios were generated, based on the findings of the literature, interviews, workshop and focus group. The best case scenario for the South African quantity surveying profession is the 'Bright and Beautiful' scenario. In this scenario, the quantity surveying profession is thriving. The conditions that allow the profession to thrive are sound government policies that enable favourable competition and low corruption. A less restrictive professional regulatory framework governing the profession enables it to easily adapt to changes in the environment.

The worst case scenario for the South African quantity surveying profession is the 'Doom and Gloom' scenario. Fuelled by poor government policies and a restrictive professional regulatory framework, in this scenario, the quantity surveying profession faces imminent death. Unfavourable competitive conditions and high levels of corruption are sentencing the profession to death. Unfavourable

competitive conditions are likely to lead quantity surveyors to engage in corrupt activities, thereby eroding one of the important tenets of any profession, which is trust. When a profession cannot be trusted, society will look for replacements.

The ‘Strong and Unsteady’ scenario is one possible scenario for the quantity surveying profession. Although the less restrictive professional regulatory framework, and a government that has, through its sound policies, created favourable competitive conditions, rampant corruption makes these favourable conditions useless to the profession. Some quantity surveyors are likely to engage in corruption, especially if they cannot win tenders fairly. To avoid corruption, some quantity surveyors might create a niche for themselves and some might emigrate. The future of the quantity surveying profession is uncertain in this scenario.

The ‘Murky and Fuzzy’ scenario represents a quantity surveying future where competition is unfavourable but corruption levels are low. In this scenario, there are effective policies and measures to deal with corruption. Unfavourable competitive conditions are brought by low government investment in infrastructure and a restrictive professional regulatory framework. Fewer projects and a restrictive professional regulatory framework place quantity surveyors into survival mode, cutting fees and an increase in unethical behaviour presenting. Emigration and transferring to other sectors is likely to be high, as current the restrictive professional regulatory framework and harsh macro conditions are impeding the growth and survival of the profession. In this scenario, the quantity surveying profession is moving towards a slow death.

8.3 Interpretation of results in terms of theory

8.3.1 The quantity surveying profession in relation to theories of the professions

Although, the South African quantity surveying profession is currently instituted and legislated from a functionalist perspective (called the ‘trait approach’), empirical evidence suggests that it behaves more like a capitalistic profession. A ‘capitalistic’ profession is classified under critical theories. This is because the profession is largely influenced by politics and economic policies, unlike functional professions, such as the medical and teaching professions.

Furthermore, the quantity surveying profession exhibits monopolistic tendencies, such as protection of work through the process of identification of work and gazetting of fees. Although policies regarding the identification of work and gazetting of fees are intended to protect the profession, they may impede the profession from evolving and taking advantage of the opportunities that may arise as a result of globalisation, sustainability, urbanisation and technological advancement. As a private enterprise profession, the quantity surveying profession must be agile enough to adapt to changes around it, which the current professional regulatory framework does not seem to allow, as the quantity surveyors are

legislated through the Quantity Surveying Profession Act 49 of 2000. Changing the Quantity Surveying Profession Act 49 of 2000 every time there are changes in the market conditions might prove cumbersome and impractical.

8.3.2 Scenario generation using the MLP Framework

The multi-level perspective (MLP) was used as a theoretical framework and a heuristic device to understand this change in the socio-technical system of the quantity surveying profession. In the MLP, transitions usually emanate from the micro-level, that is, the niches through new innovation. When new innovation gains wider diffusion, it starts to compete with the incumbent regime and ultimately replaces that regime. When the regime changes, transition occurs. The changes in the niches and regime might have some influence on the landscape developments.

Findings of the study reveal that what is likely to influence transformation in the South African construction sector are landscape developments, particularly political and economic factors. Pressure exerted on the socio-technical regime and technological niches is likely to influence transition. Professionals under pressure from harsh landscape developments are likely to find ways to survive. New innovations and new practices from the niches are likely to gain wider diffusion, if the are effective in keeping the profession relevant in society. Once these gain wider diffusion, they will begin to compete with the current regime and eventually replace the incumbent regime, thereby transforming the socio-technical system of the profession.

The current legislated framework might succeed in keeping its position in the foreseeable future, as change in legislation might be cumbersome; however, developments in the landscape and niches might render it ineffective. This means the legislated framework might still exist, but may be disregarded and made redundant by practices in the market. The bottom–up transition is somewhat of anomaly to the MLP Framework.

8.4 Interpretation of the results in terms of the research argument

8.4.1 Legitimacy of the professions based on professional tasks

The study begun by arguing that current socio-technical changes may cause the professions including the quantity surveyors to become extinct. One of the major threats to the professions is the Fourth Industrial Revolution. Some technology has the potential to take some of the tasks that have been the purview of the professions. By technology removing certain tasks from the professions, the legitimacy of the professions' exclusive rights to perform those tasks is threatened. Once technology takes those tasks, what will give the professions legitimacy?

The findings of the study have shown that within the quantity surveying profession, there are tasks that are most at risk of being replaced by technology, while there are some that are not. Those that are not a threat to technology, are those that require human interpretation. Findings also reveal that professionals, at the niches, are able to find new roles for themselves to compensate for the role that has been replaced by technology. What might be a hindrance to the profession's agility to take on the new role is the current regime. The current quantity surveying regime in South Africa is legislated. Changing legislation may prove cumbersome. This means that quantity surveying professionals, in the niches, are likely to lead the change in the profession. It might take time for the regime to eventually change. With the change in the role of the quantity surveyors, it is not clear whether the profession can still be called quantity surveying. It seems that the debate on the need to change the title of the profession to reflect their changed role in society will continue in future. This question of title might not only be an issue for the future quantity surveying profession alone, but also for other professions. As other professions' roles in society change, will they retain their titles?

Even though the findings on technology replacing certain professional tasks aligns to claims that technology will replace certain professional tasks, the findings also reveal that replacing professional tasks does not mean replacing the professions. Professions that may be replaced are those that will not create new roles for themselves. It is also important to note that in carving new roles for themselves, the professions may contest for these roles with other professions or occupations. Within the built environment, for example, in an asset-management role, quantity surveyors are likely to contest with facilities managers.

8.4.2 Legitimacy of the professions based on specialist knowledge

Findings reveal that quantity surveyors are highly regarded as construction cost experts within the construction sector. It seems most investors in infrastructure still need advice from quantity surveyors. This is in spite of the availability of technology. Quantity surveyors' future role is likely to be more valuable at a project's commencement. This is partly because LCC and FM may become the 'bread and butter' of the profession. Other roles that the professions play, such as take-off, bill preparation, cost estimation, cost planning, cost reporting, cost reporting, and payment application may be taken away. It is likely that clients might rely on technology or 'quasi-quantity surveyors', who use technology to carry out these tasks on their behalf. Hence the conclusion that the need for the current quantity surveyor might be reduced in future. The future reduction of the need for the current quantity surveying profession is analogous with claims by Susskind and Susskind (2017) – that the need for professions in future is likely to be reduced.

8.4.3 Legitimacy of the professions based on the social contract and the norms and values of society

Trust is one of the important tenets of the professions. One of the conclusions that can be drawn from the findings is that what has made the professions retain their elite positions is the trust that society accords them. Trust is what has allowed society to establish a social contract with the professions. Although norms and values in society may change, if society trusts the professions, it will continue to rely on their services.

Within the quantity surveying profession, the findings reveal that unethical behaviour is more of a threat to the profession than technological encroachment or any other factor. Unethical behaviour is beginning to erode the trust that society places on the profession. If this unethical behaviour continues, it might be the death knell for quantity surveying and any other profession that acts unethically.

8.4.4 Legitimacy based on the structure, methods and contracts

The study argued that the current structure of the construction sector, including its methods and associated contracts, provide a role for the quantity surveying profession, thereby giving the profession legitimacy. This claim is supported by a study by Winch (2001). For example, findings revealed that the traditional procurement method is still widely used to solicit contractors in South Africa. This is in spite of its adversarial nature. One of the reasons provided for the continual use of the traditional procurement method is that clients believe it gives them value for money. Unless this perception changes in the future, the quantity surveyors' role is likely to remain entrenched in society, as changes in the structure of the construction sector are likely to threaten the role of the profession. This shows that structural changes in society may influence the existence of professions in society.

8.5 Anomalies from the findings

Besides the anomaly from the MLP Framework, another anomaly is associated with the new leadership role quantity surveyors have carved for themselves in difficult economic times. Difficult economic times have elevated money as a highly ranked value in comparison to quality. This has made quantity surveyors to usurp the role of principal agent or project manager in construction projects.

8.6 Contribution of the study

8.6.1 Contribution to theory

The study demonstrates that the multi-level perspective (MLP) can be used as a theoretical framework for predicting future transitions. The MLP Framework is often used in understanding historical change (Geels, 2005a, 2005b; Geels, 2006, 2004, 2002; Geels, 2005c; Trist, 1981). Combining the MLP with

the 5Ps model demonstrated that it is possible to use the MLP Framework to predict future changes in a socio-technical system.

8.6.2 Contribution to practice

8.6.2.1 Changes in the quantity surveying profession

The state of the quantity surveying profession was discussed in three periods: current, past and future. This is useful in understanding current changes likely to influence the profession in future. The past was used to test claims about the future. This is useful in determining whether history is likely to repeat itself in future, or if the future will be different to the current state.

8.6.2.2 Factors likely to influence the profession

By providing factors likely to influence the profession in future, the profession is likely to watch those factors carefully in order to adapt to possible changes brought by those factors.

8.6.2.3 Threats and opportunities

By identifying threats and opportunities to the profession, the profession is able to position itself to take advantage of those opportunities and guard against possible threats, in order to maintain its position in society.

8.6.2.4 Possible futures for the quantity surveying profession

The aim of scenarios is not to predict one possible future, but to assist stakeholders in thinking about the future. By providing possible future scenarios for the profession, the profession can start thinking strategically about its future.

8.6.2.5 Recommendations will assist the quantity surveying profession to prepare for the future

Recommendations of the study, based on the findings of the study, will assist the profession to use this data to prepare for its future and continue with further research should it hope to remain relevant in future.

8.7 Recommendations of the study

The study makes the following recommendations based on the findings of the study:

- Decisive action to be taken against corruption and unethical behaviour in the construction sector and the built-environment profession. Unless corruption is dealt with decisively, there is only a dark future for the construction sector and the associated professions.

- A revision of the current legislative framework governing the built environment and the quantity surveying profession, such as the identification of work and the gazetting of work. These might impede the growth of the professions in a fast-paced technological society.
- A tightening of codes of conducts of all the built-environment professionals to ensure that unethical behaviours are reduced. Without ethical behaviour, the threat to the survival of the professions is great.
- Construction sector stakeholder engagement. There are clear divisions within the professions. There does not appear to be a common vision for the sector. If these divisions are not addressed, the divisions will likely grow and create further tensions, which might render the sector's performance as poor. This will impede economic growth in South Africa.
- A wider adoption of non-traditional methods of procurement and contracts. Not all construction projects should follow the traditional procurement methods and use traditional contracts. The collapse of the private construction sector is attributed to the use of traditional procurement methods where inappropriate.
- Improvement in the education and training of construction sector personnel and professionals. Poor performance of the construction sector and the built-environment professionals is partly attributed to poor education and training.
- The narrowing of the gap between tertiary institutions and practice. There seems to be a breach between the education provided by tertiary institutions and what happens in practice. Even if this gap is not addressed, tertiary institutions might be regarded as places that merely issue 'papers' with no value in practical application.
- Investment in research and development (R&D) in the construction sector. Without further dR&D, the construction sector is on the path to certain death.

8.8 Further research

This study was limited to the quantity surveying profession within the construction sector in South Africa. It was thus limited to the construction sector within South Africa. The future of the quantity surveying profession can in future be studied outside of these two contexts, that is, the construction sector and South Africa. A similar study could be carried out in other countries beyond South Africa. Furthermore, the study could be duplicated in other professions, both within and without the built environment.

References

Abas, N.H., Yusuf, N., Suhaini, N.A., Kariya, N., Mohammad, H., Hasmori, M.F., 2020. Factors Affecting Safety Performance of Construction Projects: A Literature Review. IOP Conf. Ser.: Mater. Sci. Eng. 713, 012036. https://doi.org/10.1088/1757-899X/713/1/012036

Abbott, A., 2005. Linked Ecologies: States and Universities as Environments for Professions*. Sociological Theory 23, 245–274. https://doi.org/10.1111/j.0735-2751.2005.00253.x

Abbott, A., 2001. Time Matters: On Theory and Method. Bibliovault OAI Repository, the University of Chicago Press, Chicago.

Abbott, A.D., 1988. The system of professions: an essay on the division of expert labor. University of Chicago Press, Chicago.

Abdullah, F., Bandi, S., 2013. Exploring issues on the usage of the bills of quantities and identifying relevant research area. [Online] Available from

https://www.academia.edu/2440707/Exploring_issues_on_the_usage_of_the_bills_of_quantities_and_identifying_relevant_research_area (accessed 5-3- 2020).

Abdullah, F., Haron, I., 2006. Profile of the quantity surveying practice in Malaysia. [Online] Available from http://ukurbahan-qs.blogspot.com/2007/08/profile-of-quantity-surveying-practice.html (accessed 5-3- 2020).

Abell, P., 2004. Narrative Explanation: An Alternative to Variable-Centered Explanation? | Annual Review of Sociology. Annual Review of Sociology 30, 287–310.

Aboagye-Nimo, E., Collison, J., Wood, H., Jin, R., 2018. Women as construction professionals: modern day challenges. Paper presented at Joint CIB W099 and TG59 Conference, 1–3 August 2018 Salvador, Brazil.

Abudayyeh, O., Dibert-Deyoung, A., Jaselskis, E., 2004. Analysis of Trends in Construction Research: 1985–2002. Journal of Construction Engineering & Management 130, 433–439. https://doi.org/10.1061/(ASCE)0733-9364(2004)130:3(433).

Acemoglu, D., Autor, D., 2011. Chapter 12 – Skills, Tasks and Technologies: Implications for Employment and Earnings, in: Card, D., Ashenfelter, O. (Eds.), Handbook of Labor Economics. Elsevier, pp. 1043–1171. https://doi.org/10.1016/S0169-7218(11)02410-5.

Adams, T. L. .2015. Sociology of professions: International divergences and research directions. Work, Employment & Society, 29(1), 154–165.

Adendorff, C. 2018. Global futuristic outlook-drivers for change. 2018. Keynote speaker paper presented at the CIDB 10th Postgraduate Conference, Port Elizabeth, 25–27 February 2018. Email communication with the author on 10 March 2018. Johannesburg. (Electronic file in possession of the author).

Ade-Ojo, C., Olubunmi, Fasuyi, O., Aseke, 2013. Cost-in-use; a pancea for sustainable building development in Nigeria. International Journal of Business and Management Invention 2, 5.

Agar, M., 2004. Non-linear dynamic applied anthropology. Human Organization 63, 4.

Aghimien, D., Aigbavboa, C., Aghimien, L., Thwala, W.D., Ndlovu, L., 2020. Making a case for 3D printing for housing delivery in South Africa. International Journal of Housing Markets and Analysis ahead-of-print. https://doi.org/10.1108/IJHMA-11-2019-0111.

Ahmad, U., Ibrahim, Y., Minai, M.S., 2017. Public private partnership in Malaysia: the differences in perceptions on the criticality of risk factors and allocation of risks between the private and public sectors. International Review of Management and Marketing, 2017, 7(2), 138–150.

Ahmed, S., Pasquire, C., Manu, E., 2018. Positioning quantity surveyors in collaborative production system. Paper presented at RICS Cobra 2018, London, UK, 23–14 April 2018.

Ajayi, S, Brinklow-Harris, J Alaka, H A and Dauda, J A (2019) Managing the benefits and impediments to offsite construction in the UK construction industry In: Gorse, C and Neilson, C J (Eds) Proceedings of the 35th Annual ARCOM Conference, Leeds, UK, 2-4 September 2019, Association of Researchers in Construction Management, 577–586.

Ajalekoko, J.O. 2004. Branding the quantity surveying profession to meet the challenges of built environment. Paper presented at the Fourth World Congress for the International Cost Engineering Council, Cape Town, 17–21 April 2004.

Akinradewo, O., Oke, A., Aigbavboa, C., Mashangoane, M., 2018. (18) (PDF) Willingness to Adopt Robotics and Construction Automation in the South African Construction Industry, in: Proceedings of the International Conference on Industrial Engineering and Operations Management. Presented at the International Conference on Industrial Engineering and Operations Management, Pretoria/Johannesburg, 1619–1626.

Akintola, A., Root, D., Venkatachalam, S., 2017a. Key constrints to optimal and widespread implementation of BIM in the South African construction industry. *In:* Chan,P W and Neilson, C J (Eds) *Proceeding of the 33rd Annual ARCOM Conference,* 4–6 September 2017, Cambridge, UK, Association of Researchers in Construction Management, 25–34.

Akintola, A., Venkatachalam, S., Root, D., 2017b. New BIM Roles' Legitimacy and Changing Power Dynamics on BIM-Enabled Projects. Journal of Construction Engineering and Management 143, 04017066. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001366.

Algburi, S.M., Faieza, A.A. & Baharudin, B.T.H.T.2016. Review of green building index in Malaysia; existing work and challenges. International Journal of Applied Engineering Research 11, 3 160–3 167.

Alufohai, A J .2012. Adoption of building information modeling and Nigeria's quest for project cost management. Paper presented at Knowing to Manage the Territory, Protect the Environment and Evaluate the Cultural Heritage, Rome, Italy, 6–10th May 2012.

Ameh O. J., Odusami K. T., 2010. Professionals' Ambivalence toward Ethics in the Nigerian Construction Industry. Journal of Professional Issues in Engineering Education and Practice 136, 9–16. https://doi.org/10.1061/(ASCE)1052-3928(2010)136:1(9).

Ampofo-Anti, N.L., Dumani, N., Wyk, L.V., 2016. Potential for reducing greenhouse gas emissions in the South African construction sector. DBSA Green Fund Research and Policy Development to advance a Green Economy in South Africa: Research Report.

Andrew H. Van de Ven, George P. Huber, 1990. Longitudinal Field Research Methods for Studying Processes of Organizational Change. Organization Science 1, 213.

Anon. 2018. The Carbon Brief Profile: South Africa. [Online] Available from https://www.carbonbrief.org/the-carbon-brief-profile-south-africa (accessed 11-01-2020).

Anteby, M., Chan, C.K., DiBenigno, J., 2016. Three Lenses on Occupations and Professions in Organizations: Becoming, Doing, and Relating. The Academy of Management Annals 10, 183–244. https://doi.org/10.1080/19416520.2016.1120962.

Appelbaum, S.H., 1997. Socio-technical systems theory: an intervention strategy for organizational development. Management Decision, Vol. 35 Issue: 6, 452–463, https://doi.org/10.1108/00251749710173823.

Arcade, J., Godet, M., Meunier, F and Roubelat, F. 2009. Structural analysis with Micmac method and actors, strategy with macto method. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3. Washington D.C.: The Millennium Project 3rd Edition.

Archel, P., Husillos, J., Larrinaga, C. and Spence, C. 2009. Social disclosure, legitimacy theory and the role of the state. Accounting, Auditing & Accountability Journal 22 (8), 1 284–1 307.

Armstrong, P., 1985. Changing management control strategies: The role of competition between accountancy and other organisational professions. Accounting, Organizations and Society 10, 129–148. https://doi.org/10.1016/0361-3682(85)90012-1.

Ashworth, A., Hogg, K., Higgs, C., 2013. Willis's practice and procedure for the quantity surveyor, 13th ed. ed. John Wiley Publication, Chichester, West Sussex, UK.

Ashworth, A., Hogg, K., Higgs, C., 2013. Willis's practice and procedure for the quantity surveyor, 13th ed. John Wiley Publication, Chichester, West Sussex, UK.

Atkeson, A., Kehoe, P.J., 2001. The Transition to a New Economy After the Second Industrial Revolution (Working Paper No. 8676), Working Paper Series. National Bureau of Economic Research. https://doi.org/10.3386/w8676.

Australia Government. 2008. Australia 2020 summit: strengthening communities, supporting families and social inclusion. Canberra, Australia.

Australian Institute of Quantity Surveyors. 2020. Code of professional conduct. [Online] Available from https://www.aiqs.com.au/sites/default/files/uploaded-content/website-content/02_code_of_conduct_0.pdf (accessed 10-31-2020).

Australian Institute of Quantity Surveyors, 2012. National competency standards for quantity surveyors, construction economists and cost engineers. Australian Institute of Quantity Surveyors, Deakin West, ACT.

Australian Institute of Quantity Surveyors. n.d. a. What is a QS? [Online] Available from https://www.aiqs.com.au/sites/default/files/uploaded-content/website-content/for_parents_-_soft_copy.pdf (accessed 03-11-2020).

Australian Institute of Quantity Surveyors. n.d, b. History of quantity surveying. [Online] Available from https://www.aiqs.com.au/imis/AIQS_Website/About/What_is_a_QS_/History_of_Quantity_Surveying/AIQS_Website/About/History.aspx?hkey=958ddb72-57b3-426a-90a1-72a39bec29bc (accessed 11-05-2020).

Awil, A.U. 2004. Promoting formation of alliances as a contributor to the development of the construction services sector: a Malaysian case study. Paper presented at International Symposium on Globalisation and Construction, AIT Conference Centre, Bangkok, Thailand, 17–19 November 2004.

Babatunde, S.O., Perera, S., Ekundayo, D., Adeleye, T.E., 2019. An investigation into BIM-based detailed cost estimating and drivers to the adoption of BIM in quantity surveying practices. JFMPC 25, 61–81. https://doi.org/10.1108/JFMPC-05-2019-0042.

Baloyi, L., Bekker, M., 2011. Causes of construction cost and time overruns: The 2010 FIFA World Cup stadia in South Africa. Acta Structilia 18, 51–67.

Barnes, M. 2013. Engineering and construction contract: this contract should be used for the appointment of a contractor for engineering and construction work, including any level of design. Bell & Bain Limited, Glasgow.

Bastalich, W., 2009. Reading Foucault: Genealogy and Social Science Research Methodology and Ethics. Sociological Research Online 14, 81–90. https://doi.org/10.5153/sro.1905.

Baum, F., MacDougall, C., Smith, D. 2006. Participatory action. J Epidemiol Community Health, Volume 60: 854–857.

Bazjanac, V., 2005. Model based cost and energy performance estimation during schematic design. 22nd Conference on Information Technology in Construction 677–688.

B-BBEE Commission. 2016. Broad-Based Black Economic Empowerment Act 53 of 2003 as amended by Act 46 of 2013. Government Printers, Pretoria.

Beery, J., Eidinow, E., Murphy, N. (Eds.), n.d. Jenny Beery Esther Eidinow Nancy Murphy. Deeper News 7, 26.

Belayutham, S, Ibrahim, K I, Hussain, A. 2019. Shaping the future of prevention through design (PtD) practice in the Malaysian construction industry In: Gorse, C and Neilson, C J (Eds) Proceedings of the 35th Annual ARCOM Conference, 2-4 September 2019, Leeds, UK, Association of Researchers in Construction Management, 487-496.

Berg, M., Hudson, P., 1992. Rehabilitating the industrial revolution1. The Economic History Review 45, 24–50. https://doi.org/10.1111/j.1468-0289.1992.tb01290.x

Berkhout, F., Smith, A., Stirling, A., 2004. Socio-technological regimes and transition contexts. In: Elzen, B., Geels, F.W., Green, K. (Eds.), System Innovation and the Transition to Sustainability: Theory, Evidence and Policy. Edward Elgar, Cheltenham, 48–75.

Bernard Barber, 1963. Some Problems in the Sociology of the Professions. Daedalus 92, 669.

Beukes, S., 2014. How a quantity surveyor in South Africa can use building information model (BIM) to stay relevant in the construction industry. (Unpublished honours treatise). University of Pretoria, Pretoria.

Bezold, C., Peck, J., Bettles, C. and Olson, B . 2009. Using vision in futures. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. Washington D.C.: The Millennium Project 3rd Edition.

Biech, E., 2007. Thriving Through Change: A Leader's Practical Guide to Change Mastery, AP/CDR edition. ed. Association for Talent Development, Alexandria, VA.

BIM Academy Africa. 2018. BIM 4 students. BIM Academy Africa Pty Ltd, Cape Town.

Bloem, J., van Doorn, M., Duivestein, S., 2014. The Fourth Industrial Revolution: Things to tighten the link between IT and OT. [Online] Available from https://www.fr.sogeti.com/globalassets/global/downloads/reports/vint-research-3-the-fourth-industrial-revolution (accessed 12-11-2017).

Blomgren, M., Waks, C., 2015. Coping with contradictions: hybrid professionals managing institutional complexity. Journal of Professions and Organization 2, 78–102. https://doi.org/10.1093/jpo/jou010.

Blumberg B, Cooper D.R., Schindler P.S. 2008. Business research methods. McGraw-Hill Higher Education, London.

Boon, J., Prigg, C., 2012. Evolution of Quantity Surveying Practice in the Use of BIM – the New Zealand Experience. [Online] Available from https://www.semanticscholar.org/paper/Evolution-of-Quantity-Surveying-Practice-in-the-Use-Boon/c2540a963bda2725f75017b1236853bd9a446ef4 (accessed 10.23.20).

Bowen, P., Akintoye, A., Pearl, R., Edwards, P.J., 2007. Ethical behaviour in the South African construction industry. Construction Management and Economics 25, 631–648. https://doi.org/10.1080/01446190701225707.

Bowen, P., Cattell, K., Edwards, P., Jay, I., 2010. Value management practice by South African quantity surveyors. Facilities 28, 46–63. https://doi.org/10.1108/02632771011011396.

Bowen, P., Edwards, P., Cattell, K., 2015. Corruption in the South African construction industry: experiences of clients and construction professionals. International Journal of Project Organisation and Management 7, 72–97. https://doi.org/10.1504/IJPOM.2015.068003.

Bowen, P.A., Edwards, P.J., Cattell, K., 2012. Corruption in the South African construction industry: a thematic analysis of verbatim comments from survey participants. Construction Management and Economics 30, 885–901. https://doi.org/10.1080/01446193.2012.711909.

Bowles, J.E., Le Roux, G.K., 1992. Quantity surveying: an introduction. Q S Publications, Centrahill.

Brandon, P.S., 1992. Quantity surveying techniques New directions. Blackwell Scientific, Oxford.

Brandon, P.S., Stafford, B., Atkin, B., 1990. The potential for expert systems within quantity surveying: an overview. Royal Institution of Chartered Surveyors, London.

Bridgen, S., 2017. Using Systems Theory to Understand the Identity of Academic Advising: A Case Study. NACADA Journal 37, 9–20. https://doi.org/10.12930/NACADA-15-038.

Briedenhann, J., 2011. Economic and Tourism Expectations of the 2010 FIFA World Cup – A Resident Perspective. Journal of Sport & Tourism, 16:1, 5–32, doi:10.1080/14775085.2011.568085.

Brier, D.J., 2005. Marking the future: a review of time horizons. Futures 37, 833–848. https://doi.org/10.1016/j.futures.2005.01.005

Brighthub. 2014. What are the various qualitative methods of data analysis? [Online] Available from https://www.brighthubpm.com/methods-strategies/115531-explaining-the-types-of-qualitative-analysis-methods/#:~:text=Matrix%20analysis%20or%20logical%20analysis,and%20in%20construction%20of%20hypothesis (accessed 09-16-2020).

Brint, S., 1996. In an Age of Experts: The Changing Role of Professionals in Politics and Public Life. Princeton University Press, Princeton NJ.

Britannica, 2018. Industrial revolution. [Online] Available from https://www.britannica.com/event/Industrial-Revolution (accessed 10-23-2018).

Brock, D. M., Saks, M., 2016. Professions and organizations: A European perspective. European Management Journal, 34(1), 1–6.

Brookfield, E., 2017. NEC4: ICE's collaborative procurement suite continues to evolve. Proceedings of the Institution of Civil Engineers – Civil Engineering 170, 99–99. https://doi.org/10.1680/jcien.2017.170.3.99.

Brown, J., Loosemore, M., 2015. Behavioural factors influencing corrupt action in the Australian construction industry. Engineering, Construction and Architectural Management 22, 372–389. https://doi.org/10.1108/ECAM-03-2015-0034.

Bryman, A., Bell, E., 2014. Research methodology: business and management contexts. Oxford University Press Southern Africa, Cape Town.

Bryman, A., 2012. Social research methods. Oxford University Press, Oxford.

Brynjolfsson, E., McAfee, A., 2014. The second machine age: work, progress, and prosperity in a time of brilliant technologies, First Edition. ed. W. W. Norton & Company, New York.

Burlea-Şchiopoiu, A., Popa, I., 2013. Legitimacy Theory, in Encyclopedia of Corporate Social Responsibility, Editors Samuel O. Idowu, Nicholas Capaldi, Liangrong Zu, Ananda das Gupta, Springer-Verlag Berlin Heidelberg, pp.1579-1584. [Online] Available from https://www.springerreference.com/docs/html/chapterdbid/333348.html (accessed 10-30-2018).

Byrne, C., 2015. Building Information Modelling in Australia, Lessons from the UK. International Specialised Skills Institute: Melbourne.

Cambridge Dictionary, n.d. EXPERT | meaning in the Cambridge English Dictionary [Online] Available from https://dictionary.cambridge.org/dictionary/english/expert. URL https://dictionary.cambridge.org/dictionary/english/expert (accessed 1-3-20).

Cameron, K.S. 1984. Organizational adaptation and higher education. The Journal of Higher Education 55 (2), 122–144.

Cape Peninsula University of Technology. Not Dated. Course information and fees. [Online] Available from https://www.cput.ac.za/academic/faculties/engineering/prospectus/course?i=367&seo=QlRlY2g6IENPTlNUUlVDVElPTiBNQU5BR0VNRU5UIChGQUNJTElUWSBNQU5BR0VNRU5UKQ== (accessed 06-04-2020)

Carr-Saunders, A.M., Wilson, P.A., 1933. The Professions. Clarendon Press: Oxford.

Cartlidge, D., 2009. Quantity Surveyor's Pocket Book. Routledge: Abingdon.

Cartlidge, D.P., 2006. New aspects of quantity surveying practice. Elsevier Butterworth-Heinemann: Oxford.

CBE, 2018a. About CBE. [Online] Available from https://cbe.org.za/about/#councils (accessed 06-03-20).

CBE, 2018b. Regulations. CBE. [Online] Available from URL https://cbe.org.za/regulations/ (accessed 10-17-20).

CBE, 2000. Council for the Built Environment Act 43 of 2000. [Online] Available from http://cbe.org.za/content/Home/About%20CBE/What%20We%20Do/Act_43_of_2000_CBE.pdf (accessed 06-04-2020).

Central Intelligence Agency. 2019. Urbanization. [Online] Available from https://www.cia.gov/library/publications/the-world-factbook/fields/349.html (accessed 05-11-2020).

Centre for Development and Enterprise. 2013. Rising middle classes in India, Brazil and South Africa: What is happening and what are the implications? [Online] Available from https://www.cde.org.za/wp-content/uploads/2018/07/Rising-middle-classes-in-India-Brazil-and-South-Africa-what-is-happening-and-what-are-the-implications-Executive-Summary-CDE.pdf (accessed 06-03-2020).

Chamikara, P.B.S., Perera, B.A.K.S., Rodrigo, M.N.N., 2020. Competencies of the quantity surveyor in performing for sustainable construction. International Journal of Construction Management 20, 237–251. https://doi.org/10.1080/15623599.2018.1484848.

Chan, D.W.M., Olawumi, T.O., Ho, A.M.L., 2019. Critical success factors for building information modelling (BIM) implementation in Hong Kong. Engineering, Construction and Architectural Management 26, 1838–1854. https://doi.org/10.1108/ECAM-05-2018-0204.

Chan, G., 2012. Hong Kong: summary of GFA concession in private developments. [Online] Available from https://www.mondaq.com/hongkong/construction-planning/198676/summary-of-gross-floor-area-concessions-in-private-developments (accessed 05-10-2020).

Chan, I., Leung, M., 2017. Sustainable Development Worldwide: Costs of Green Buildings. HKIS-funded Research Project 2016-17: Hong Kong [Online] Available from https://www.hkis.org.hk/ufiles/HKIS17_GB_Report_20180301_R.PDF (accessed 10-29-2020).

Chan, T K and Gao, S (2019) Can We Really Measure Construction Productivity? In: Gorse, C and Neilson, C J (Eds) Proceedings of the 35th Annual ARCOM Conference, Leeds, UK, 2-4 September 2019, Association of Researchers in Construction Management, 143–152.

Charmaz, K., 2014. Constructing Grounded Theory. SAGE Publications, London ; Thousand Oaks, CA.

Che Haron, R., Ibrahim, P.H., Mat Rawi, A., 2016. The challenges of quantity surveying practice in sustainable construction project. Advanced Science Letters Vol. 23, No.7, July 2017, 6 035–6 039.

Cheng, J.C.P., Lu, Q., 2015. A review of the efforts and roles of the public sector for BIM adoption worldwide. Journal of Information Technology in Construction (ITcon) 20, 442–478.

Chermack, T.J., 2004. Improving decision-making with scenario planning. Futures 36 (3), 295–305.

Cheung, E., Chan, A.P.C., Kajewski, S., 2009. Reasons for implementing public private partnership projects: Perspectives from Hong Kong, Australian and British practitioners. Journal of Property Investment & Finance 27, 81–95. https://doi.org/10.1108/14635780910926685.

Chimhundu, S., 2016. A study on the BIM adoption readiness and possible mandatory initiatives for successful implementation in South Africa (PhD Thesis). University of the Witwatersrand, Johannesburg.

Chiu, W.Y.B., Lai, J.H.K., 2020. Building information modelling for building services engineering: benefits, barriers and conducive measures. Engineering, Construction and Architectural Management. https://doi.org/10.1108/ECAM-10-2018-0460.

Chong, B.L., Lee, W.P., Lim, C.C., 2012. The Roles of Graduate Quantity Surveyors in the Malaysian Construction Industry. International Conference on Management and Education Innovation. IPEDR vol.37, 17-20. IACSIT Press, Singapore.

Cilliers, J., 2014. South African Futures 2030: How Bafana Bafana Made Mandela Magic (SSRN Scholarly Paper No. ID 2690232). Social Science Research Network, Rochester, NY. https://doi.org/10.2139/ssrn.2690232.

CIOB 2013. A report exploring corruption in the UK construction industry. Berkshire, United Kingdom.

Clough, P., Nutbrown, C., 2002. A student's guide to methodology: justifying enquiry. SAGE Publications, London.

Coetzer, D.A., Brent, A.C. 2015. Perceptions of professional practitioners and property developers relating to the costs of green buildings in South Africa. Journal of the South African Institution of Civil Engineering 57 (4), 12–19.

Collier, J., 1945 .United States Indian Administration as a Laboratory of Ethnic Relations. Social Research 12, 275–85.

Competition Commission South Africa. 2011. Invitation to firms in the construction industry to engage in settlement of contraventions of the competition act. [Online] Available from https://www.comptrib.co.za/assets/Uploads/Collusive-Tendering/Annexure-A.pdf (accessed 01-01-2018).

Construction Industry Council. 2009. The Impact of the Recession on Construction Professional Services [Online] Available from http://cic.org.uk/download.php?f=an-economic-perspective-impact-of-the-recession.pdf (accessed 03-06-2020).

Construction Industry Development Board (South Africa). 2015. Standard for uniformity in construction procurement. [Online] Available from http://www.cidb.org.za/publications/Documents/Standard%20for%20Uniformity%20in%20Contruction%20Procurement%20-%20July%202015.pdf. (accessed 12-28-2017).

Construction Industry Review Committee. 2001. Construct for excellence. [Online] Available from https://www.devb.gov.hk/filemanager/en/content_735/reporte.pdf (accessed 04-19-2020).

Construction Task Force, Great Britain (Eds.), 1998. Rethinking construction: the report of the Construction Task Force to the Deputy Prime Minister, John Prescott on the scope for improving the quality and efficiency of UK construction. Department of the Environment, Transport and the Regions, London.

Cooper, D.J., Robson, K., 2006. Accounting, professions and regulation: Locating the sites of professionalization. Accounting, Organizations and Society 31, 415–444. https://doi.org/10.1016/j.aos.2006.03.003.

Cottle, E., 2015. The Transformation of the Construction Sector in South Africa since apartheid: Social inequality and labour. Global Labour Column 198-199, 1–2.

Coyle, G.R. 2009. Field anomaly relaxation. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3. The Millennium Project 3rd Edition, Washington D.C.

Creswell, J.W., 2014. Research design: qualitative, quantitative, and mixed methods approaches, Fourth edition, international student edition. ed. SAGE Publications, Los Angeles, California.

Creswell, J.W., Creswell, J.D., 2018. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 5th Edition. ed. SAGE Publications, Los Angeles.

Cronjé, F., 2017. A time traveller's guide to South Africa in 2030, First edition. ed. Tafelberg, Cape Town.

Cummings, T. G., Worley, C. G., 2005. Organization Development and Change. South-Western/Cengage Learning, Mason, Ohio.

Cunningham, T., 2014. The work and skills base of the quantity surveyor in Ireland-An introduction. [Online] Available from https://arrow.tudublin.ie/cgi/viewcontent.cgi?article=1034&context=beschreoth (accessed 11-13-2020).

Dada, J.O., Jagboro, G.O., 2012. Core skills requirement and competencies expected of quantity surveyors: perspectives from quantity surveyors, allied professionals and clients in Nigeria. Australasian Journal of Construction Economics and Building 12, 78–90. https://doi.org/10.5130/ajceb.v12i4.2808.

Dakhil, A.J., 2017. Building Information Modelling (BIM) maturity-benefits assessment relationship framework for UK construction clients. (Unpublished Phd Thesis), University of Salford, Salford.

Dalkey, N., Brown, B., Cochran, S.W., 1970. "The Delphi Method III: Use of Self Ratings to Improve Group Estimates, Technological Forecasting and Social Change, Vol. 1.

Dantata, S., 2007. General overview of the Nigerian construction industry (Thesis). Massachusetts Institute of Technology, Cambridge, USA.

Davis, M., 2009. Is Engineering a Profession Everywhere? Philosophia 37, 211–225. https://doi.org/10.1007/s11406-008-9125-9.

Davison, R.D. 1998. An action research perspective of group support systems: how to improve meetings in Hong Kong (Unpublished PhD thesis). City University of Hong Kong: Hong Kong.

de Jong, M., Henry, W.P., Stansbury, N., 2009. Eliminating Corruption in Our Engineering/Construction Industry. Leadership Manage. Eng. 9, 105–111. https://doi.org/10.1061/(ASCE)1532-6748(2009)9:3(105).

De Valence, G. 2019. Three pathways to the future for building and construction. Paper presented at the 1st international conference on construction futures, Wolverhampton, UK, December 2018.

DeCanio, S.J., 2016. Robots and humans – complements or substitutes? Journal of Macroeconomics 49, 280–291. https://doi.org/10.1016/j.jmacro.2016.08.003.

Deegan, C., 2002. Introduction: The legitimising effect of socialand environmental disclosures – a theoretical foundation. Accounting, Auditing & Accountability Journal 15, 282–311. https://doi.org/10.1108/09513570210435852

Department of Education. 2009. Space and cost norms for buildings and other land improvements at higher education institutions. Pretoria: Government Printer.

Department of Home Affairs. 2014. Immigration Act, 2002: Act No. 13 of 2002. Government Gazette No. 37716. [Online] Available from https://www.greengazette.co.za/pages/national-gazette-37716-of-03-june-2014-vol-588_20140603-GGN-37716-012 (accessed 06-03-2020).

Department of National Treasury. 2019. Media statement: gazetting of the carbon offsets regulations in terms of the Carbon Tax Act and related draft regulations for public comment. [Online] Available from https://www.gov.za/speeches/treasury-gazetting-carbon-offsets-regulations-terms-carbon-tax-act-and-related-draft (accessed 06-04-2020).

Department of Public Works. 2019. The scope of work for categories of registration for the profession regulated by the South African Council for the architectural profession. Government Gazette No. 42739 [Online] Available from https://cdn.ymaws.com/www.sacapsa.com/resource/collection/72C82274-648D-47A2-BB60-288ADF749F34/Identified_Scope_of_Work_for_each_category_of_registered_persons.pdf. (accessed 10-20-2020).

Department of Public Works. 2015. Guideline for the implementation of labour intensive infrastructure projects under the expanded public works programme (EPWP). Pretoria: Government Printer.

Department of Public Works. 1997. White paper on creating an enabling environment for reconstruction, growth and development in the construction industry. Pretoria: Government Printer.

Derbyshire, J., 2016. The implications, challenges and benefits of a complexity-orientated Futures Studies. Futures 77, 45–55. https://doi.org/10.1016/j.futures.2016.02.001.

Desai, G.S., 2018. Artificial Intelligence: The Future of Obstetrics and Gynecology. The Journal of Obstetrics and Gynecology of India 68, 326–327. https://doi.org/10.1007/s13224-018-1118-4.

Desmet, K., Greif, A., Parente, S.L., 2020. Spatial competition, innovation and institutions: the Industrial Revolution and the Great Divergence. Journal of Economic Growth 25 (1), 1–35. https://doi.org/10.1007/s10887-019-09173-3.

Dinokengscenario. n.d. Dinokeng. [Online] Available from https://www.dinokengscenarios.co.za/over_purpose.php (accessed 07-25-2020).

Dogne, N., Choudhary, A., 2014. Smart construction materials and techniques. National conference on Alternative & innovation Construction Materials & Techniques. e-proceeding: Sept-2014. [Online] Available from https://www.researchgate.net/publication/297167802_SMART_CONSTRUCTION_MATERIALS_TECHNIQUES (accessed 11-13-2020).

Donaghy, R., Great Britain, Department for Work and Pensions, 2009. Inquiry into the underlying causes of construction fatal accidents. Stationery Office Books: [distributor] Stationery Office Books, London.

Donnelley, L. 2019. Rise of the new construction mafia. Mail and Guardian. [Online] Available from https://mg.co.za/article/2019-04-12-00-rise-of-the-new-construction-mafia/ (accessed 08-13-2020).

Drake, B. (Ed.), 1994. Construction Economics in the Single European Market. Routledge, London ; New York.

Dunbar-Hall, P. 2009. Chapter 14: narrative inquiry as reflection on pedagogy-a commentary. [Online] Available from https://link.springer.com/chapter/10.1007/978-1-4020-9862-8_16 (accessed 2020-08-03-2020).

Dunton, J., 2012. Senior MoD surveyor pleads guilty to bribery [Online] Available from https://www.building.co.uk/news/senior-mod-surveyor-pleads-guilty-to-bribery/5032622.article (accessed 10-24-20).

Dupwa, R.P. 2017. Investigation of the utilisation of modular construction in South Africa (Unpublished masters dissertation). University of the Witwatersrand, Johannesburg.

Dwikojuliardi, R., 2015. Malaysia and Construction Industry Present. [Online] Available from https://www.researchgate.net/publication/297403568_Malaysia_and_Construction_Industry_Present (accessed 11-13-20).

Easterby-Smith, M., Thorpe, R. and Lowe, A., 1991. Management Research, Sage, London.

Ebekozien, A., 2020. Corrupt acts in the Nigerian construction industry: is the ruling party fighting corruption? Journal of Contemporary African Studies 0, 1–18. https://doi.org/10.1080/02589001.2020.1758304.

Economic Planning Unit. 2004. Malaysia: 30 years of poverty reduction, growth and racial harmony. [Online] Available from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.531.987&rep=rep1&type=pdf (accessed 04-19-2020).

ECSA. 2013. Identification of Engineering Work. [Online] Available from https://www.ecsa.co.za/engineeringsa/Documents/IDOEW_Policy.pdf (accessed 10-17-2020).

El Agha, O.I., 2013. Factors affecting the selection of procurement methods in the construction projects in the Gaza Strip (Unpublished masters dissertation). The Islamic University of Gaza, Gaza.

El-Sayegh, S., Romdhane, L., Manjikian, S., 2020. A critical review of 3D printing in construction: benefits, challenges, and risks. Archiv.Civ.Mech.Eng 20, 34. https://doi.org/10.1007/s43452-020-00038-w.

Elo, M.N.K, Halinen, A., Törnroos, J., 2010. Process research in business networks – an event based method for qualitative analysis. 26th IMP Conference, Budapest, September 2010.

Emiedafe, W., 2017. 5 Common Challenges of Nigeria's Construction Industry. [Online] Available from http://sapientvendors.com.ng/challenges-of-nigerias-construction-industry/ (accessed 10-27-20).

Engineering News. 2016. Housing backlog at 2.1m, says Minister Sisulu. [Online] Available from http://www.engineeringnews.co.za/article/housing-backlog-at-21m-says-minister-sisulu-2016-04-22 (accessed 04-04-2019).

Enslin, N. 2013. Death and injury stalk construction sites | Safe Build Forum. [Online] Available from http://forum.safebuild.co.za/index.php?threads/death-and-injury-stalk-construction-sites.758/ (accessed 04-09-2019).

Eppenberger, M., Haupt, T., 2009. Eppenberger, M. and Haupt, T. (2009) Construction Worker Injuries and Costs—A Comparative Study of Older and Younger Workers. Occupational Health Southern

Africa, 6-13. – References – Scientific Research Publishing. Occupational Health Southern Africa 6–13.

Epstein, S.R., 2008. Craft guilds in the pre-modern economy: a discussion. Economic History Rev 61, 155–174. https://doi.org/10.1111/j.1468-0289.2007.00411.x.

Estimation QS. 2020. List of the best quantity surveying courses and universities in the world: how to choose the right curricular programme [Online] Available from https://estimationqs.com/best-quantity-surveying-courses-and-universities-in-the-world/ (accessed 03-15-2020).

Estimation QS. 2017. Top 10 distance laser-measuring tools for construction estimators and quantity surveyors. [Online] Available from https://estimationqs.com/distance-laser-measuring-tools-for-construction-estimators/ (accessed 03-15-2020).

Eugene, S., 2009. Sustainable construction and the impact on the quantity surveyor.In:13th PAQS Congress, Kuala Lampur:17-18 2009. 36–48.

Evetts, J., 2009. New professionalism and new public management: Changes, continuities and consequences. Comparative Sociology, 8(2), 247–266.

Ezenwa, A.O., 2001. A study of fatal injuries in Nigerian factories. Occupational Medicine 51, 485–489. https://doi.org/10.1093/occmed/51.8.485.

Famakin, I.O., Fawehinmi, O.S., 2012. Quantity surveyor's perception of construction health and safety regulations in Nigeria. Journal of Building Performance 3 (1), 1–9.

Farmer, M., 2016. The farmer review of the UK construction labour model: modernise or die. Construction Leadership Council, London.

Fauzi, R.T., Lavoie, P., Sorelli, L., Heidari, M.D., Amor, B., 2019. Exploring the Current Challenges and Opportunities of Life Cycle Sustainability Assessment. Sustainability 11, 636. https://doi.org/10.3390/su11030636.

Feinberg, L., 2020. ASAQS launches programme to support quantity-surveying students. [Online] Available from https://www.bizcommunity.com/Article/196/640/161022.html (accessed 04-04-2020).

Ferrari, R., 2015. Writing narrative style literature reviews. Medical Writing 24, 230–235. https://doi.org/10.1179/2047480615Z.000000000329.

Fleming, E., Callaghan, N., Craig, N. 2019. Robotics and automation as a solution to bridging the UK housing gap in: Gorse, C and Neilson, C J (Eds) Proceedings of the 35th Annual ARCOM Conference, Leeds, UK, 2-4 September 2019, Association of Researchers in Construction Management, 557–566.

Flick, U., 2011. Introducing research methodology: a beginner's guide to doing a research project. Sage Publications, Thousand Oaks, California.

Forsyth, P.B., Danisiewicz, T.J., 1985. Toward a theory of professionalization. Work and occupations 12, 59–76.

Franco, L.A., Meadows, M., Armstrong, S.J., 2013. Exploring individual differences in scenario planning workshops: A cognitive style framework. Technological Forecasting and Social Change, Scenario Method: Current developments in theory and practice 80, 723–734. https://doi.org/10.1016/j.techfore.2012.02.008.

Frei, M., 2010. Implications of the global financial crisis for the quantity surveying profession. [Online] Available from http://www.icoste.org/Frei.pdf (accessed 11-13-2020).

Freidson, E., 1988. Professional Powers: A Study of the Institutionalization of Formal Knowledge. University of Chicago Press, Chicago.

French, W.L., 1969 .Organization Development: Objectives, Assumptions, and Strategies. California Management Review 12, 23–24.

Frey, C.B., Osborne, M.A., 2017. The future of employment: How susceptible are jobs to computerisation? Technological Forecasting and Social Change 114, 254–280. https://doi.org/10.1016/j.techfore.2016.08.019.

Gardner, H., 2016. Is There a Future for the Professions? [Online] Available from https://hedgehogreview.com/issues/work-in-the-precarious-economy/articles/is-there-a-future-for-the-professions-an-interim-verdict (accessed 10.15.20).

Gee, C., 2010. The influence of building infirmation modelling on the quantity surveying profession. (Unpublished honours treatise), University of Pretoria, Pretoria.

Geels, F., 2006. The hygienic transition from cesspools to sewer systems (1840–1930): The dynamics of regime transformation. Research Policy 35, 1 069–1 082. https://doi.org/10.1016/j.respol.2006.06.001.

Geels, F., 2005a. Co-evolution of technology and society: The transition in water supply and personal hygiene in the Netherlands (1850–1930)—a case study in multi-level perspective. Technology in society 27, 363–397.

Geels, F., 2005b. Co-evolution of technology and society: The transition in water supply and personal hygiene in the Netherlands (1850–1930)—a case study in multi-level perspective. Technology in Society 27, 363–397. https://doi.org/10.1016/j.techsoc.2005.04.008.

Geels, F.W., 2020. Micro-foundations of the multi-level perspective on socio-technical transitions: Developing a multi-dimensional model of agency through crossovers between social constructivism, evolutionary economics and neo-institutional theory. Technological Forecasting and Social Change 152, 119894. https://doi.org/10.1016/j.techfore.2019.119894.

Geels, F.W., 2011. The multi-level perspective on sustainability transitions: Responses to seven criticisms. Environmental Innovation and Societal Transitions 1, 24–40. https://doi.org/10.1016/j.eist.2011.02.002.

Geels, F.W., 2010. Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective. Research Policy 39, 495–510. https://doi.org/10.1016/j.respol.2010.01.022.

Geels, F.W., 2006. Co-evolutionary and multi-level dynamics in transitions: The transformation of aviation systems and the shift from propeller to turbojet (1930–1970). Technovation 26, 999–1016. https://doi.org/10.1016/j.technovation.2005.08.010.

Geels, F.W., 2005. The Dynamics of Transitions in Socio-technical Systems: A Multi-level Analysis of the Transition Pathway from Horse-Drawn Carriages to Automobiles (1860-1930). Technology Analysis and Strategic Management 17, 445–476.

Geels, F.W., 2005. Technological transitions and system innovations: a co-evolutionary and socio-technical analysis. Edward Elgar Pub, Cheltenham, UK ; Northampton, Mass.

Geels, F.W., 2004. From sectoral systems of innovation to socio-technical systems: Insights about dynamics and change from sociology and institutional theory. Research policy 33, 897–920.

Geels, F.W., 2002. Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. Research Policy 31, 1 257–1 274. https://doi.org/10.1016/S0048-7333(02)00062-8.

Geels, F.W., Schot, J.W., 2010. The dynamics of transitions: a socio-technical perspective. In: Grin, J., Rotmans, J., Schot, J., Geels, F.W. and Loorbach, D. (Eds.), Transitions to Sustainable Development: New Directions in the Study of Long Term Transformative Change. Routledge, New York: 9–87.

Geels, F.W., Schot, J., 2007. Typology of sociotechnical transition pathways. Research Policy 36, 399–417. https://doi.org/10.1016/j.respol.2007.01.003.

Genus, A., Coles, A.-M., 2008. Rethinking the multi-level perspective of technological transitions. Research Policy 37, 1436–1445. https://doi.org/10.1016/j.respol.2008.05.006.

George, J.M., Jones, G.R., 2002. Understanding and Managing Organizational Behavior. Prentice Hall, Upper Saddle River, NJ.

Ghotge, R., Wijk, A. van, Vandeventer, E., Álvarez, J.S., 2020. A Global Analysis on Microgrids through the PESTEL Framework, in: 2020 IEEE International Conference on Power Electronics, Smart Grid and Renewable Energy (PESGRE2020). Presented at the 2020 IEEE International Conference on Power Electronics, Smart Grid and Renewable Energy (PESGRE2020), pp. 1–5. https://doi.org/10.1109/PESGRE45664.2020.9070725.

Ginigaddara, B., Perera, S., Feng, Y.,Rahnamayiezekavat, P. 2019. Skills required for offsite construction. Paper presented at CIB World Building Congress 2019, Hong Kong SAR, China 17–21, June 2019.

Glazer, N., 1974. The Schools of the Minor Professions. Minerva 12, 346–364.

Glen, S. 2019. Statistics how to. [Online] Available from https://www.statisticshowto.com/quasi-statistical-definition/ (accessed 09-16-2020).

Glenn, J.C. 2009a. Introduction. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3. The Millennium Project 3rd Edition Washington D.C.

Glenn, J.C. 2009b. The futures wheel. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3. The Millennium Project 3rd Edition, Washington D.C.

Glenn, J.C. 2009c. Participatory methods. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3. The Millennium Project 3rd Edition, Washington D.C.

Glenn, J.C. 2009d. Genius forecasting, intuition and vision. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3. The Millennium Project 3rd Edition, Washington D.C.

Glenn, J.C. and The Futures Group International. 2009. Scenarios. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

Glenn, J.C. and Gordon, T.J.2009. Integration, comparisons and frontiers of futures research methods. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. Washington D.C.: The Millennium Project 3rd Edition, Washington D.C.

Goldie-Scot, H., 2008. Briefing: Corruption in construction in developing countries. Proceedings of the Institution of Civil Engineers – Municipal Engineer 161, 211–213. https://doi.org/10.1680/muen.2008.161.4.211.

Goldstein, J., 1984. The "disciplines" and the history of the professions. History and Theory 23 (2), 170–192

Goode, W.J., 1957. Community Within a Community: The Professions. American Sociological Review 22, 194–200. https://doi.org/10.2307/2088857.

Gordham, P. 2013. The budget speech 2013. [Online] Available from http://www.treasury.gov.lk/depts/fpd/budgetspeech/2013/budgetSpeech2013- eng.pdf (accessed 10-11-2020).

Gordon, T.J. 2009a. The Delphi method. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0.The Millennium Project 3rd Edition, Washington D.C.

Gordon, T.J. 2009b. The real-time Delphi method. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

Gordon, T.J. 2009c. Trend impact analysis. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

Gordon, T.J. 2009d. Cross-impact analysis. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

Gordon, T.J. 2009e. Substitution analysis. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

Gordon, T.J. 2009f. Technology sequence analysis. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

Gordon, T.J. 2009g. Interactive scenario. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

Gordon, T.J. 2009h. Science and technology road mapping. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

Gordon, T.J. 2009i. Agent modelling. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

Gordon, T.J. 2009j. Uses of forecast analysis in forecasting. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

Gordon, T.J. 2009k. State of the future index (SOFI) method. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

Gordon, T.J. and Glenn, J.C. 2009. Environmental scanning. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

Goulding, C. 2002. Grounded theory: a practical guide for management: business and market researchers. London: Sage.

Green, B.N., Johnson, C.D., Adams, A., 2006. Writing narrative literature reviews for peer-reviewed journals: secrets of the trade. J Chiropr Med 5, 101–117. https://doi.org/10.1016/S0899-3467(07)60142-6.

Green, M., Dowsett, R., Maftei L., Sexton, M., 2019. Mobile methods for mobile work? an exploration of head-cams in construction research. Paper was presented as a working paper at the ARCOM 2019 Conference, Leeds, UK, 2–4 September 2019.

GOV.UK. 2019. Construction sector deal. [Online] Available from https://www.gov.uk/government/publications/construction-sector-deal/construction-sector-deal (accessed 02-29-2020).

Grimsey, D., Lewis, M.K., 2002. Evaluating the risks of public private partnerships for infrastructure projects. International Journal of Project Management 20, 107–118. https://doi.org/10.1016/S0263-7863(00)00040-5.

Grin, J., Rotmans, J., Schot, J.W., 2010. Transitions to Sustainable Development: New Directions in the Study of Long Term Transformative Change. Routledge, Abingdon.

Grossmann, I., Na, J., Varnum, M.E.W., Kitayama, S., Nisbett, R.E., 2013. A Route to Well-being: Intelligence vs. Wise Reasoning. J Exp Psychol Gen 142, 944–953. https://doi.org/10.1037/a0029560.

Gubrium, J., Holstein, J., 2003. 'Analyzing Interpretive Practice', in Denzin, N. and Lincoln, Y. (eds) Strtegies of Qualitative Inquiry, pp. 214–48. Sage Publications, Thousand Oaks, CA.

Guest, G., MacQueen K.M., Namey, E.E., 2012. Applied thematic analysis. Sage Publications, Los Angeles.

Gurung, N., 2020. BIM for Infrastructure in Developing Countries. (Unpublished thesis), Metropolia University of Applied Sciences, Helsinki.

Hager, I., Golonka, A., Putanowicz, R., 2016. 3D printing of buildings and building components as the future of sustainable construction? Procedia Engineering 151, 292–299.

Haggag, M.A. 2004. The impact of globalization on urban spaces in Arab cities. Paper presented at International Symposium on Globalisation and Construction AIT Conference Centre, Bangkok, Thailand, 17–19 November 2004.

Hall, J. 2013. How does a company name affect your buying decision? [Online] Available from http://www.examiner.com/article/how-does-a-company-name-affect-your-buying-decision (accessed 05-13-2014).

Hall, P., 2003. Comparative Historical Analysis in the Social Sciences. Cambridge University Press, Cambridge, UK and New York.

Hamakareem, M.I., n.d. Smart construction materials and techniques. [Online] Available from https://www.researchgate.net/publication/297167802_SMART_CONSTRUCTION_MATERIALS_TECHNIQUES (accessed 3-7-20).

Hamma-adama, M., Kouider, T., Salman, H., 2018. State of building information modelling (bim) adoption in Nigeria. Paper presented as a working paper at the ARCOM 2018 Conference, Belfast, UK, 3–5 September 2018.

Hammond, S.F., Savage, D.A., Gajendran, T. 2019. Stakeholders embrace green construction as the right direction: but as individuals they make self-Interested decisions. Paper presented CIB World Building Congress 2019, Hong Kong SAR, China, 17–21 June 2019.

Hampson, K., Brandon, P., 2004. Construction 2020: A Vision for Australia's Property and Construction Industry. Cooperative Research Centre for Construction Innovation, Brisbane.

Happ, M.B., Swigart, V., Tate, J., Crighton, M.H., 2004. Event analysis techniques. Advances in Nursing Science 27, 239–248. https://doi.org/10.1097/00012272-200407000-00008.

Harary, F., Batell, M.F., 1981. What is a System. Social Networks 3, 29–40. https://doi.org/10.1016/0378-8733(81)90003-4.

Haron, N.A., 2017. Implementation of Building Information Modelling (BIM) in Malaysia: A Review. Pertanika Journals. Science and Technology, 25 (3), 661–674.

Harris, V., 2019. BIM in South Africa 2019 global report. [Online] Available from https://www.biminstitute.org.za/bim2019report/ (accessed 11-01-2020).

Harty, C., Goodier, C.I., Soetanto, R., Austin, S., Dainty, A.R.J., Price, A.D.F., 2007. The futures of construction: a critical review of construction future studies. Construction Management and Economics 25, 477–493. https://doi.org/10.1080/01446190600879117.

Harun, H., Torrance, J.V.A., 2006. Drivers of change: new challenges for the quantity surveyors, in proceedings of the International Conference on Construction Industry 2006: Toward Innovative Approach in Construction and Property Development, Kuala Lumpur, Malaysia.

Hearn, J. 1982. Notes on patriarchy, professionalization and the semi-professions. Sociology 16 (2), 184–202

Helmer, O., Rescher, N., 1959. On the Epistemology of the Inexact Sciences, Management Sciences 6 (1).

Hepple, A., 1963. Job reservation- cruel, harmful and unjust. The Black Sash, July 1963. [Online] Available from https://www.sahistory.org.za/sites/default/files/DC/BSJul63.0036.4843.007.002.Jul%201963.7/BSJul63.0036.4843.007.002.Jul%201963.7.pdf (accessed 11-13-2020).

Henderson, S.W. (2017) Expanded public works programme (EPWP) of South Africa (phase 3): the expanded public-works programme as a catalyst for work opportunities, growth and development. [Online] Available from https://www.parliament.gov.za/storage/app/media/ProjectsAndEvents/2017_ncop_provincial_week_october/docs/EPWP_as_a_Catalyst_for_Development-Mr_Dladla.pdf (accessed 2018-12-07-2018).

Hergunsel, M., 2011. Benefits of Building Information Modeling for Construction Managers and BIM Based Scheduling. (Unpublished Masters thesis), Worcester Polytechnic Institute, Worcester.

Hill, C.J., 2013. The 10,000-hour threshold: interviews with successful percussionists (Unpublished PhD thesis). University of Kentucky, Kentucky.

Hindle, B. 2004. Construction: a colonized industry. Paper presented at International Symposium on Globalisation and Construction, AIT Conference Centre, Bangkok, Thailand, 17–19 November 2004.

Hirschi, A., 2018. The Fourth Industrial Revolution: Issues and Implications for Career Research and Practice. Career Development Quarterly 66, 192–204. https://doi.org/10.1002/cdq.12142.

HKCIC. 2013. Final Draft Report of the Roadmap for BIM Strategic Implementation in Hong Kong's Construction Industry. Construction Industry Council, Hong Kong.

HKCIC. 2015. CIC Building Information Modelling Standards Draft 6.2. Construction Industry Council, Hong Kong.

HM Government, 2018. Industrial strategy: construction sector deal. [Online] Available from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/731871/construction-sector-deal-print-single.pdf (accessed 04-04-2020).

HM Government. 2017. Modernise or die: the farmer review of the UK Construction Labour Model. [Online] Available from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/630457/farmer-review-construction-labour-model-government-response.pdf (accessed 03-01-2020).

Ho, J., Wang, J., 2007. Examination of Audit Fee Premiums and Auditor Switching Pre and Post the Demise of Arthur Andersen and the Enactment of Sarbanes-Oxley Act. [Online] Available from https://www.researchgate.net/publication/228226001_Examination_of_Audit_Fee_Premiums_and_Auditor_Switching_Pre_and_Post_the_Demise_of_Arthur_Andersen_and_the_Enactment_of_Sarbanes-Oxley_Act (accessed 13-11-2020).

Ho, P.H.K., 2013. Forecasting the manpower demand for quantity surveyors in Hong Kong. Construction Economics and Building 13, 1–12. https://doi.org/10.5130/AJCEB.v13i3.3278.

Honeytreat Academy. 2018. The Nigerian construction industry outlook. [Online] Available from https://honeytreatacademy.com/the-nigerian-construction-industry-outlook/ (accessed 04-21-2020).

Horn, J.L., Cattell, R.B., 1966. Refinement and test of the theory of fluid and crystallized general intelligences. Journal of Educational Psychology 57, 253–270. https://doi.org/10.1037/h0023816.

House of Commons, 2016. The energy revolution and future challenges for UK energy and climate change policy. [Online] Available from https://publications.parliament.uk/pa/cm201617/cmselect/cmenergy/705/705.pdf (accessed 13-11-2020).

Hotcoursessabroad. 2020a. 85 institutions offering quantity surveying: courses abroad. [Online] Available from https://www.hotcoursesabroad.com/study/training-degrees/international/quantity-surveying-courses/cgory/tc.36-4/sin/ct/programs.html (accessed 10-09-2020).

Hotcoursessabroad. 2020b. 44 institutions in the UK: offering quantity surveying: courses. [Online] Available from https://www.hotcoursesabroad.com/study/training-degrees/uk/quantity-surveying-courses/loc/210/cgory/tc.36-4/sin/ct/programs.html (accessed 2020-10-09-2020).

Høvring, C.M., Andersen, S.E., Nielsen, A.E., 2018. Discursive Tensions in CSR Multi-stakeholder Dialogue: A Foucauldian Perspective. J Bus Ethics 152, 627–645. https://doi.org/10.1007/s10551-016-3330-4.

Hughes, E.C., 1963. Professions. Daedalus 92, 655–668.

Hugman, R., 1996. Professionalization in Social Work—The Challenge of Diversity. International Social Work 39, 131–147. https://doi.org/10.1177/002087289603900203.

Iarskaia-Smirnova, E., Lyons, K., 2018. Social work in FSU countries: mapping the progress of 'the professional project.' European Journal of Social Work 21, 114–127. https://doi.org/10.1080/13691457.2016.1255926.

Idoro, G.I. 2004. The effect of globalization on safety in the construction industry in Nigeria. Paper presented at International Symposium on Globalisation and Construction, AIT Conference Centre, Bangkok, Thailand, 17–19 November 2004.

Ifije, O., Aigbavboa, C., 2020. Identifying Barriers of Sustainable Construction: A Nigerian Case Study. MATEC Web Conf. 312, 04004. https://doi.org/10.1051/matecconf/202031204004.

Inayatullah, S. 2009. Causal layered analysis: an integrative and transformative theory and method. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition., Washington D.C.

Independent Commission Against Corruption . 1998. Corruption prevention package for construction industry. [Online] Available from https://hkbedc.icac.hk/Upload/guides/5/pdf/640b0baf7be54083a425634a9284dd03.pdf (accessed 05-18-2020).

Independent Commission Against Corruption. n.d. 26 public housing blocks case: ducking responsibility. [Online] Available from https://hkbedc.icac.hk/Upload/guides/5/pdf/640b0baf7be54083a425634a9284dd03.pdf (accessed 05-18-2020).

Infrastructure Unit System Support. 2018. Norms and Standards. [Online] Available from https://www.iussonline.co.za/norms-standards (accessed 03-14-2020).

International Labour Organization. 2005. Facts on safety at work. [Online] Available from https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_067574.pdf (accessed 04-04-2019).

International Construction Week. 2019. Stay updated! 5 construction industry trends to be aware of in 2019. [Online] Available from https://www.icw.my/stay-updated-5-construction-industry-trends-to-be-aware-of-in-2019/ (accessed 04-19-2020).

Isipho Sempilo. 2016. Challenges faced by the construction industry in South Africa. Business Essentials. [Online] Available from https://www.businessessentials.co.za/2016/12/06/challenges-faced-construction-industry-sa/ (accessed 04-08-2020).

Jaillon, L., Poon, C.S., 2009. The evolution of prefabricated residential building systems in Hong Kong: A review of the public and the private sector. Automation in Construction 18, 239–248. https://doi.org/10.1016/j.autcon.2008.09.002.

Jaimovich, N., Siu, H.E., 2012. Job Polarization and Jobless Recoveries. National Bureau of Economic Research, Cambridge, Massachusetts.

Jan Goldstein, 1984. Foucault among the Sociologists: The "Disciplines" and the History of the Professions. History and Theory 23, 170. https://doi.org/10.2307/2505005.

Janesick, V.J., 2011. "Stretching" exercises for the qualitative researcher" (3rd ed.). Sage Publications, Thousand Oakes, CA.

Jiang, X., 2011. Developments in cost estimating and scheduling in BIM technology. Northeastern University, Boston, Massachusetts.

Jick, T. D., 2003. *Managing Change: Cases and Concepts*, Second Edition. Irwin Publishing, New York.

Jick, T. D., 2001. Vision Is 10%, .Implementation The Rest,. Business Strategy Review 12(4), .36–38.

Jin, R., Zou, P.X., Li, B., Piroozfar, P., Painting, N., 2019. Comparisons of students' perceptions on BIM practice among Australia, China and UK. Engineering, Construction and Architectural Management 26, 1899–1923. https://doi.org/10.1108/ECAM-07-2018-0275.

Johanson, B. n.d. Prefab and the Australian building sector, Built Offsite. [Online] Available from http://builtoffsite.com.au/issue-01/prefab-australian-building-sector/ (accessed 04-27-2020).

Johnson, T.J., 1972. Professions and Power. Macmillan, London.

Kaissi A, 2005. Manager-physician relationships: an organizational theory perspective. Health Care Manager 24, 165–176. https://doi.org/10.1097/00126450-200504000-00010.

Kamaruddin, S.S., Mohammad, M.F., Mahbub, R., 2016. Barriers and Impact of Mechanisation and Automation in Construction to Achieve Better Quality Products. Procedia - Social and Behavioral Sciences, ASEAN-Turkey ASLI QoL2015: AicQoL2015Jakarta, Indonesia, 25–27 April 2015 222, 111–120. https://doi.org/10.1016/j.sbspro.2016.05.197.

Kamarudin, S.S., Osman, N., Abdul Razak, N., Shazwan, M., 2019. Evaluation of BIM Education for Quantity Surveying: A Review of Teaching Approaches. KnE Social Sciences 3, 546. https://doi.org/10.18502/kss.v3i14.4336.

Kärreman, D., Levay, C., 2017. The interplay of text, meaning and practice: methodological considerations on discourse analysis in medical education. Med Educ 51, 72–80. https://doi.org/10.1111/medu.13212.

Kekana, G., Aigbavboa, C., Thwala, W., 2015. Understanding Building Information Modelling in the South Africa construction industry. Presented at the OTMC Conference. [Online] Available from https://ujcontent.uj.ac.za/vital/access/manager/Repository?view=null&f0=sm_identifier%3A%22http%3A%2F%2Fhdl.handle.net%2F10210%2F73329%22&sort=null (accessed 13-11-2020).

Kelly, J., 2014. Value Management of Construction Projects, 2nd Edition | Wiley [Online]. Available from https://www.wiley.com/en-us/Value+Management+of+Construction+Projects%2C+2nd+Edition-p-9781118351239 (accessed 10.23.20).

Kelly, J., Poynter-Brown, R. 1990. Value Management, in Brandon, P.S. (ed.) Quantity Surveying Techniques: New Directions, BSP, Oxford, pp. 54–74.

Khan, R.A., Liew, M.S., Ghazali, Z.B., 2014. Malaysian Construction Sector and Malaysia Vision 2020: Developed Nation Status. Procedia – Social and Behavioral Sciences 109, 507–513. https://doi.org/10.1016/j.sbspro.2013.12.498.

Khatleli, N., 2009. Utilizing principal agent and principal steward theories to assess the efficiacy of public private partnership in delivering black economic empowerment (Unpublished PhD thesis). University of Cape Town, Cape Town.

Khoshnevis, B., 2004. Automated construction by contour crafting—related robotics and information technologies. Automation in Construction, The best of ISARC 2002 13, 5–19. https://doi.org/10.1016/j.autcon.2003.08.012.

Khumalo, S. 2020. South Africa in recession after shock economic slump. [Online] Available from https://www.news24.com/fin24/Economy/South-Africa/breaking-south-africa-in-recession-after-shock-economic-slump-20200303 (accessed 12-12-2020).

King, O., Bortwick, A., Nancarrow, S., Grace, S., 2018. Sociology of the professions: what it means for podiatry. Journal of Foot and Ankle Research 11, 1–8. https://doi.org/10.1186/s13047-018-0275-0.

Kjartansdóttir, I.B., Mordue, S., Nowak, P., Philp, D., Jónas Thór Snæbjörnsson, Politechnika Warszawska, Wydział Inżynierii Lądowej, 2017. Building information modelling – BIM. Civil Engineering Faculty of Warsaw University of Technology, Warsaw.

Klein, S., Dalgeish, B., 2007. Quantity Surveying in the 21st Century. Construction Law International 2, 14–17.

KPMG South Africa. 2013. Planned infrastructure expenditure and the NDP: mind the gap. KPMG Services (Proprietary) Limited, Johannesburg.

KPMG South Africa. 2014. Unpacking the Infrastructure Development Plan. Infrastructure, 6 March: [Online] Available from: http://www.sablog.kpmg.co.za/2014/03/unpacking-national-infrastructure-development-plan/ (accessed 12-05-2014).

Köhler, J., Turnheim, B., Hodson, M., 2020. Low carbon transitions pathways in mobility: Applying the MLP in a combined case study and simulation bridging analysis of passenger transport in the Netherlands. Technological Forecasting and Social Change 151, 119314. https://doi.org/10.1016/j.techfore.2018.06.003.

Kolo, S.J., Rahimian, F.P., Goulding, J.S., 2014. Offsite Manufacturing Construction: A Big Opportunity for Housing Delivery in Nigeria. Procedia Engineering 85, 319–327. https://doi.org/10.1016/j.proeng.2014.10.557.

Korff, S. 2019. BIM in South Africa: The good, the bad and the promising. 2019. [Online] Available from https://www.buildinganddecor.co.za/bim-in-south-africa-the-good-the-bad-and-the-promising/ (accessed 2020-11-01-2020).

Korinek, A., Stiglitz, J.E., 2017. Artificial Intelligence and Its Implications for Income Distribution and Unemployment (Working Paper No. 24174). National Bureau of Economic Research. https://doi.org/10.3386/w24174.

Kosow, H., Gaßner, R., 2008. Methods of future and scenario analysis: overview, assessment. and selection criteria. Deutsches Institut für Entwicklungspolitik, Bonn.

Kotter, J.P., 1996. Leading Change. Harvard Business School Press, Boston.

Krause, E.A., 1999. Death of the Guilds: Professions, States, and the Advance of Capitalism, 1930 to the Present. Yale University Press, New Haven; London.

Kulasekara, G., Jayasena, H.S., Ranadewa, K., 2013. Comparative effectiveness of quantity surveying in a building information modelling implementation. Paper presented at the Second World Construction Symposium 2013: Socio-Economic Sustainability in Construction, Colombo, Sri-Lanka, 14-15 June 2013.

Kumar, R., 2014. Research methodology: a step-by-step guide for beginners, Fourth edition. ed. SAGE, Los Angeles.

Kuosa, T., 2011. Evolution of futures studies. Futures 43, 327–336. https://doi.org/10.1016/j.futures.2010.04.001.

Kymmell, W. (2008). Building information modelling: planning and managing construction projects with 4D CAD and simulations. New York: McGraw Hill Companies.

Lam, P.T.I., Chan, A.P.C., 1994. Construction management as procurement method: a new direction for Asian contractors. [Online] Available from https://www.irb.fraunhofer.de/CIBlibrary/search-quick-result-list.jsp?A&idSuche=CIB+DC12585 (accessed 10-15-20).

Langley, A., 2007. Process thinking in strategic organization. Strategic Organization 5, 271.

Larson, M., S., 2013. The Rise of Professionalism: Monopolies of Competence and Sheltered Markets. Transaction Publishers, Piscataway, New Jersey.

Latham, M., 1994. Constructing the team: final report: joint review of procurement and contractual arrangements in the United Kingdom construction industry. HMSO, London.

Lawrence, J., Tar, U., 2013. The use of Grounded Theory Technique as a Practical Tool for Qualitative Data Collection and Analysis 11, 13.

Le, Y., Shan, M., Chan, A.P.C., Hu, Y., 2014. Overview of Corruption Research in Construction. J. Manage. Eng. 30, 02514001. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000300

Lee, R.J., Ng, S.H., Pang, K.S., Yap, J.E., Yeo, D.E., 2016. Procurement strategies: an analysis and recommendation of procurement methods, digital image. [Online] Available from https://www.slideshare.net/PangKhaiShuen/a-report-on-procurement-strategies-pp1?from_action=save (accessed 10-28-2020).

Lempert, R. J., Myles T. C., 2007. Managing the Risk of Uncertain Threshold Response: Comparison of Robust, Optimum, and Precautionary Approaches ǁ Risk Analysis 27(4): 1 009–1 026.

Lempert, R., Popper, S., Bankes, S. 2009. Robust decision-making (RDM). In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

Lempert, R., Popper, S., Bankes, S. 2003: Shaping the Next One Hundred Years: New Methods for Quantitative, Long-Term Policy Analysis, Santa Monica, California: RAND, MR-1626-CR.

Leonard, A. and Beer, S. 2009. The systems perspective: methods and models for the future. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

Letwin, W.L., 1954. The English Common Law concerning Monopolies. The University of Chicago Law Review 21, 355. https://doi.org/10.2307/1597844.

Lewin, K., 1945, 1946, 1951. Field Theory in Social Science: Selected Theoretical Papers by Kurt Lewin, Ed. Dorwin Cartwright, Harper and Brothers Publishers: Boston, Massachusetts: MIT Research Center for Group Dynamics and New York.

Lewis- Hickmann, C J. 2015. Strengths -and-limitations-of-a qualitative research. [Online] Available from https://www.researchgate.net/profile/Cynthia_Hickman2/publication/286459625_Strength_and_Limitations_of_a_Qualitative_Research_Design_from_the_perspective_of_a_PhD_student/links/566b464b08aea0892c4c3811/Strength-and-Limitations-of-a-Qualitative-Research-Design-from-the-perspective-of-a-PhD-student (accessed 01-03-2018).

Lexico. 2020. Tenderpreneur. [Online] Available from https://www.lexico.com/definition/tipping_point (accessed 12-12-2020).

Lexico. 2020. Tipping point. [Online] Available from https://www.lexico.com/definition/tipping_point (accessed 06-09-2020).

Lexico. 2020. Trend [Online] Available from https://www.lexico.com/definition/trend (accessed 08-06-2020).

Li, Y., 2010. The Case Analysis of the Scandal of Enron. International Journal of Business and Management. International Journal of Business and Management 5 (10), 37–41.

Ling, C.S., Almeida, S.J., Wei, H.S., 2017. Affordable Housing: Challenges and the Way Forward. [Online] Available from https://www.bnm.gov.my/files/publication/qb/2017/Q4/p3ba1.pdf (accessed 11-13-2020).

Linstone, 2009. H.A. The multiple perspective concept. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

Lippitt, R., Watson, J., Westley, B., 1958. Dynamics of Planned Change, Harcourt Brace, New York.

Liu, A.M.M., Fellows, R., Ng, J., 2004. Surveyors' perspectives on ethics in organisational culture. Engineering, Construction and Architectural Management 11, 438–449. https://doi.org/10.1108/09699980410570193.

Llale, J., 2015. The role of quantity surveyors in public-private partnerships projects in South Africa (Unpublished masters dissertation). University of Pretoria, Pretoria.

Locatelli, G., Mariani, G., Sainati, T., Greco, M., 2017. Corruption in public projects and megaprojects: There is an elephant in the house! International Journal of Project Management 35(3), 252–268.

Luksha, P., Peskov, D., Luksha, E., Varlamova, D., Sudakov, D., Korichin, D., 2015. The Atlas of Emerging Jobs. Zenodo. https://doi.org/10.5281/zenodo.1253768.

Lyons, S. 2015. Eletter 59- 2015 new years resolutions. [Online] Available from https://cdn.ymaws.com/www.sacqsp.org.za/resource/collection/56589CD0-6930-486E-8B79-5A75BEEA41C5/Eletter-59__2015_Year_Resolution.pdf (accessed 06-03-2020).

Lyytinen, K., Newman, M., 2008. Explaining information systems change: A punctuated socio-technical change model. EJIS 17, 589–613. https://doi.org/10.1057/ejis.2008.50.

Ma, T., Luu, H.T., 2013. The changing role of quantity surveyors in the green building development in South Australia. Paper presented at 38th AUBEA International Conference, Auckland, New Zealand, 20–22 November 2013.

Madgwick, D. and Wood, H.L. 2015. Rationalising built environment education in the UK. Paper presented at The Construction, Building and Real Estate Research Conference of the Royal Institution of Chartered Surveyors, Held in Sydney, Australia in association with AUBEA, the University of Technology Sydney and University of Western Sydney 8–10 July 2015.

Madiba, T. 2019. Growth in S African construction sector expected. Engineering News. [Online] Available from https://www.engineeringnews.co.za/article/growth-in-s-african-construction-sector-expected-2019-05-24 (accessed 06-05-2020).

Mahbub, R., 2012. Readiness of A Developing Nation in Implementing Automation and Robotics in Construction: A Case Study of Malaysia. Journal of Civil Engineering and Architecture, USA Volume 6, 858–866. https://doi.org/10.17265/1934-7359/2012.07.008.

Mahoney, J., 2004. Revisiting General Theory in Historical Sociology. Social Forces 83, 459–489.

Mak Y.W. 2013. Strategic implementation of prefabrication and modular construction & some experience sharing of Hong Kong Housing Authority. In Second Construction Technology Forum: Construction for Sustainability, Hong Kong, 2013.

Makwana, D.N., 2017. Gender Perspective and Sociology in Nursing. International Journal of Research and Analytical Review 4 (4), 508–510.

Manning, P.K., Cullum-Swan, B., 2008. Narrative, content and semiotic analysis. In: Denzin, N.K., Lincoln, Y.S.(Eds) *Collecting and interpreting qualitative materials.* Sage Publications, Thousand Oaks.

Manu, P., Mahamadu, A.-M., Phung, V.M., Nguyen, T.T., Ath, C., Heng, A.Y.T., Kit, S.C., 2018. Health and safety management practices of contractors in South East Asia: A multi country study of Cambodia, Vietnam, and Malaysia. Safety Science 107, 188–201. https://doi.org/10.1016/j.ssci.2017.07.007.

Marcuse, P., Kempen, R.V. (Eds.), 2000. Globalizing Cities: A New Spatial Order?, 1st Edition. ed. Wiley-Blackwell, Oxford ; Malden, Mass.

Mariotti, M., 2012. Labour markets during apartheid in South Africa. The Economic History Review 65, 1100–1122.

Maritz, M.J., Siglé, H.M., 2016. Quantity surveying practice in South Africa. Construction Economics Associates (Pty) Ltd, Lynnwood Ridge, South Africa.

Markard, J., Truffer, B., 2008. Technological innovation systems and the multi-level perspective: Towards an integrated framework. Research Policy 37, 596–615. https://doi.org/10.1016/j.respol.2008.01.004.

Marshall, T.H., 1964. Class, citizenship, and social development: essays by T.H. Marshall. Doubleday, Garden City, N.Y.

Marshall, T.H., 1939. The Recent History of Professionalism in Relation to Social Structure and Social Policy. The Canadian Journal of Economics and Political Science / Revue canadienne d'Economique et de Science politique 5, 325. https://doi.org/10.2307/137036.

Marx, K., Fowkes, B., Marx, K., 1976. Capital: A Critique Of Political Economy. Penguin, Harmondsworth.

Materials, P. in B., Guide, B.T., 2012. Smart Construction Materials - Applications in Civil Engineering [Online] Available from https://theconstructor.org/building/smart-construction-materials-applications/13/ (accessed 03-07-20).

Mathonsi, M.D., Thwala, W.D., 2012. Factors influencing the selection of procurement systems in the South African construction industry. African Journal of Business Management 6 (10), 3 583–3 594.

Matipa, W.M., Cunnigham, P., Naik, B., 2010. Assessing the impact of new rules of cost planning on BIM schema pertinent to quantity surveying practice, in: Proceedings 26th Annual ARCOM Conference. Presented at the 26th Annual Conference, September 6th – 8th, 2010, Association of Researchers in Construction Management, (ARCOM), http://www.arcom.ac.uk/-docs/proceedings/ar2010-0625-0632_Matipa_Cunningham_and_Naik.pdf, Leeds, UK, pp. 625–632.

Matsu, J., 2017. Upping the ante on skills. [Online] Available from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4909789/ (accessed 04-03-2020).

Maxwell, J.A., 2010. Using Numbers in Qualitative Research: Qualitative Inquiry. Qualitative Inquiry 16(6), 475–482. https://doi.org/10.1177/1077800410364740 (accessed 2020-09-16).

McGinty, G.B., Allen, B., 2018. The ACR Data Science Institute and AI Advisory Group: Harnessing the Power of Artificial Intelligence to Improve Patient Care. Journal of the American College of Radiology 15, 577–579. https://doi.org/10.1016/j.jacr.2017.12.024.

McGraw Hill Construction. 2014. The business value of BIM in Australia and New Zealand: how building information modelling is transforming the design and construction industry. [Online] Available from https://www.bimmepaus.com.au/initiative/wp-content/uploads/sites/4/2016/06/mcgraw-hill-construction-the-business-value-of-bim-in-australia-and-new-zealand-201403.pdf (accessed 05-10-2020).

McKinlay, A., Pezet, E., 2018. Foucault, governmentality, strategy: From the ear of the sovereign to the multitude. Critical Perspectives on Accounting, Making strategy critical? Part I: Micro and philosophical perspectives 53, 57–68. https://doi.org/10.1016/j.cpa.2017.03.005.

McMillan, S.S, King, M., Tully, P., 2016. How to use the nominal group and Delphi technique. [Online] Available from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4909789/ (accessed 01-05-2018).

McNamara, C. Not dated. General guidelines for conducting interviews. [Online] Available from https://managementhelp.org/businessresearch/interviews.htm (accessed 2020-08-06-2020).

Meere, M. 2019. 2020 Trends for Building and Construction in Australia. [Online] Available from https://collegeforadultlearning.edu.au/2020-trends-for-building-and-construction-in-australia/ (accessed 04-18-2020).

Mento, A.J., Jones, R.M., Dirndorfer, W., 2002 .A Change Management Process: Grounded in Both Theory and Practice. Journal of Change Management 3 (1), 45–59.

Merriam, S.B., 2009. Qualitative research: a guide to design and implementation, The Jossey-Bass higher and adult education series. Jossey-Bass, San Francisco.

Mfongeh, N.G., 2010. The constraints of using design and build for the procurement of construction projects in South Africa (Unpublished masters dissertation). University of the Witwatersrand, Johannesburg.

Millerson, G. 1964. Dilemmas of Professionalism, New Society.

Mitchell, D., 2012. 5D BIM: Creating Cost Certainty and Better Buildings. [Online] Available from https://www.irbnet.de/daten/iconda/CIB_DC27547.pdf (accessed 11-13-2020).

Mo, J.K.W. 2004. Meeting the challenges of change for building professionals of Hong Kong. Paper presented at International Symposium on Globalisation and Construction, AIT Conference Centre, Bangkok, Thailand, 17–19 November 2004.

Mohamad, N., Abdul Rahman, H., M. Usman, I., M. Tawil, N., 2015. Ethics Education and Training for Construction Professionals in Malaysia. Asian Social Science 11(4), 55–64. https://doi.org/10.5539/ass.v11n4p55.

Mohr, L.B., 1982. Explaining Organizational Behavior. Jossey-bass, San Francisco.

Mokyr, J., 1990. The lever of riches: technological creativity and economic progress. Oxford University Press, New York.

Montgomery, M.L.T., Shepard, B., Mokgolodi, H., Qian, M., Tang, M., 2018. Professionalization of Counseling: Perspectives from Different International Regions. International Journal for the Advancement of Counselling 40, 343–364.

Morello, A., Issa, R.R.A., Franz, B., 2018. Exploratory Study of Recruitment and Retention of Women in the Construction Industry. Journal of Professional Issues in Engineering Education and Practice 144, 04018001. https://doi.org/10.1061/(ASCE)EI.1943-5541.0000359.

Mostafa, A.S., 2016. Developing the Construction Procurement Methods in the UAE to Implement Building Information Modelling (BIM) (Unpublished masters dissertation). The British University in Dubai, Dubai.

Mouton, J., 2001. How to succeed in your master's and doctoral studies: a South African guide and resource book. Van Schaik, Pretoria.

Mudi, A., 2016. Quantity Surveyor's Role in Public-Private Partnership Highway Concession. International Journal of Engineering Research 5 (2), 407–417.

Nair K. and Sarin R.K. 1979. Generating Future Scenarios – Their Use, in Strategic Planning Long Range Planning, June, Vol.12.

Nasir, M.N.M., 2014. The services required by the Malaysian construction industry from quantity surveyors and their implications to quantity surveying graduates (Unpublished masters thesis). Universiti Tunku Abdul Rahman, Petaling Jaya.

National Science Foundation. 2002. The 2002 user-friendly handbook for project evaluation. [Online] Available from http://www.nsf.gov/pubs/2002/nsf02057/nsf02057_4pdf (accessed 10-19-2015).

National Treasury. 2012. Standard for an Infrastructure Delivery Management System. Pretoria, Government Printers.

National Treasury Public Private Partnerships Unit. 2004. Standardised public-private partnerships provisions. [Online] Available from http://www.ppp.gov.za/Legal%20Aspects/Standardised%20PPP%20Provinsions/National%20Treasury%20PPP%20Practice%20Note%20No%201%20of%202004;%20Standardised%20PPP%20Provisions;%20First%20Issue;%2011%20March%202004_1.pdf (accessed 10-17-2020).

NBS National BIM Report 2011.[Online] Available from https://www.thenbs.com/knowledge/nbs-national-bim-report-2011 (accessed 12.30.19).

Nelson Mandela University. 2018a. BSc construction economics: quantity surveying with financial and business management. [Online] Available from https://qs.mandela.ac.za/Qualifications-Offered/BSc-Construction-Economics-Quantity-Surveying-Wit (accessed 03-11-2020).

Nelson Mandela University. 2018b. BSc construction economics: quantity surveying with financial and business management. [Online] Available from https://qs.mandela.ac.za/Qualifications-Offered/BSc-Honours-(-Quantity-Surveying-) (accessed 03-11-2020).

Neuman, W.L., 2014. Social research methods: qualitative and quantitative approaches, Seventh edition. ed. Pearson, Harlow, Essex.

New Zealand, Office of the Auditor-General, 2011. Managing the implications of public private partnerships. Office of the Auditor-General, Wellington [N.Z].

Nigam, M., Dixit, A., 2016. BIM vs Traditional Quantity Surveying And Its Future Mapping. International Journal of Engineering Development and Research 4 (2), 1 261–1 265.

Nigerian Institute of Quantity Surveyors. n.d. Who we are. [Online] Available from https://niqs.org.ng/newniqs/about-us/ (accessed 05-03-2020).

Nkado, R.N., 2000. Competencies of Professional Quantity Surveyors in a Developing Economy. [Online] Available from https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.199.1152&rep=rep1&type=pdf (accessed 11-13-2020).

Ng, K. 2017. Quantity surveyor denies defrauding Hong Kong government with fake quotes. [Online] Available from https://www.scmp.com/news/hong-kong/law-crime/article/2097167/quantity-surveyor-denies-defrauding-hong-kong-government [Accessed 2020-05-18].

Noordegraaf, M., 2015. Public Management: Performance, Professionalism and Politics. Macmillan International Higher Education, London.

Noordegraaf, M., 2007. From "Pure" to "Hybrid" Professionalism: Present-Day Professionalism in Ambiguous Public Domains. Administration & Society 39, 761–785. https://doi.org/10.1177/0095399707304434.

Nordin, R.M., Takim, R., Nawawi, A.H., 2013. Behavioural Factors of Corruption in the Construction Industry. Procedia – Social and Behavioral Sciences 105, 64–74. https://doi.org/10.1016/j.sbspro.2013.11.008

Odubiyi, T.B., Oke, A.E., 2016. Strengths, weaknesses, opportunities and threats of virtual team in Nigerian construction industry. Organization, Technology and Management in Construction: an International Journal 8, 1422–1428. https://doi.org/10.1515/otmcj-2016-0003.

O'Dwyer, L.M., Bernauer, J.A., 2013. Quantitative research for the qualitative researcher. SAGE Publications, Inc, Thousand Oaks.

Oesterreich, T.D., Teuteberg, F., 2016. Understanding the implications of digitisation and automation in the context of Industry 4.0: A triangulation approach and elements of a research agenda for the construction industry. Computers in Industry 83, 121–139.

Office of the Auditor General, New Zealand. 2011. Managing the implications of public private partnerships, digital image. [Online] Available from https://oag.parliament.nz/2011/public-private-partnerships/docs/public-private-partnerships.pdf (accessed 05-19-2020).

Ofori, G., Toor, S.-R., 2009. Role of Leadership in Transforming the Profession of Quantity Surveying. Construction Economics and Building 9, 37–44. https://doi.org/10.5130/AJCEB.v9i1.3013.

Oke, A., Aigbavboa, C., Mabena, S., 2017. Effects of Automation on Construction Industry Performance. Presented at the Second International Conference on Mechanics, Materials and Structural Engineering (ICMMSE 2017), Atlantis Press, pp. 370–374. https://doi.org/10.2991/icmmse-17.2017.61.

Oke, A., Aigbavboa, C., Omole, O., 2019. Drivers to the Adoption of Automation and Robotics in the Construction Industry. Paper presented at the International Conference on Industrial Engineering and Operations Management, 23–25 October 2019, Toronto, Canada.

Oke, A.E., Aje, I.O., Ibironke, T.O., 2017. Impact of globalisation on quantity surveying profession in Nigeria. Paper presented at a 2-Day Seminar and Workshop organised by Quantity Surveyors Registration Board of Nigeria (QSRBN) in collaboration with the Nigerian Institute of Quantity Surveyors (NIQS) with the theme "Quantity Surveying Profession: Unbundling Latent Competencies and Developing New Frontiers", 26–27th September 2013, Abuja. https://doi.org/10.13140/RG.2.2.21696.74245.

Okonjo-Iweala, D.N., 2014. Unleashing the Housing Sector in Nigeria and in Africa. Paper presented at 6th Global Housing Finance Conference, World Bank Headquarters, Washington DC, USA, 28th May, 2014.

Olanrewaju, A., 2016. Measuring the service gaps in the roles of quantity surveyors in the emerging market. Benchmarking: An International Journal 23, 1 111–1 131. https://doi.org/10.1108/BIJ-07-2014-0066.

Olanrewaju, A., n.d. The Nigerian Quantity Surveyors in an Emerging Market. [Online] Available from https://www.irbnet.de/daten/iconda/CIB_DC27710.pdf (accessed 11-13-2020).

Olanrewaju, I.O., Idiake, J.E., Oyewobi, L.O., Akanmu, P.W., 2018. Global economic recession: causes and effects on Nigeria building construction industry. Journal of Surveying, Construction and Property 9, 9–18. https://doi.org/10.22452/jscp.vol9no1.2.

Olanrewaju, O., 2013. The Emerging Development in Nigeria's Construction Industry: The Place of a Quantity surveyor. [Online] Available from https://doi.org/10.13140/RG.2.2.15570.81603 (accessed 11-13-2020).

Olatunji, O.A., Sher, W., Gu, N., 2010. Building information modeling and quantity surveying practice. Emirates Journal for Engineering Research 15, 67–70.

Olusola Babatunde, S., Opawole, A., Emmanuel Akinsiku, O., 2012. Critical success factors in public-private partnership (PPP) on infrastructure delivery in Nigeria. Journal of Facilities Management 10, 212–225. https://doi.org/10.1108/14725961211246018.

Onashile, Obafemi. 2018. There's urgent need for Construction Industry Development Board – Onashile. [Online] Available from https://www.independent.ng/theres-urgent-need-for-construction-industry-development-board-onashile/ (accessed 10-11-2020).

OpenStax College, 2015. An Introduction to Sociology [Online] Available from https://openstax.org/details/books/introduction-sociology-2e (accessed 10-17-20).

Oshungade, O., Kruger, D., 2015. A comparative study on the procurement methods used in the construction industry of South Africa. Paper presented at 3rd IPMA Research Conference, 25-26 November 2015, Stellenbosch**.** https://doi.org/10.13140/RG.2.1.3756.9520.

Oxford Learner's Dictionaries. n. d. Knowledge: noun. [Online] Available from https://www.oxfordlearnersdictionaries.com/definition/english/knowledge?q=knowledge (accessed 03-11-2020).

Owusu, E.K., Chan, A.P.C., Ameyaw, E.E., Robert, O.-K., 2020b. Evaluating the Effectiveness of Strategies for Extirpating Corrupt Practices in Infrastructure Project Procurement. Journal of Infrastructure Systems 26 (2), 1–14. https://doi.org/10.1061/(ASCE)IS.1943-555X.0000531.

Owusu, E.K., Chan, A.P.C., Shan, M., 2019. Causal Factors of Corruption in Construction Project Management: An Overview. Sci Eng Ethics 25, 1–31. https://doi.org/10.1007/s11948-017-0002-4.

Oyedele, O., 2016. Evaluation of the problems of Nigerian construction industry.[Online] Available from https://www.researchgate.net/publication/295854709_Evaluation_of_the_problems_of_Nigerian_construction_industry (accessed 13-11-2020).

Öztürk, Ş., Jarbandhan, D.B., 2020. Institutional handicaps of Black economic empowerment and its reconceptualisation: the case of South Africa. International Journal of Economics, Politics, Humanities & Social Sciences 3 (1), 1–23.

Pacinelli, A. 2009a. The futures polygon. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

Pacinelli, A. 2009b. Statistical modelling: from time series to simulation. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

Pan, M., Linner, T., Pan, W., Cheng, H., Bock, T., 2020. Structuring the context for construction robot development through integrated scenario approach. Automation in Construction 114, 103174. https://doi.org/10.1016/j.autcon.2020.103174.

Parsons, T. 1939. The Professions and Social Structure, Social Forces, 17: 4, 457–67.

Parsons, T. 1951. The Social System . Free Press, New York.

Parsons, T. 1964. Essays in Sociological Theory. Free Press, New York.

Parsons, T. 1968. The Structure of Social Action, 2 vols., paperback edn. Free Press, New York.

Patton, M.Q. 2002. Qualitative research and evaluation methods. Sage, Thousand Oaks.

Pasquire, C., Sarhan, S., King, A., 2015. A critical review of the safeguarding problem in construction procurement: unpicking the coherent current model. Paper presented at 23rd Annual Conference of the International Group for Lean Construction, 29–31 July 2015, Perth, Australia. https://doi.org/10.13140/RG.2.1.1461.2328.

Patterson, R., 2009. Using NEC contracts to manage risk and avoid disputes. Proceedings of the Institution of Civil Engineers – Management, Procurement and Law 162, 157–167. https://doi.org/10.1680/mpal.2009.162.4.157.

Pattinson, H.M., Sood, S.C., 2010. Marketers expressing the future: Scenario planning for marketing action. Futures, Learning the Future Faster 42, 417–426. https://doi.org/10.1016/j.futures.2009.11.026.

Pekkola, E., Carvalho, T., Siekkinen, T., & Johansson, J.-E. (2018). The sociology of professions and the study of the academic profession. In E. Pekkola, J. Kivistö, V. Kohtamäki, Y. Cai, & A. Lyytinen (Eds.), Theoretical and Methodological Perspectives on Higher Education Management and Transformation : An advanced reader for PhD students (pp. 121–150). Tampere, Finland: Tampere University Press. http://tampub.uta.fi/handle/10024/104274.

Petersen, J.L., Steinmüller K. and Adeyema, H. 2009. Wild cards. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition. Washington D.C.

Perera, K., Hemajith, S., 2007. Quantity Surveyor as the Technical Appraiser in the Sri Lankan Financial Industry.Paper presented at Built Environment Education Annual Conference (BEECON 2007), 12–13 Sep 2007, University of Westminster, London.

Pettigrew, A.M., 1997. What is a processual analysis? Scandinavian Journal of Management, Reflections on Conducting Processual Research on Management and Organizations 13, 337–348. https://doi.org/10.1016/S0956-5221(97)00020-1.

Plecher, H. 2020. Urbanization in Nigeria. [Online] Available from https://www.statista.com/statistics/455904/urbanization-in-nigeria/ (accessed 11-05-2020).

Porter, A.L. 2009. Text mining. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

PR Newswire. 2019. Quantity surveying in South Africa 2019. [Online] Available from https://www.prnewswire.com/news-releases/quantity-surveying-in-south-africa-2019-300846465.html#:~:text=The%20quantity%20surveying%20sector%20in,candidate%20quantity%20surveyors%20in%202018. (accessed 06- 04-2020).

Prinsloo, H., Andersen, B., 2015. Is there still a need for the Tariff of Professional fees for the Quantity Surveying Profession in South Africa?, in: Proceedings of the 2015 (6th) International Conference on Engineering, Project, and Production Management. Presented at the International Conference on Engineering, Project, and Production Management, Association of Engineering, Project, and Production Management, pp. 344–353. https://doi.org/10.32738/CEPPM.201509.0034.

Prokesch, S.E., 1997. Unleashing the Power of Learning. An Interview with British Petroleum's John Browne. Harvard Business Review 75, 146–68.

Mildred Golden Pryor, M.G, Humphreys, J.H., Taneja, S, Toombs, L.A., 2011. Where Are the New Organization Theories? Evolution, Development and Theoretical Debate. International Journal of Management 28 (3), 959–578.

Pryor, M.G., Taneja, S., Humphreys, J., Anderson, D., Singleton, L., 2008. Challenges facig change management theories and research. Delhi Business Review X 9 (1), 1–20.

Ptasznik, A., 2019. The 5 Biggest Trends That Will Shape Australian Construction in 2020 [Online]Available from https://blog.plantminer.com.au/the-5-biggest-trends-that-will-shape-australian-construction-in-2020 (accessed 4.18.20).

Rahim, F.A., Abd-Rahman, H., Wang, C., Othman, N.D., Zainon, N., 2013. Quantity Surveying Firms Survival of Fast Developing Economy. Journal of Surveying, Construction and Property 4, 1–18. https://doi.org/10.22452/jscp.vol4no1.3.

Rahimian, F.P., Goulding, J., Akintoye, A., Kolo, S., 2017. Review of Motivations, Success Factors, and Barriers to the Adoption of Offsite Manufacturing in Nigeria. Procedia Engineering 196, 512–519. https://doi.org/10.1016/j.proeng.2017.07.232.

Rahmani, F., n.d. Importance of Quantity Surveyors for public sector organisations in the prevaling recession. [Online] Available from https://www.academia.edu/466357/Importance_of_Quantity_Surveyors_for_public_sector_organisations_in_the_prevaling_recession (accessed 13-11-2020).

Ramburuth, S. 2013. Construction companies fined R1.46bn for collusion. Engineering News. [Online] Available from http://www.engineeringnews.co.za/article/construction-majors-fined-r146bn-for-collusion-2013-06-24 (accessed 01-01-2018).

Ramdav, T., Harinarain, N., 2020. A strategic framework for the survival of the quantity surveying profession. Journal of Engineering, Design and Technology. https://doi.org/10.1108/JEDT-03-2019-0058.

Ramus, T., Vaccaro, A., Brusoni, S., 2017. Institutional Complexity in Turbulent Times: Formalization, Collaboration, and the Emergence of Blended Logics. Academic of Management Journal 60, 1253–1284. https://doi.org/10.5465/amj.2015.0394.

Randall, A., 1991. Before the Luddites: Custom, Community and Machinery in the English Woollen Industry, 1 776–1 809. Cambridge University Press, Cambridge England; New York.

Rashid, R.A., Mustapa, M., Wahid, S.N.A., 2006. Bills of quantities - are they still useful and relevant today? [Online] Available from https://www.academia.edu/1160076/BILLS_OF_QUANTITIES_ARE_THEY_STILL_USEFUL_AND_RELEVANT_TODAY?auto=download (accessed 13-11-2020).

Rasmeni, C and Crafford, G.J. 2016. Managing unethical conduct in the quantity surveying profession. Paper presented at the 9th Annual Quantity Surveying Conference, Port Elizabeth, 19–21 October 2016.

Ratcliff, D. 2004. 15 methods of data analysis in qualitative research. [Online] Available from http://psychsoma.co.za/files/15methods.pdf (accessed 09-28-2020).

Rausch, E. and Catanzaro, F. 2009. Simulation and games. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

Reed, C. 2018. Professionalizing corporate professions: Professionalization as identity project. Management Learning , 1–17.

Reiff, R., 1974. The Control of Knowledge: The Power of the Helping Professions. The Journal of Applied Behavioral Science 10, 451–461. https://doi.org/10.1177/002188637401000316.

Reissman, C K. 2005. Narrative analysis. in: narrative, memory & everyday life. University of Huddersfield, Huddersfield.

Reos Institute. 2013. Dinokeng scenarios: Collectively constructing a sustainable future for South Africa. Reospartners.com. [Online] Available from http://reospartners.com/wp-content/uploads/old/131022%20Scenarios%20Case%20Study%20-%20Dinokeng.pdf (accessed 11-04-2020).

Rhodes, C., 2019. The construction industry: statistics and policy.Briefing Paper 01432. House of Commons Library, London.

Richards, P., Bowen, P., Root, D., Akintoye, A., 2005. Clients strategic objectives: the impact of choice of construction contract on project delivery. Construction Law Journal 7 (21), 1–25.

Rip, A., R. Kemp . 1998. Technological change, in S. Rayner and E.L. Malone (eds.) Human Choice and Climate Change 2, 327–399, Columbus, OH: Battelle Press.

Ritchey, T. 2009. Morphological analysis. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

Roberts, J., Coutts, J., 1992. Feminization and Professionalization – a Review of an Emerging Literature on the Development of Accounting in the United-Kingdom. Accounting Organizations and Society 17, 379–395.

Roderick, Y., McEwan, D., Wheatley, C., Alonso, C., 2009. Comparison of energy performance assessment between leed, bream and green star. Paper presented at Eleventh International IBPSA Conference, 27-30, July, 2009, Glasgow, Scotland.

Root, D.S., 2001. The influence of professional and occupational cultures on project relationships mediated through standard forms and conditions of contract (Unpublished PhD thesis). Bath University, Bath, UK.

Roser, C. 2015. Industry 4.0, digital image. Allaboutbean.com. [Online] Available from https://www.allaboutlean.com/industry-4-0/industry-4-0-2/ (accessed 10-25-2018).

Rossouw, A. 2016. Executive Summary. SA construction 4th edition, November 2016, 3 [Online] Available from https://www.pwc.co.za/en/publications/sa-construction.html (accessed 11-01-2020).

Royal Institution of Surveyors Malaysia. 2019. Constitution. Royal Institution of Surveyors Malaysia: Kuala Lumpur [Online] Available from https://rism.org.my/the-constitution-and-byelaws/ (accessed 05-03-2020).

Royal Institution of Surveyors Malaysia. n. d. Introduction. [Online] Available from https://rism.org.my/quantity-surveying-division-qs/ (accessed 05-03-2020).

Rudestam, K.E., Newton, R.R., 2015. Surviving your dissertation: a comprehensive guide to content and process, Fourth edition. ed. Sage Publication, Thousand Oaks, California.

Rudestam, K.E., Newton, R.R., 2007. Surviving your dissertation: a comprehensive guide to content and process, 3rd ed. ed. SAGE Publications, Los Angeles.

Rycroft, A. 2009. Workplace bullying: unfair discrimination, dignity violation, or unfair labour practice? Proceedings of the 22nd Annual Labour Law Conference. 12–14 Augusts 2009. LexisNexis.

Safe Work Australia. Not dated. Construction. [Online] Available from https://www.safeworkaustralia.gov.au/construction (accessed 05-11-2020).

Saka, A. B., Chan, D.W.M., 2020a. Knowledge, skills and functionalities requirements for quantity surveyors in building information modelling (BIM) work environment: an international Delphi study. Architectural Engineering and Design Management 16, 227–246. https://doi.org/10.1080/17452007.2019.1651247

Saka, A.B., Chan, D.W.M. and Siu, F.M.F. 2019. Adoption of building information modelling in small and medium-sized enterprises in developing countries: a system dynamics approach. Paper presented at CIB World Building Congress 2019 Hong Kong SAR, China, 17–21 June 2019.

Saks, M., 2016. A review of theories of professions, organizations and society: The case for neo-Weberianism, neo-institutionalism and eclecticism. Journal of Professions & Organization 3 (2), 1–8.

Salleh, M.F., Khuzzan, S.M.S., Hashim, K.S.H.-Y., 2014. Bridging the competecies gap between quantity surveyors and facilities managers. [Online] Available from https://www.researchgate.net/publication/286934097_BRIDGING_THE_COMPETENCIES_GAP_BETWEEN_QUANTITY_SURVEYORS_AND_FACILITIES_MANAGERS (accessed 11-13-2020).

Sandrey, R., Fundira, T., Vink, N., Jensen, H.G., Viljoen, W., Nyhodo, B., 2013. BRICS: South Africa's way ahead? – NAMC | National Agricultural Marketing Council. RSAM Printers, Kuils River.

Sanusi, Z.M., Omar, N., Aziz, R.A., Islam, M.S., 2011. (18) Fraud and financial performance of construction and engineering firms. Paper presented at the 2011 IEEE Colloquium on Humanities, Science and Engineering Research (CHUSER 2011), 5–6 December 2011, Penang.

Saunders, M., Lewis, P., Thornhill, A., 2009. Research methods for business students, 5th ed. FT/Prentice Hall, Harlow, England ; New York.

Saunders, M.N.K., Lewis, P., Thornhill, A., 2016. Research methods for business students, Seventh edition. ed. Pearson Education Limited, Harlow, Essex, England.

Schein, E.H., 1980. Organizational Psychology, 3rd Ed., Englewood Cliffs, Prentice-Hall, New Jersey.

Schoemaker, P., 1991. When and How to Use Scenario Planning: A Heuristic Approach with Illustration. Journal of Forecasting 10, 549–564. https://doi.org/10.1002/for.3980100602.

Schutt, R.K., 2001. Investigating the social world: the process and practice of research, 3rd ed. ed, The Pine Forge Press series in research methods and statistics. Pine Forge Press, Thousand Oaks, Calif.

Schwab, K., 2017. The Fourth Industrial Revolution. Currency, New York.

Schweber, L., 2013. The effect of BREEAM on clients and construction professionals. Building Research and Information 41. https://doi.org/10.1080/09613218.2013.768495.

SCITC (2016), "Report on the inquiry into the role of smart ICT in the design and planning of infrastructure", Standing Committee on Infrastructure, Transport and Cities, ACT, Canberra.

Scott, J.C., 1998. Seeing like a state: how certain schemes to improve the human condition have failed, Yale agrarian studies. Yale University Press, New Haven.

Seeley, I.H., 1997. Quantity surveying practice. Macmillan, Houndmills, Basingstoke, England.

Seyler, N.J., 2020. Megatrends and Sustainability, in: Seyler, N.J. (Ed.), Sustainability and the Occupant: The Effects of Mindfulness and Environmental Attitudes on Real Estate User Behaviors, Essays in Real Estate Research. Springer Fachmedien, Wiesbaden, pp. 5–23. https://doi.org/10.1007/978-3-658-27390-3_2.

Shafique, M., Rafiq, M., 2019. An Overview of Construction Occupational Accidents in Hong Kong: A Recent Trend and Future Perspectives. Applied Sciences 9, 2069. https://doi.org/10.3390/app9102069.

Shahbaz, M., Loganathan, N., Sbia, R., Afza, T., 2015. The effect of urbanization, affluence and trade openness on energy consumption: A time series analysis in Malaysia. Renewable and Sustainable Energy Reviews 47, 683–693. https://doi.org/10.1016/j.rser.2015.03.044.

Shari, Z., Soebarto, V., 2014. Investigating sustainable practices in the Malaysian office building developments. Construction Innovation, 14, 17–35.

Shazali, M., Kalsum, U., Karim, A., Bari, S., n.d. Metamorphosis of QS profession: a revolutionary journey in Malaysia. [Online] Available from https://www.paqs.net/sites/default/files/149%20-%20m%20sulaiman_0.pdf (accessed 11-13-2020)

Shields, J., 1999 .Transforming Organizations, Methods for Accelerating Culture Change Processes., Information Knowledge Systems Management 1 (2), 105–115.

Skosana, N., Amisi, M., Maseko, Z., Lukwago-Mugerwa, P., 2016. When a stipend puts food on the table. [Online] Available from

https://evaluations.dpme.gov.za/images/gallery/EPWP%20Policy%20Brief.pdf (accessed 12-07-2018).

Smith, A., 2007. Translating Sustainabilities between Green Niches and Socio-technical Regimes. Technology Analysis and Strategic Management 19, 427–450.

Smith, A., Stirling, A., Berkhout, F., 2005. The governance of sustainable socio-technical transitions. Research Policy 34, 1491–1510. https://doi.org/10.1016/j.respol.2005.07.005.

Smith, A., Voß, J.-P., Grin, J., 2010. Innovation studies and sustainability transitions: The allure of the multi-level perspective and its challenges. Research Policy 39, 435–448. https://doi.org/10.1016/j.respol.2010.01.023.

Smith, P., 2014. BIM & the 5D Project Cost Manager. Procedia - Social and Behavioral Sciences, Selected papers from the 27th IPMA (International Project Management Association), World Congress, Dubrovnik, Croatia, 2013 119, 475–484. https://doi.org/10.1016/j.sbspro.2014.03.053.

Smith, P. 2002. The utilisation of information technology by the Australian quantity surveying profession. Construction Economics Unit, University of Technology, Sydney Australia.

Smith, P.V., 2004. Trends in the Australian Quantity Surveying Profession 1995–2003. International Roundup: The electronic journal of the International Cost Engineering Council 19 (1), 1–15.

Sofaer, S. 1999. ‘‘Qualitative Methods: What Are They and Why Use Them?’’ Health Services Research 34 (5, part 2): 1 101–1 118.

South African Council for the Quantity Surveying Profession. 2015a. 2015 guideline tariff of professional fees schedule: guideline tariff of professional fees in respect of services rendered by persons registered in terms of the quantity surveying profession Act 2000 (Act No. 49 of 2000). [Online] Available from http://www.sacqsp.org.za/?page=tariff_of_fees (accessed 03-13-2020).

South African Council for the Quantity Surveying Profession. 2015b. 2013 registration policy and guide to the apc: revised 30th March 2015. [Online] Available from https://cdn.ymaws.com/www.sacqsp.org.za/resource/collection/AB1D407C-C34F-44F0-9031-3C8D009A1070/Registration_Policy_-_Revised_30_March_2015.pdf (accessed 03-13-2020).

South African Council for the Quantity Surveying Profession. 2011. Identification of work: guideline tariff of professional fees in respect of services rendered by persons registered in terms of the quantity surveying profession Act 2000 (Act No. 49 of 2000). [Online] Available from http://www.cbe.org.za/content/images/SACQSP_IDOW_Policy.pdf. (accessed 04-17-2020).

South African Council for the Quantity Surveying Profession. n.d. Accredited tertiary institutions. [Online] Available from https://www.sacqsp.org.za/page/accreditation (accessed 03-10-2020).

South African Facilities Management Association. Not dated. Online] Available from https://safma.org.za/About (accessed 06-04-2020).

South African National Treasury Public Private Partnerships Unit. 2015. PPP projects signed in terms of Treasury Regulation 16, as at February 2013. [Online] Available from http://www.ppp.gov.za/Documents/Signed%20PPP%Project%20List%202013.pdf (accessed 12-28-2017).

South African National Treasury Public Private Partnerships Unit. 2004. Public private partnership manual: National Treasury ppp practice notes issued in terms of the Public Finance Management Act. Pretoria: National Treasury Public Private Partnerships Unit [CD].

South African Receiver of Revenue. 2020. Carbon tax. [Online] Available from https://www.sars.gov.za/ClientSegments/Customs-Excise/Excise/Environmental-Levy-Products/Pages/Carbon-Tax.aspx#:~:text=The%20first%20phase%20has%20a,and%20annually%20by%20inflation%20thereafter. (accessed 06-04-2020).

Statistics South Africa. 2019. Economy dodges recession as GDP climbs 3,1%. [Online] Available from http://www.statssa.gov.za/?p=12471 (accessed 12-12-2020).

Statistics South Africa. 2018a. Statistical Release P0211: Quarterly Labour Force Survey – Quarter 3:2018. Pretoria: Statistics South Africa.

Statistics South Africa. 2018b If South Africa's Provinces were Independent States. [Online] Available from http://www.statssa.gov.za/?p=11092 (accessed 04-02-2019).

Statistics South Africa. 2018c. Statistical Release P0302:Mid-Year Population Estimates. [Online] Available from https://www.statssa.gov.za/publications/P0302/P03022018.pdf. (accessed 04-02-2019).

Statista, 2020. United Kingdom – Urbanization 2019 [Online]. Available from https://www.statista.com/statistics/270369/urbanization-in-the-united-kingdom/ (accessed 10-24-20).

Strategos. n.d. What is a socio-technical system, digital image. Strategos, consultants, engineers, strategists. [Online] Available from http://www.strategos-m.com/socio-technical.htm (accessed 12-28-2017).

Struková, Z., Líška, M., 2013. Application of automation and robotics in construction work execution..Journal of Interdisciplinary Research 2 (2), 121–125.

Suchman, M.C., 1995. Managing Legitimacy: Strategic and Institutional Approaches. The Academy of Management Review 20, 571.

Suddaby, R., Muzio, D., 2015. Theoretical Perspectives on the Professions. The Oxford Handbook of Professional Service Firms. [Online] Available from https://doi.org/10.1093/oxfordhb/9780199682393.013.2.

Suresh, S., 2014. Nursing Research and Statistics. Elsevier Health Sciences, India.

Susskind, R.E., Susskind, D., 2017. The future of the professions: how technology will transform the work of human experts. Oxford University Press, Oxford, United Kingdom; New York, NY.

Sutrisna, M., Cooper-Cooke, B., Goulding, J., Ezcan, V., 2019. Investigating the cost of offsite construction housing in Western Australia. International Journal of Housing Markets and Analysis 12, 5–24. https://doi.org/10.1108/IJHMA-05-2018-0029.

Swarr, T.E., Hunkeler, D., Klöpffer, W., Pesonen, H.-L., Ciroth, A., Brent, A.C., Pagan, R., 2011. Environmental life-cycle costing: a code of practice. Int J Life Cycle Assess 16, 389–391. https://doi.org/10.1007/s11367-011-0287-5.

Syam, N., Sharma, A., 2018. Waiting for a sales renaissance in the fourth industrial revolution: Machine learning and artificial intelligence in sales research and practice. Industrial Marketing Management 69, 135–146. https://doi.org/10.1016/j.indmarman.2017.12.019.

Takim, R., Harris, M., Nawawi, A.H., 2013. Building Information Modeling (BIM): A New Paradigm for Quality of Life Within Architectural, Engineering and Construction (AEC) Industry. Procedia – Social and Behavioral Sciences, 101, 23–32. https://doi.org/10.1016/j.sbspro.2013.07.175.

Tang, Y., Wang, G., Li, H., Cao, D., Li, X., 2019. Comparing Project-Based Collaborative Networks for BIM Implementation in Public and Private Sectors: A Longitudinal Study in Hong Kong. Advances in Civil Engineering 2019, 1–14. https://doi.org/10.1155/2019/6213694.

Tansey P, Meng X and Cleland D (2013) A critical review of response strategies adopted by construction companies during an economic recession *In:* Smith, S.D and Ahiaga-Dagbui, D.D (Eds) Procs 29th Annual ARCOM Conference, Reading, UK, 2–4 September 2013, Association of Researchers in Construction Management, 679–689.

Tapinos, E., 2013. Scenario planning at business unit level. Futures 47, 17–27. https://doi.org/10.1016/j.futures.2012.11.009.

Technopedia. n.d. Interoperability. [Online] Available from https://www.techopedia.com/definition/631/interoperability (accessed 05-08-2020).

The Association for Qualitative Research. n.d. Typology. [Online] Available from https://www.aqr.org.uk/glossary/typology (accessed 07-12-2020).

The Association of South African Quantity Surveyors. 2018. Number of practicing quantity surveyors declines. [Online] Available from https://infrastructurenews.co.za/2018/12/10/number-of-practising-quantity-surveyors-declines/ (accessed 06-03-2020).

The Association of South African Quantity Surveyors. 2017. Standard system of measuring building works seventh edition: illustrated and explained. The Association of Souh African Quantity Surveyors, Johannesburg.

The Association of South African Quantity Surveyors. 2008. A century of quantity surveying in South Africa. Chris van Rensburg Publications (Pty) Ltd, Johannesburg.

The Association of South African Quantity Surveyors. 1991. A scenario of the South African quantity surveying firm in the year 2005. 1996 Class Notes.

The Association of South African Quantity Surveyors. n.d. a. A career as a quantity surveyor. [Online] Available from http://www.asaqs.co.za/?page=career_as (accessed 03-10-2020).

The Association of South African Quantity Surveyors. n.d. b . The history of quantity surveying. [Online] Available from https://www.asaqs.co.za/page/history?&hhsearchterms=%22history+and+quantity+and+surveying%22 (accessed 03-10-2020).

The Association of South African Quantity Surveyors. n.d. c. What is a quantity surveyor. [Online] Available from https://www.asaqs.co.za/page/what_is_QS?&hhsearchterms=%22is+and+quantity+and+surveyor%22 (accessed 03-10-2020).

The Futures Group International .2009a. Decision modelling. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

The Futures Group International .2009b. Relevance trees. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

The Green Building Council of South Africa. 2017. Certify. GBCA. [Online] Available from https://gbcsa.org.za/certify/ (accessed 06 -04-2020).

The Hong Kong Institute of Surveyors. 2020a. About us. [Online] Available from https://www.hkis.org.hk/en/hkis_aboutus.html (accessed 05-07-2020).

The Hong Kong Institute of Surveyors. 2020b. Our history. [Online] Available from https://www.hkis.org.hk/en/hkis_history.html (accessed 04-19-2020).

The Hong Kong Institute of Surveyors. 2020c. Introduction. [Online] Available from https://www.hkis.org.hk/en/division_qsd.html?id=101 (accessed 05-06-2020).

The Hong Kong Institute of Surveyors. 2020d. Procurement methods. [Online] Available from https://www.hkis.org.hk/en/division_qsd.html?id=108 (accessed 05-06-2020).

The Hong Kong Institute of Surveyors. 2020e. Valuation of construction work. [Online] Available from https://www.hkis.org.hk/en/division_qsd.html?id=111 (accessed 05-06-2020).

The Hong Kong Institute of Surveyors. 2019. PAQS sustainability committee – information on green building.. [Online] Available from http://paqs.net/sites/default/files/PAQS%20Sustainability%20Committee%20%20%28HKIS%29.pdf (accessed 05-10-2020).

The Hong Kong Institute of Surveyors. 2017. Rules of conduct. [Online] Available from https://www.hkis.org.hk/en/hkis_rules.html (accessed 05-18-2020).

The Hong Kong Institute of Surveyors. 2012. Rules and guide to the assessment of professional competence: quantity surveying division. [Online] Available from https://www.hkis.org.hk/hkis/papers/qsd/APCQS-RuleNGuide.pdf (accessed 05-10-2020).

The Millennium Project. 2009a. History. [Online] Available from https://www.107.22.164.43/millennium/overview.html (accessed 03-19-2018).

The Millennium Project. 2009b. Global challenges for humanity. [Online] Available from https://www.millennium-project.org/projects/challenges/ (accessed 2018-03-19-2018).

The National Bureau of Economic Research. 2008. The NBER's Recession Dating Procedure. [Online] Available from https://www.nber.org/cycles/jan2003.html (accessed 02-26-2020).

The Royal Institution of Chartered Surveyors. 2020a. Upholding professional standards. [Online] Available from https://www.rics.org/en-za/upholding-professional-standards/ (accessed 03-08-2020).

The Royal Institution of Chartered Surveyors. 2020b. Rules of conduct for members: version 7 with effect from 2 March 2020. [Online] Available from https://www.rics.org/globalassets/rics-

website/media/upholding-professional-standards/regulation/rules-of-conduct-for-members_2020.pdf (accessed 06-06-2020).

The Royal Institution of Chartered Surveyors. 2020c. About us. [Online] Available from https://www.rics.org/uk/about-rics/?link=bottom-nav (accessed 2020-05-03).

The Royal Institution of Chartered Surveyors. 2020d. Assessment of professional competence. [Online] Available from https://www.rics.org/uk/surveying-profession/join-rics/chartered-member-mrics/assessment-of-professional-competence-apc/ (accessed 2020-12-30).

The Royal Institution of Chartered Surveyors. 2019a. [Online] Available from https://www.rics.org/uk/footer/contact-us/ (accessed 03-10-2020).

The Royal Institution of Chartered Surveyors. 2019b. History. [Online] Available from https://www.rics.org/uk/about-rics/?link=bottom-nav (accessed 03-10-2020)

The Royal Institution of Chartered Surveyors. 2019c. Sustainability. [Online] Available from https://www.rics.org/north-america/news-insight/future-of-surveying/sustainability/(accessed 04-06-2020).

The Royal Institution of Chartered Surveyors. 2019d. Future of the Profession: Consultation Response Report. RICS, London.

The Royal Institution of Chartered Surveyors. 2018. England and Wales: Quantity Surveyor Services 2018 Edition [Online] Available from https://www.rics.org/north-america/search/?search=England+and+Wales%3A++Quantity+Surveyor+Services+2018+Edition

df (accessed 03-10-2020).

The Royal Institution of Chartered Surveyors. 2017. Associate assessment: quantity surveying and construction. [Online] Available from https://www.rics.org/globalassets/rics-website/media/qualify/pathway-guides/qs-and-construction-pathway-guide-associate-rics.pdf (accessed 03-07-2020).

The Royal Institution of Chartered Surveyors. 2008. Quantity Surveyor Services. [Online] Available from https://www.rics.org/globalassets/rics-website/media/upholding-professional-standards/sector-standards/construction/quantity-surveyor-services-rics.pdf (accessed 03-10-2020).

The South African Government, The Presidency. 2011. National development plan. Pretoria: Government Printer.

The Standard. 2017. Ex-quantity surveyor for $3.9m works orders fraud. [Online] Available from https://www.thestandard.com.hk/breaking-news/section/4/98319/Ex-quantity-surveyor-for-$3.9m-works-orders-fraud [accessed 2020-05-18].

The Writing Center, 2012. Make Your Last Words Count [Online] Available from https://writing.wisc.edu/handbook/process/conclusions/ (accessed 10-16-20).

Thornton, P.H., Ocasio, W., 1999. Institutional Logics and the Historical Contingency of Power in Organizations: Executive Succession in the Higher Education Publishing Industry, 1958–1990 1. American Journal of Sociology 105, 801. https://doi.org/10.1086/210361.

Tilling, M., 2004. Some thoughts on legitimacy theory in social and environmental accounting. Social and Environmental Accountability Journal 24, 3–7. https://doi.org/10.1080/0969160X.2004.9651716.

Torrance, J.V.B. 2004. Globalisation and trends in the international construction industry: a Malaysian perspective. Paper presented at International Symposium on Globalisation and Construction, AIT Conference Centre, Bangkok, Thailand, 17–19 November 2004.

Torres, C., Weiner, J., 2018. The New Professionalism? Charter Teachers' Experiences and Qualities of the Teaching Profession. education policy analysis archives 26, 19. https://doi.org/10.14507/epaa.26.3049.

Transparency International. 2005. Global Corruption Report 2005, Cambridge University Press, New York.

Transparency International 2019. What is corruption? [Online] Available from https://www.transparency.org/what-is-corruption (accessed 05-17-2020).

Transparency International . 2020a. Nigeria: country data – corruption perception index [Online] Available from https://www.transparency.org/en/countries/nigeria (accessed 05-17-2020).

Transparency International . 2020b. Corruption perception index [Online] Available from https://www.transparency.org/en/cpi/2019 (accessed 05-17-2020).

Traulsen, J.M., Bissel, P., 2004. (9) Theories of professions and the pharmacist. International Journal of Pharmacy Practice 12, 107–114. https://doi.org/10.1211/0022357023727.

Trist, E. 1981. The evolution of socio-technical systems: a conceptual framework and an action research program. [Online] Available from https://trove.nla.gov.au/work/18802828?q&versionId=210615961 (accessed 05-06-2018).

Umeokafor, N., Evangelinos, K., Windapo, A., 2020. Strategies for improving complex construction health and safety regulatory environments. International Journal of Construction Management 0, 1–12. https://doi.org/10.1080/15623599.2019.1707853.

Umeokafor, N., Isaac, D., Jones, K., Umeadi, B., 2014. Enforcement of occupational safety and health regulations in Nigeria: An exploration. European Scientific Journal 3, 93–104. https://doi.org/10.19044/ESJ.2014.V10N7P%P

Unal, F., Tarhan, S., Koksal, E.C., 2018. Gender and Perception of Profession. Journal of Education and Training Studies, 6 (3a): 35–44.

United Nations, Department of Economic and Social Affairs, Population Division (2019). World Urbanization Prospects: The 2018 Revision (ST/ESA/SER.A/420). New York: United Nations.

United Nations Economic Commission for Europe. 2008. Guidebook on promoting good governance in public private partnerships. Geneva: United Nations.

United States Patent. 1996. Methods and apparatus for automatic fabrication of three-dimensional objects. [Online] Available from https://patentimages.storage.googleapis.com/0b/58/f0/3f55d9be4ea8b0/US5514232.pdf (accessed 07-03-2020).

University of Cape Town. 2020a. Postgraduate Bachelor of Science (Honours) in Quantity Surveying. [Online] Available from www.cons.uct.ac.za/cons/undergrad/surveying_honours (accessed 03-10-2020).

University of Cape Town. 2020b. Undergraduate: bachelor of science in construction studies. [Online] Available from www.cons.uct.ac.za/cons/undergrad/construction_studies (accessed 03-10-2020).

University of Pretoria. 2020a. Programme: BSc Hons Quantity Surveying. [Online] Available from https://www.up.ac.za/yearbooks/2020/programmes/view/12242017 (accessed 03-10-2020).

University of Pretoria. 2020b. Programme: BSc Quantity Surveying. [Online] Available from https://www.up.ac.za/yearbooks/2020/programmes/view/12132023. (accessed 03-10-2020).

USAF. Not dated. Public universities in South Africa. [Online] Available from https://www.usaf.ac.za/public-universities-in-south-africa/ (accessed 10-07-2020).

Vähä, P, Heikkilä, T, Kilpeläinen, P, Järviluoma, M and Gambao, E (2013) Extending automation of building construction - survey on potential sensor technologies and robotic applications, Automation in Construction, 36, 168–178.

Van de Ven A, Huber, G., 1990. Longitudinal field research methods for studying processes of organizational change. Organization Science 1(2), 213–219.

Van de Ven, A., Polley, D., Garud, R, Venkataramans, S., 1999. The Innovation Journey. Oxford University Press, London.

Vee, C., Skitmore, M., 2003. Professional ethics in the construction industry. Engineering Construction and Architectural Management 10, 117–127.

Ven, A.H.V. de, Polley, D., Garud, R., 2008. The Innovation Journey. Oxford University Press.

Venter, B.M., 2009. Skills deficit in the Quantity Surveying Industry in South Africa. University of North West, Potchefstroom.

Von Steiger, A., 2018. Broad-based black economic empowerment – basic principles | South Africa | Global law firm | Norton Rose Fulbright [Online]. Available from https://www.nortonrosefulbright.com/en-za/knowledge/publications/fe87cd48/broad-based-black-economic-empowerment--basic-principles (accessed 11-1-2020).

Walker, D.H., Lloyd-Walker, B., 2012. Understanding early contractor involvement (ECI) procurement forms, in: Smith, S.D (Ed) Procs 28th Annual ARCOM Conference, 3-5 September 2012, Edinburgh, UK.

Walter, M. .2009. Participatory research. [Online] Available on http://www.academia.edu/3563840/Participatory_Action_Research (accessed 01-03-2018).

Walker, S.P., 2016. Revisiting the roles of accounting in society. Accounting, Organizations and Society 49, 41–50.

Wang, J., Zou, P.X., Li, P.P., 2016. Critical factors and paths influencing construction workers' safety risk tolerances. Accident Analysis & Prevention 93, 267–279.

Wao, J., 2016. Predicting the Future of Quantity Surveying Profession in the Construction Industry. Journal of Construction Project Management and Innovation 5, 1 211–1 223.

Wao, J.O., Flood, I., 2016. The role of quantity surveyors in the international construction arena. International Journal of Construction Management 16, 126–137. https://doi.org/10.1080/15623599.2016.1142251.

Warren, N.C., 2005. Date or Soul Mate?: How to Know if Someone is Worth Pursuing in Two Dates or Less, 8.2.2005 edition. ed. Thomas Nelson, Nashville, Tennessee.

Weber, M. 1978. Economy and Society, Volume 1. University of California Press, Berkeley, Los Angeles.

Weber, M., 1968. Economy and Society: An Outline of Interpretive Sociology. Bedminster Press, Bedminster, NJ.

Weber, M. 1947. Bureaucracy. In Max Weber: Essays in Sociology, ed. Hans Heinrich Gerth and Charles Wright Mills. Oxford University Press, New York.

Welcome, S., n.d. Sociology paper -I foundation of sociology 2 1 Sociology as a discipline. [Online] Available from https://www.academia.edu/8025161/SOCIOLOGY_PAPER_I_FOUNDATION_OF_SOCIOLOGY_2_1_SOCIOLOGY_AS_A_DISCIPLINE (accessed 10-22-2020).

Williams, D. n.d. Domains analysis. [Online] Available from https://qualitativeinquirydailylife.wordpress.com/chapter-8/chapter-8-domain-analysis/ (accessed 12-06-2020).

Williams, J.J., 2014. Teaching the Professions. rt 99, 69–75. https://doi.org/10.5195/rt.2014.53.

Winch, G.M., 2000. Institutional reform in British construction: partnering and private finance. Building Research & Information 28(2), 141–155.

Windapo, A., 2013. The South African Construction Industry: Perceptions of Key Challenges Facing Its Performance, Development and Growth. Journal of Construction in Developing Countries 18, 65–79.

Windapo, A.O., 2016. Skilled labour supply in the South African construction industry: The nexus between certification, quality of work output and shortages. SA Journal of Human Resource Management 14, 8. https://doi.org/10.4102/sajhrm.v14i1.750.

Windapo, A.O., 2014. Examination of Green Building Drivers in the South African Construction Industry: Economics versus Ecology. Sustainability 6, 6088–6106. https://doi.org/10.3390/su6096088.

Wolfers, J., Zitzewitz, E., Gordon, T.J., 2009. In Glenn, J.C. and Gordon, T.J. (Eds). Futures research methodology: version 3.0. The Millennium Project 3rd Edition, Washington D.C.

Wong, J., Zhang, J., Lee, J., 2015. A Vision of the Future Construction Industry of Hong Kong. Presented at the 32nd International Symposium on Automation and Robotics in Construction, Oulu, Finland. https://doi.org/10.22260/ISARC2015/0110.

Wong, K.S., 2004. Corruption in Hong Kong construction industry (Unpublished bachelors dissertation). The University of Hong Kong, Hong Kong.

Wong, P. F., Salleh, H., Rahim, F.A., 2014. The relationship of Building Information Modeling (BIM) capability in quantity surveying practice and project performance. International Journal of Civil, Environmental, Structural, Construction and Architectural Engineering 8, 1 031–1 036.

Wong, P F, Salleh, H., Rahim, F.A., 2014. The Relationship of Building Information Modeling (BIM) Capability in Quantity Surveying Practice and Project Performance. International Journal of Civil, Environmental, Structural, Construction and Architectural Engineering 8 (10), 1 039–1 044.

Wood, A., Evans, D.J. 2018. Librarians' Perceptions of Artificial Intelligence and Its Potential Impact on the Profession. Computers in Libraries, 38 (1). http://www.infotoday.com/cilmag/jan18/Wood-Evans--Librarians-Perceptions-of-Artificial-Intelligence.shtml.

World Economic Forum .2016. Shaping the Future of Construction: A Breakthrough in Mindset and Technology. [Online] Available from http://www3.weforum.org/docs/WEF_Shaping_the_Future_of_Construction_full_report__.pdf (accessed 10-20-2020).

Wu, S., Wood, G., Ginige, K., Jong, S.W., 2014. A technical review of BIM based cost estimating in UK quantity surveying practice, standards and tools. Journal of Information Technology in Construction (ITCon) 19, 534–562.

Xia, B., Zuo, J., Skitmore, M., Pullen, S., Chen, Q., 2013. Green Star Points Obtained by Australian Building Projects. J. Archit. Eng. 19, 302–308. https://doi.org/10.1061/(ASCE)AE.1943-5568.0000121.

Yahya, M.Y.B., Lee Hui, Y., Yassin, A.B.Md., Omar, R., Robin, R.O. anak, Kasim, N., 2019. The Challenges of the Implementation of Construction Robotics Technologies in the Construction. MATEC Web Conf. 266, 05012. https://doi.org/10.1051/matecconf/201926605012.

Yale Poorvu Centre for Teaching and Learning. n.d. Classroom seating arrangements. [Online] Available from https://poorvucenter.yale.edu/ClassroomSeatingArrangements (accessed 05-02-2018).

Yap, J.B.H., Lee, K.Y., Rose, T., Skitmore, M., 2020. Corruption in the Malaysian construction industry: investigating effects, causes, and preventive measures. International Journal of Construction Management 0, 1–12. https://doi.org/10.1080/15623599.2020.1728609.

Yin, R.K. 2014. Case study research: design and methods. Sage, Los Angeles.

Yirmibesoglu, G., Dincer, F.C.Y., 2018. Effects of the rise of Britain in international trade: a global power after industrial revolution. Proceedings of ICES 2018 – 1st International Congress on New Horizons in Education and Social Sciences, Istanbul, Turkey, 9–11 April, 2018.

Zaini, A.A., Endut, I.R., 2018. Major challenges in implementing green construction. Journal of Engineering and Applied Sciences, 13, 8 865-8 869.

Zainon, N., Mohd-Rahim, F.A., Salleh, H., 2016. The Rise Of BIM in Malaysia And Its Impact Towards Quantity Surveying Practices. MATEC Web Conf. 66, 00060. https://doi.org/10.1051/matecconf/20166600060.

Zainul Abidin, N., 2010. Investigating the awareness and application of sustainable construction concept by Malaysian developers. Habitat International 34, 421–426.

Zarkada-Fraser, A., Skitmore, M., 2000. Decisions with moral content: collusion: Construction Management and Economics 18, 101–111.

Zhang, Z., Demir, K.G., Gu, G.X., 2019. Developments in 4D-printing: a review on current smart materials, technologies, and applications. International Journal of Smart and Nano Materials 10, 205–224. https://doi.org/10.1080/19475411.2019.1591541.

Zhou, L., Perera, S., Udeaja, C., Paul, C., 2012. Readiness of BIM: a case study of a quantity surveying organisation. Paper presented at the First UK Academic Conference on BIM, 5–9 September 2012, Northumbria University, Newcastle-upon-Tyne, UK.

Zondervan, 2009. True Identity: The Bible for Women (NIV): Becoming Who You Are in Christ. Zondervan, Grand Rapids, Michigan.

Zufiaurre, B., de Villarreal, M.P., 2018. Researching Gender Professions: Nurses as Professionals. Journal of Curriculum and Teaching 7, 197–205.

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