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Governance and Dynamic Capabilities in South African state-owned energy companies

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A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Management in Energy Leadership

Note: This is NOT a thesis (PhD only) and NOT a dissertation (Masters by 100% research only)

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ABSTRACT

Governance of state institutions is widely accepted to be one of the critical levers to unlock clean energy technology innovation that fosters energy transition. The dynamic capabilities framework has been successfully used globally by State Owned Entities to unlock the bureaucratic competencies of senior management towards increasing innovation outcomes, but the framework is not usually associated with entities' governance. This research highlights the criticality of this framework in the governance structures of entities. The prolonged past governance and financial woes at the two South African state-owned energy entities of PetroSA and iGas invite a level of scrutiny regarding the true extent of the deployment of the dynamic capabilities therein This qualitative research sought to explore how the deployment of dynamic capabilities by senior management in the two entities impacted their innovation outcomes. Data collection was done through semi-structured interviews of seven participants. The research findings show that the dynamic capabilities were not holistically deployed by the entities in the six business areas wherein they reside. The DC's framework is the appropriate strategic framework to be deployed by entities and their management if true innovation outcomes are to be increased.

KEY WORDS

State owned entities, governance, innovation outcomes, dynamic capabilities, research and development, South Africa

DECLARATION

I, Xola G Stock, declare that this research proposal is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Management in Energy Leadership at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

Name: Xola Gladman Stock Signature:

Signed at …Centurion……

On the day of 23 June 2022.

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ACRONYMS

CEF - Central Energy Fund State Owned Company Limited
CSIR - Council for Scientific and Industrial Research
DC's - Dynamic Capabilities
DEA - Department of Environmental Affairs
iGas - SA Gas Development Company SOC Ltd
Nersa - National Energy Regulator of SA
NOC - National Oil Company
PFMA - Public Finance Management Act, 1999 (Act of No.1 of 1999)
SA - South Africa
SOC - State Owned Company
SOE's - State Owned Entities (or entity)
UWC - University of Western Cape

1. CHAPTER 1 - INTRODUCTION

1.1. Purpose of the study

This qualitative research sought to explore if dynamic capabilities (DC's) were a critical component of governance that was deployed by senior management to unlock innovation outcomes in a South African state-owned energy company context.

1.2. Context of the study

In its 2014 Synthesis Report, the Integrated Panel on Climate Change noted that the global emissions target of less than 2^{o}C rise in temperature above pre-industrial emissions by 2050 will only be achieved through interventions such as effective institutional governance, innovation and investment in environmentally-friendly technologies and infrastructure (Pachauri et al., 2014). This 2^{o}C target, which would soon be adopted at the Paris Agreement in 2015, was an improvement on earlier emissions reductions targets as first globally agreed to under the 1997 Kyoto (Breidenich, Magraw, Rowley, & Rubin, 1998). The above-mentioned interventions from the 2014 Synthesis Report are echoed in many other reports, such as the World Economic Council Trilemma Index report (Council, 2020), Global Innovation Index reports (Dutta, Lanvin, & Wunsch-Vincent, 2020), and many others. With SOE's (State Owned Entities) making up 27% of global energy companies and more than 50% of global fossil fuel assets (Prag, Röttgers, & Scherrer, 2018), they are significant contributors to the energy transition agenda , and thus their governance for unlocking innovation outcomes is also critical (Forum, 2021). The SOEs' energy-transition contribution is amplified in many developing countries as SOE's continue to have a significant share in the related energy markets (West, 2019). An example is SA (South Africa) where Eskom makes up over 90% of the electricity sector, accounts for circa 40% of SA's total emissions (Burkhardt, 2019) and is under pressure to adopt low-carbon technologies (Ting & Byrne, 2020). This study of the South African energy SOEs is as much about their governance capabilities to increase innovation output through the deployment of DC's, as it is about their seriousness about climate change.

Eskom's coal-plants pollution performance is not surprising as SOEs with large fossil fuel plants are generally reluctant of embracing innovative low-carbon technologies due to fear of cannibalising their own profits (Prag et al., 2018). However, this strategy has not worked as it is in

fairly well publicised financial woes. In 2019 government approved a R23 billion per annum bail out for Eskom over ten years (Terrrence Creamer, 2021) despite a Nersa tariff-increase of more than four times the inflation rate since 2007 (Moolman, 2015). Other examples of prominent SA energy SOE's are PetroSA SOC (State Owned Company) and iGas. By 2018/19, PetroSA SOC had made cumulative losses of R20 billion since 2014, and it has long been projected to run out of gas finds in 2020/21 (Terence Creamer, 2021; West, 2019). iGas on the other hand has not made any significant gas infrastructural investments in decades according to its annual reports. Given the relationship between innovation and organisational performance (Sipos & Ionescu, 2018) and this research's assumption that innovation leads to commercial profits, the poor performance (including financial distress) is attributable to lack of innovation. The other cause of poor performance in South African SOEs generally is the oft-cited governance failures such as: political-patronage Board appointments (Gumede, 2019); board and management turnovers which affect innovation outcomes as they diminish innovation commitment continuity (Leifer, O'connor, & Rice, 2001); and incompetence (Baker, Newell, & Phillips, 2014; Bezuidenhout, Bussin, & Coetzee, 2018; McGregor, 2014; Mustapha, Kruss, & Ralphs, 2018). Some of PetroSA's governance failures include non-appointment of a permanent CEO for five years up to 2020 (Maeko, 2020).

With so many governance failures, this research focuses only on the corporate governance task (or component) that deals with senior management capabilities to unlock innovation outcomes – i.e. the bureaucratic competence task of corporate governance. Governance as defined is all-encompassing and incorporates this corporate governance and the political economy thereof (Asensio-López, Cabeza-García, & González-Álvarez, 2019; Katsamunska, 2016) whilst corporate governance involves the design of independent directors, specialist board sub-committees, increased transparency, centralised or decentralised government ownership structures (Belloc, 2014). Goyer (2001) demonstrated that solely focusing on these tenets of corporate governance design was inadequate for successful innovation in France over the 1985-2000 period – it had to be accompanied by French SOEs unlocking their core competencies, or capabilities (i.e. a capabilities framework). Pereira, Mellahi, Temouri, Patnaik, and Roohanifar (2019) also confirmed, after studying over 4000 emerging economies multinational-firms in Europe that their investment in DC's increased their performance in the period 2005-2016. The DC's framework is but one of many strategic management frameworks, and thus capabilities frameworks, whose core aims are about ensuring the sustenance of organisational competitive advantage (Teece, 2014). The deployment of DC's is however both sparsely researched in SA

and hardly viewed as part of corporate governance, and this study will add to the knowledge about its deployment in SA.

SA's public sector corporate governance is robust on paper and compares favourably to international practices (Enterprises, 2002; Waweru, 2014), and yet innovation is seemingly inadequate given the above-noted results of the three South African energy SOE's. Mustapha et al. (2018), supported by GCIS (2021), note that SA's SOEs' Research and Development (R&D) investment, one of the key inputs into innovation outputs, topped 27.9% of total business R&D in 2008/09 and reduced to half of that immediately thereafter up to 2018, due mainly to Eskom's drastic declining contribution thereto and generally due to inadequate R&D researchers across the SOEs. In that report, no mention is made by Mustapha et al. (2018) of R&D investments by other SA energy SOEs, suggesting that the energy SOEs' innovation outcomes have been disappointing for a decade now, despite their robust corporate governance on paper.

Research attributes many international energy SOEs' successes to the deployment of DC's by their management, including China being the leading global manufacturer and innovator of wind and solar technologies (Baker & Shen, 2017); France's Engie which transformed into one of the biggest privately-owned utility in the world (Bootz, Monti, Durance, Pacini, & Chapuy, 2019); Italy's Enel that is also a global maker of RE technologies (Herrmann, Sangalli, & Teece, 2017) and Malaysia's Petronas' deep sea engineering technology (Nem Singh & Chen, 2018). These successes further support the contemporary public management theory that suggests that SOE's should inherently be more innovative than the private sector because of the societal benefit from government research and development (Belloc, 2014), and that SOE's must engage in riskier innovation investments (after all innovation is a risky undertaking) as they generally have a vast array of government support behind them (Florio, Ferraris, & Vandone, 2018; Prag et al., 2018). In the SA context however, government support may not always be a certainty due to limiting factors such as shareholder/ Ministerial compacts and/or entities' legal mandates. Deployment of DC's in the three South African energy SOE's is thus very relevant, however there is very little research thereof.

1.3. Research problem

There have been many scholarly articles over the years regarding the improvement of corporate governance in South African entities (Kanyane & Sausi, 2015; McGregor, 2014; Mekwe, 2015),

and much of it has been focused on the corporate governance principles of accountability, responsibility, fairness and transparency, and improvements thereto vis-a-vi improved board and senior management performance. This is the traditional corporate governance approach, or what Filatotchev, Aguilera, and Wright (2020) refer to as legacy governance models. South African entities, which include SOE's, compare favourably to such international corporate governance norms and standards including in SOE's (Mekwe, 2015; Waweru, 2014). However, there is very little research into the deployment of DC's, as a component of corporate governance, in South African entities, and more so in SOE's. This is anomalous to international experience and this study will assist towards addressing this problem.

Improving governance capabilities that unlock enterprise innovation (i.e. enhancing bureaucratic competence) is also well-researched, however recommendations therefrom generally tend to be siloed as they offer individualistic recommendations (Belloc, 2012; Filatotchev et al., 2020). Such recommendations have included: improving efficient senior management accountability measures (e.g. career progressions) (Belloc, 2014); keeping management commitment high and aligned to shareholders similarly to the private sector monetary incentives management (i.e. contract management theory) (Belloc, 2014; Danilin, 2015; Nem Singh & Chen, 2018); removing management capture by corrupt politicians (Belloc, 2014); capacitation of SOE's by skilled management (Anadón, 2012; Geddes, Schmidt, & Steffen, 2018; Rothstein & Teorell, 2008), and increased investment input in research and development (R&D) (Filatotchev et al., 2020; Sagar & Holdren, 2002). South African research has tended to follow the aforementioned traditional corporate governance framework or pattern (Mekwe, 2015; Waweru, 2014). The problem is that research does not find definitive consensus on direct link between such "traditional" corporate governance approaches and innovation (Asensio-López et al., 2019; Belloc, 2012). On the other hand, the deployment of DC's has proven more holistic and very successful in unlocking innovation amongst many international energy SOE's, making them the more appropriate governance component (over traditional corporate governance approach) to truly unlock organisational innovation. Despite this, DC's are generally not viewed as part of corporate governance. It is for this reason that DC's are deemed appropriate to scrutinise the prolonged innovative failures by inherently innovative SOE's of Eskom, PetroSA and iGas (e.g. non-adoption of cleaner-technologies).

1.4. Research objectives

The research objectives are:

1. To determine if DC's are a critical component of governance, and identify in which critical business areas they reside in; and
2. To investigate if the organisational deployment of DC's, or lack thereof, impacted innovation outcomes in the two selected South African state-owned entities of PetroSA and iGas.

Research objective 1 is further addressed in sections 2.3 (literature review) and 4.2. (findings and discussions), whilst research objective 2 is similarly addressed in sections 2.4 and 4.4.

1.5. Significance of the study

This research will contribute towards readily connecting DC's as a critical component of corporate governance. It will also add more local findings to the negligible pool of scholarly material on the deployment of DC's in SA'n SOE's, to ensure innovative outcomes. The supply of RE technology by reportedly a mere 5% of local manufacturers in the highly successful Renewable Energy Independent Power Producers Programme's (REIPPP) rounds one and two (Larsen & Hansen, 2020; Walwyn & Brent, 2015) has confirmed SA's electricity market's non-readiness of localised low-carbon technologies. Localised low-carbon technologies accelerates the energy transition through faster adoption of lower-carbon technologies (Ockwell, Ely, Mallett, Johnson, & Watson, 2009; Steffen, Matsuo, Steinemann, & Schmidt, 2018), and SA would do well to increase its SOE's innovation outcomes to facilitate this energy transition (Baker et al., 2014). The study will help policymakers and South African state-Owned Entities' management to better appreciate the applicability of the broader DC's in SOE's to improve innovation outcome and thereby lead to their business sustainability.

1.6. Delimitations of the study

Firm performance is influenced by external factors such as cultural, institutional (e.g. policies), macro-social, macro-economic, technical, macro-political (or political economy) (Anadón, 2012; Wei, Xie, & Zhang, 2017), and many other elements as guided by the Energy Technology Innovation System framework (such as funding, role of academic institutions, advocacy groups, consultancy groups, etc), (Gallagher, Grübler, Kuhl, Nemet, & Wilson, 2012). This research delimits all of these influences. This research also excludes the impact of many corporate

governance measures (like ownership structures, funding, Board of Directors make up and functioning, etc), but rather focuses on the corporate governance role or task of ensuring that the entity is appropriately capacitated for innovation outcomes.

It has been acknowledged by researchers that innovation benefits go beyond Schumpeterian profits, and include other benefits such as cultural improvements, improved management of commercial secrets, (Wei et al., 2017), innovation spill overs or integration with existing innovation (Danilin, 2015). The premise in this research is that the deployment of DC's leads to increase in innovation and consequently an increase in a firm's operational and economic performances (Dreiling & Recker, 2013).

Not much emphasis will be placed on other strategic management frameworks that could have been used to analyse innovation outcomes, except as short contextual background to justify the choice of the DC's.

1.7. Definitions of terms

Corporate foresight – sets of practices that enable firms to attain superior position in future markets (Rohrbeck & Kum, 2018).

Corporate governance – refers to tools or mechanisms that are used within (internal governance) and outside (external governance) the organisation to align the behaviour of management to that of the funders or owners of the organisation (Asensio-López et al., 2019; Belloc, 2012). It includes the corporate governance principles of accountability, responsibility, fairness and transparency (Mekwe, 2015).

Dynamic Capabilities - these are a firm's top management's abilities to **sense** and **seize** business opportunities by **transforming** competencies/resources/processes for innovative responses in rapidly changing business environments (Teece, Pisano, & Shuen, 1997).

Energy technology innovation – is "a set of processes by which improvements in energy technology, which may take the form of refinements of previously existing technologies or their replacement by substantially different ones, are conceived; studied; built, demonstrated, and refined in environments from the laboratory to the commercial marketplace; and propagated into widespread use" (Gallagher, Holdren, & Sagar, 2006).

Innovation (outcome) – the commercial implementation of a new or significantly changed product or process (Gault, 2018). Innovation extends beyond products and services and includes methods of production, opening of new markets, new forms of competition, and indeed business models (Keith Goffin & Mitchell, 2016).

GDP – Gross Domestic Product, which is a measure of national economic output.

Governance – the dominant definition is that governance is a process of steering and co-ordination of social systems and the role of the state and institutions in that process (Katsamunska, 2016), and includes political rules in a search for control, efficiencies and accountability.

Pentathlon innovation framework – an innovation framework that identifies the five innovation elements, viz ideation, prioritisation, implementation, innovation strategy and people/organisation (K Goffin & Mitchell, 2005)

Schumpeterian profits – very high organisational profits that are realised on the back of continuous innovation (Muriuki, 2018)

State-Owned Entities - The Organisation for Economic Co-operation classifies former SOE's who are now minority-government owned, as government SOE's due to the influence that government still has over them and this research paper is aligned to that definition.

Strategic Management framework – organisational management frameworks that assist senior management in guiding an organisation towards sustainable competitive advantage (Saadatmand, Dabab, & Weber, 2018)

1.8. Assumptions

This research will support the deployment of DC's by senior management as best suited to unlock innovative outcomes - it is not important that respondents understand the meaning of DC's framework, and this is reflected in the research questions that have no reference to such framework.

It is assumed that the respondents will reflect normal perspectives on the definition of innovation (though an attempt was made to clarify this to them at the start of the interview to close any understanding-gaps). This assumption will not have any impact on the research outcomes.
It is assumed that the respondents will reflect normal perspectives and experiences in general.
As acknowledged by many researchers that innovation benefits lead to profits, (Wei et al., 2017), this research aligns with this as an assumption.

1.9. Summary

Many international bodies recommend interventions that improve institutional governance in order to improve investments in innovative low-carbon technologies, as key to mitigate climate-change risks. These interventions become more so relevant to SOE's in developing countries as they dominate the electricity-generation landscape therein. This research focuses only on the corporate governance task that deals with senior management capabilities to unlock innovation outcomes – i.e. the bureaucratic competence task of corporate governance. This research assumes that enterprise deployment of innovation leads to commercial profits, and the well-publicised financial losses of SA's energy companies of Eskom, PetroSA and iGas, amongst other governance failures, point to lack of innovation by these SOE's. The well-researched traditional corporate governance which focuses on transparency, accountability, etc, has been proven, however, to be inadequate for unlocking innovation.

The research problem is that SA energy SOE's excel in traditional corporate governance, and yet they have lacked innovation over many years as shown by poor financial performances. In addition to this, the well-researched deployment of DC's as a strategic management framework, which is behind the successes of many international energy SOEs', is sparsely researched in SA and more so in SA SOE's. The research objectives are thus to establish DC's as a critical part of governance, and then to determine how their deployment, or lack thereof, in SA's PetroSA SOC and iGas SOC impacted their innovation outcomes. The study will increase their awareness amongst policymakers and managers, thereby help increase local innovation outputs that have been proven to be critical to the acceleration of the energy transition.

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2. CHAPTER 2 - LITERATURE REVIEW

2.1. Introduction

Governance as defined is the all-encompassing definition that includes corporate governance which includes bureaucratic competence of senior management. The latter component of governance is a key enabler of firm performance (Belloc, 2014) and there are many ways, or scholarly frameworks, that seek to enhance bureaucratic competence but even fewer frameworks that can guarantee increased firm innovation. This study has chosen the strategic management framework of DC's because of its intrinsic linkage to organisational innovation outcomes. DC's are however often researched to unlock individual business area (e.g. human resources) innovation outcome (Breznik & Lahovnik, 2016), but it is important in this study that DC's are assessed organisationally to ensure successful deployment of innovation. This is consistent with the innovation frameworks (K Goffin & Mitchell, 2005) that confirm that successful diffusion of innovation involves more than one business areas.

This chapter will firstly locate bureaucratic competence capability within the governance literature, followed by a brief summary of the four dominant strategic management frameworks that senior management can deploy to sustain firm competitive advantage, and a justification for the use of the DC's framework in the assessment of this study's two South African energy entities. A detailed evaluation will be made of how DC's are to be deployed organisationally, viz at a business area level.

2.2. Background discussion

There are many scholarly articles that place bureaucratic competence at the centre of governance of entities. To cite a few, Jia, Huang, and Man Zhang (2019) state that improving internal corporate governance for increased innovation outcomes involves the task of stronger monitoring of innovation measures by the Board. This means that the gearing of senior management capabilities towards innovation should also preoccupy Board priorities. Singh and Gaur (2013) note also that the different corporate governance arrangements, both internal and external, offer competitive advantage to a firm, and at the core of these arrangements is the Board unlocking (senior) management performance for improved company performance for the benefit of its owners, including through unlocking innovation performance. Influencing or unlocking management capabilities for innovation are thus one of the core tasks of internal corporate governance, and we

know that corporate governance is part of the general governance definition (Asensio-López et al., 2019; Belloc, 2014). However a simple preoccupation with traditional corporate governance role that focuses on the high-level tasks such as the design of independent directors, specialist board sub-committees, increased transparency, etc will not be enough to unlock innovation, and hence it is no wonder that literature review finds no definitive consensus on direct link between corporate governance and innovation (Asensio-López et al., 2019; Belloc, 2012). It is the corporate governance that equally prioritises senior management innovation capabilities that will lead to increased innovation outcomes, as noted by Belloc (2012) who states that corporate governance shapes an entity's innovation activity through allowing individuals to integrate their human capital to improve innovation performance. This is supported by others, such as Herrmann et al. (2017) who state that senior management innovation capabilities are thus one of the key core components of the Board's corporate governance (Herrmann et al., 2017). This means that corporate governance needs a detailed understanding of how to activate such capabilities in its senior management.

Much research has been done into strategic management frameworks deployed by senior management for their firms' competitive advantage through shaping management's capabilities. The four dominant frameworks, including their authors and inception years, are briefly discussed below, but others include the following: Structure-Conduct-Performance, Delta model, Game Theory, Hyper competition, and Competitive dynamics (Saadatmand et al., 2018).

1. Porter's five (developed by E. Porter in 1979) – this is primarily a strategy that shields companies from competition by focusing on five threats from rivals and new entrants, from substitute products/services, suppliers and customers. Its main limitations include the fact that it offers top management no solutions for evaluating alternative opportunities, nor direction on how to compete better.
2. Distinctive Competencies of architecture, reputation and innovation (developed by J. Kay in 1993) – this framework focuses on the quality of top management for setting long-term vision, accomplishing higher resource allocation and being the change-agents for transformation. Its main limitations are that it deprioritises both tangible and intangible assets of the firm (e.g. poor balance sheet, rigid decision-making process, etc).
3. Resource Based View (RBV) (developed by J. Barney in 1991) – this framework states that a firm's sustained competitive advantage is in its capability to use its available variable, rare, inimitable and non-substitutable (i.e. VRIN) unique resources (both intangible and tangible). Examples of resources or competencies from the RBV perspective are: entrepreneurship

skills, marketing skills, sense and response skills, etc. Teece et al. (1997) and others (Priem & Butler, 2001) contend that the RBV framework does not explain well enough capabilities in a rapidly changing business environment, and that a DC's framework is rather needed.

4. Dynamic Capabilities (developed by D. Teece in 1997) – these are a firm's top management's abilities to **sense** and **seize** business opportunities by **transforming** competencies/resources/processes for innovative responses in rapidly changing business environments (Shuen, Feiler, & Teece, 2014; Teece, 2014; Teece et al., 1997). This framework will be chosen for its intrinsic link, by its definition, to innovation outcomes. Because it unlocks management's innovation capabilities, a pre-occupation of governance, this strategic management framework must therefore be an integral part of governance.

The research will be conducted with reference to the two companies of PetroSA and iGas. The two entities will make a good contrast of the deployment of DC's for innovation outcomes due to both their prominence in the SA energy sector and their seemingly opposing financial fortunes noted in chapter one. What follows next now is a brief discussion of these two energy companies.

PetroSA SOC

Formed in 2002 from the merger of three government-owned companies of Mossgas (Pty) Limited, Soekor (Pty) Limited, and parts of the Strategic Fuel Fund Association. Soekor (later renamed PetroSA) is SA's wholly state-owned NOC and started drilling for offshore oil and gas in the 1960's off the south coast in Mosel Bay (Mahlangu, 2014). The key activities of PetroSA (SOC) are upstream (exploration and production of oil and natural gas), midstream (operation of gas fields) and downstream (operation of Gas To Liquids refinery, logistics infrastructure, marketing and trading of petroleum products) (Mabena, 2005). The insignificant oil production was depleted by 2012, whilst natural gas production has rapidly declined due to its inability to find new gas reserves despite many initiatives to find alternative sources of gas-feed and thereby reduce too much reliance on imports (Swilling, Musango, & Wakeford, 2016).

PetroSA has a long history of creating international business partnerships and joint ventures, from Nigeria, Algeria Angola and others (J. Daniel & Lutchman, 2006). It also has a good record of working with stakeholders, with examples such as its first-class hydrogen infrastructure with a state-of-the-art laboratory and technology development facility at UWC (Bidandi, Anthony, & Mukong, 2022), its participation in the phased co-

development with iGas, DEA and the office of the Surveyor General of a gas pipeline along the South African coastline, and other interactions with stakeholders.

iGas SOC

iGas is responsible for developing hydrocarbons gas infrastructure (i.e. pipelines and storage facilities), and developing the gas market (research and finance projects to diversify towards gas) in the country (Ting, 2019). Its key project and performance-highlight is its 25% share (acquired in 2005) in the ROMPCO Mozambique to Secunda (MSP) gas transmission pipeline with capacity of well over 100 Peta Joules (Gakusi, Sartori, & Asamoah, 2015). Its ROMPCO venture is a partnership of monopoly with Sasol since the pipeline's start of operations in 2004 (Crompton & Matsika, 2021). PetroSA and iGas are fully controlled by the state's CEF, which has seen its share of corruption allegations (Albertus, 2019; Crompton & Matsika, 2021).

For the Board of Directors of SA SOC's, their powers are obtained from the PFMA, the Companies Act and the common law, which collectively ensure their accountability for decisions taken in the best interests of that SOC (Pretorius, 2018).

2.3. Identification of the DC's that are to be deployed by senior management

DC's are intrinsically linked to innovation and are possible because of their reliance on managerial orchestration, entrepreneurial and leadership skills. DC's are relevant even in SOE's as these have intrinsic entrepreneurial skills according to the public management theory. What sets them apart from other strategic frameworks is their ability to respond better to rapidly changing environments, and the industries in which the three researched entities operate are proven to be rapidly changing. Organisationally they reside in the six business capabilities (or areas) that are critical for sustainable competitive advantage, viz: HR management, Research and Development (R&D), technology/innovation, marketing, networking, and management.

2.3.1. What are DC's?

DC's, i.e. top management's abilities to **sense** and **seize** business opportunities by **transforming** competencies/resources/processes for innovative responses, require in nature managerial orchestration, entrepreneurial and leadership skills through the creation of innovative signature processes fit for firm evolution (Teece, 2014). Managerial orchestration and leadership skills are fairly common traits of any business entity, but at times there are questions as to whether

entrepreneurship can be a trait associated with government or SOE's (Florio, 2014). Corporate entrepreneurship is an organisation-wide behaviour that exploits opportunities through a process of innovating and transforming itself (Chen, Wang, Nevo, Benitez-Amado, & Kou, 2015). Contemporary public management theory locates this capability also in the public sector, and thus in an energy SOE, through the public service managers' intrinsic motivations to ensure the performance of SOE's (Bernier, 2014; and Gronblom & Willner, 2014 as cited in (Florio, 2014) – in other words entrepreneurship is not the sole purview of the private sector. Teece (2014) emphasises that DC's must achieve congruence between strategy, business model and business opportunities to respond appropriately to customer needs, which congruence gives entities sustainable innovation-led competitive advantage through doing the right things. The DC's framework is diagrammatically presented in figure 1 below, modified from Teece (2014)'s diagram through the inclusion of the business model block inclusion – it shows that once strategy is aligned to a goal (e.g. low carbon technology development), management uses DC's to continuously transform its resources, through buying or building its capabilities, to create signature business models that give the firm competitive advantage. Shuen et al. (2014) note that signature business models are differentiated models (i.e. going beyond best practices) and are accumulated from prior management actions and continuous context-specific learning.

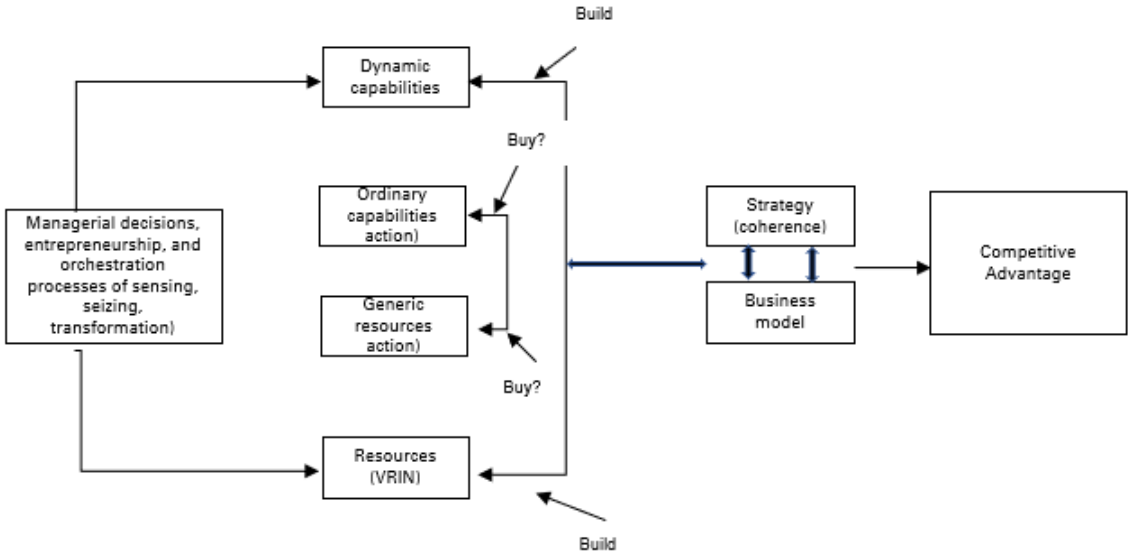


Figure 1 - Logical structure of the DC's paradigm (adopted from (Teece, 2014)).

2.3.2. Relevance of DC framework to the researched entities

Though the DC's framework has gained prominence in the last two decades for its appropriateness as a managerial response to the innovation challenge in dynamic and volatile markets, with over 3800 researched articles by 2015 (Albort-Morant, Leal-Rodríguez, Fernández-Rodríguez, & Ariza-Montes, 2018), an assessment ought to be made whether this framework is

applicable to the three state-owned entities in this study. PetroSA SOC and iGas SOC are specifically in the oil and gas energy industry and Shuen et al. (2014) argue that the Oil and Gas upstream industry needs a DC management framework more than any other due to global industry shifts such as reduction in skills base, technical difficulties in finding new gas-finds in ever-more remote locations, etc. Consequently, the proposed DC's needed in this sector, chosen because of their ability to rapidly change business models to respond to industry shifts, include ambidexterity across mature and emerging domains, ability to manage the upstream business ecosystem, and the management of HSSE (health, safety, security and environmental) managing joint ventures and other partnerships, acquiring and/or development of new technology.

Similarly, the electricity sector (wherein Eskom SOC operates) is rapidly changing with the introduction of new low carbon technologies annually competitive prices that were thought never possible a decade ago. Spanish utilities have had to deploy DC's to transform themselves into global RE utilities (Villasalero, Pinar, & García, 2011). The deployment of DC's is thus highly relevant to the three energy SOE's as shown by their international peers.

2.3.3. Identification of DC's for organisationally innovation

Teece et al. (1997) note that the DC's framework is not meant to be comprehensive but to cover core or critical management capabilities needed to sustain a firm's success. This means thus that DC's must always be viewed from an organisational perspective. The challenge however is that much research into DC's is still done at a singular or isolated capability/business area - Breznik and Lahovnik (2016) noted this disconnection still persisted in 2016, and proposed six capabilities that are relevant in a firm for DC's. Through literature review, this research interchangeably refers to the capabilities as business areas as that is what top management would manage on a day to day basis. Also, a consideration must also be made as to whether the six critical capabilities are complete or not because a missing capability could mean the non-successful deployment of such innovation at an organisational level.

Innovation capability is an intrinsic part of DC's (Dreiling & Recker, 2013) - and therefore from the start an entity needs an innovation-focused business area or department or capability. Alves, Barbieux, Reichert, Tello-Gamarra, and Zawislak (2017) note on the other hand that innovation capability is made up of the four capabilities of: management capabilities, research and development capabilities, transaction (including marketing) capabilities, and operations capabilities - the first three they observe are DC's whilst the last one is not. This list from Alves et

al. (2017) is incomplete however as the 2005 pentathlon innovation framework (although this is not preferred as it does not respond to rapidly changing environments as the DC's framework does) had long observed that the capabilities of research and development, Human Resources (and organisational culture), marketing and innovation-networking must be activated to increase innovation output (K Goffin & Mitchell, 2005). Regarding the latter capabilities, the importance of exploiting socio-technical organisational networks was an important DC as also highlighted by (Lutzenhiser, 1994; Meissner, Sarpong, & Vonortas, 2019), if ever the static pentathlon innovation framework was not forceful enough in that regard. It is believed that this capability is especially important in the public sector, wherein the SOE's are located, for the management of social and political stakeholders.

The business areas wherein DC's must reside for organisational innovation are consequently: **Human Resource (HR) management, Research and Development (R&D), marketing, networking, and managerial (or management).** Whilst these business areas were compiled from separate literatures readings, their completeness was confirmed from the work of Breznik and Lahovnik (2016) who, in their literature review, identified six relevant firm capabilities needed for an entity's competitive advantage, viz: Human Resource (HR) management, Research and Development (R&D), managerial, marketing**, technology, and innovation capabilities**. The last two will be grouped together for reasons explained later in this chapter, and earlier in this chapter it has already been explained why innovation (and technology) are DC's. This thus leaves us with the six business areas wherein DC's (of sensing, transforming and seizing) must reside for organisational innovation outcomes. DC's have in the past been criticised for their immeasurability and thus reliance on qualitative research methodologies as a consequence (Alves et al., 2017; Muriuki, 2018). However it must be appreciated that DC's are dynamic leadership endowments (Della Corte, 2013) which are evolving continuously to achieve sustainable business performances and profits. Qualitative research offers an opportunity to gain more insight into the deployment thereof.

2.3.4. Proposition 1

DC's are a critical component of an entity's governance and organisationally reside in the business capabilities (or areas) of HR management, Research and Development (R&D), technology/innovation, marketing, networking, and management.

2.4. How organisational deployment of DC's unlocks innovation outcomes

Irrespective of the names assigned to the identified DC's by researchers (e.g. ambidexterity across mature and emerging domains, ability to manage the upstream business ecosystem and the management of HSSE, etc as identified by Shuen et al. (2014) in the oil and gas sector as noted earlier), at the core of these names would be activation of DC's in the six business areas, and these are now further explored in detail by identifying DC practices from literature review. Consistent with the holistic organisational view of DC's (Alves et al., 2017; Breznik & Lahovnik, 2016), this research contributes towards locating these practices more holistically rather than disparately as so much literature currently does. Application of DC's entails fair amounts of learning and relearning as management continuously reconfigures, or transforms, the whole organisation to seize emerging business opportunities, and not just a stand-alone DC as noted by Gloet and Samson (2016) and Guo and Zheng (2019). At the core of DC's is management exercise of its entrepreneurial, orchestration and leadership capabilities (Teece et al., 1997) applied organisationally to sense and seize opportunities through continuous business transformation. This is done at individual business areas and at organisational level. The business areas are themselves specialist areas, but this research objective's aim is to cover the core parts of each, guided by literature review, in as far as they relate to the DC's framework.

2.4.1. Human Resources Management capability:

Setting of clear innovation targets and output (such as machine acquisition, institutional establishment, etc) by the principal for the agent (i.e. the SOE) is very important (Danilin, 2015) and (Geddes et al., 2018) for improving innovation performance. These targets are then devolved down the organisation through setting and monitoring specific performance targets (i.e. normal contract management theory) (Abrami, Kirby, & McFarlan, 2014), and through linking these to material Management incentives. Through these measures, an entity will link staff performance to its innovation strategic outcome(s). These mechanisms have been deployed successfully by the Asian SOE's (Abrami et al., 2014; Anadón, 2012), and though it seems relatively straight-forward, in an SOE environment it can be complex given government's obligations like cultural preservations, cultivation of risk-aversion, racial demographics representativeness, political considerations, administrative (e.g. tendering or sourcing systems), etc (Bortolotti, Fotak, & Wolfe, 2019; Cinar, Trott, & Simms, 2019; Lutzenhiser, 1994). SOE's must ensure that these obligations are not in the way of merit-appointments and the creation of an entrepreneurial culture versus a static bureaucratic culture (Lutzenhiser, 1994).

Merit appointments, which entail capacitating SOEs with specialist skills, form the base of innovation and knowledge deployment (Anadón, 2012; Geddes et al., 2018). These have allowed Chinese energy SOEs to graduate from basic research to applied research, thereby allowing themselves to be differentiated by competitively-priced energy technologies perspective which in turn allowed more uptake of their innovation outcomes (Anadón, 2012). So important is this aspect to innovation that Doz and Wilson (2012) succinctly observed that innovation-intent must follow the brains across the globe.

2.4.2. Research and Development capability

Research and development investment is the well-researched base capability (Meissner et al., 2019) for innovation output. Publications such as the Global Innovation Index regularly include this capability as one of the top innovation-enablers. In the public sector however the R&D capability has been found to lag that in the private sector due to prevailing beliefs of government-ownership being a source of inefficiencies due to government benevolence (which Prag et al. (2018) list as: poorly managed and incentivised managers and staff, lack of market discipline due to state support, “soft-budgets” or bailouts) and malevolence (corruption and political capture). This is supported by statistics from the World Intellectual Property Organisation which recorded that patents, which is one of key innovation outputs from R&D, increased from circa 1.4 million to 3.2 million in the 2001 to 2017 period, driven mainly by private sector business. However if the DC capabilities are deployed, it is inevitable that there will be an increase in R&D output due to the entrepreneurial focus of the DC’s framework, as was found to be the case in Netherlands which improved their lowly R&D spend of 0.6% (Assink, 2006) towards the OECD countries average of 1.9%, per the World Bank reports, of GDP per annum. This is another evidence of the intrinsic link between DC’s deployment to innovation outcomes. Belloc (2014) and Bortolotti et al. (2019) advise that SOEs managers must mentally believe that they are well suited to undertake valuable research and development that is good for society – this is especially important in galvanising a culture shift of SOEs’ employees that have for years been trapped in the government benevolence and malevolence mindset. This shift in mindset gives room for SOE managers to embrace the DC’s deployment for better innovation outcomes.

2.4.3. Technological and innovation capability

Though literature treats these as two separate capabilities, they can be grouped into one cluster due to them needing similar Management actions. They refer to a firm’s capability to use technology as an input into the innovation outcome, and the firm’s ability to generate technology

as an output of the innovation process. With the former, robust technology performance facilitates communication of relevant information (e.g. big data analytics) in a timeous manner (Guan & Yam, 2015; Meissner et al., 2019), and thereby facilitating quick decision making (see section 2.4.6). Regarding the innovation output capability, a firm needs to be precise about where and how it will acquire such output, with the two available options being either internal capacity-building or external acquisition. Internal capacity building will require Management to imbue a systemised culture of observing the world differently, challenging prepositions, expanding boundaries, discovering unmet customer needs and setting challenging output targets (Assink, 2006). This will then enable an entrepreneurial culture in the firm, and to the extent that local managerial talent is unavailable, companies should be prepared to source this skill from outside. As an example, Chinese energy SOEs tapped into the West's talent pool of CEO's and IT leaders (Abrami et al., 2014).

Technology acquisition includes strategies such as open-sourcing, forming partnerships or joint ventures with international technology leading firms whilst ensuring transfer of skills to locals for sustainability. Chinese energy SOEs deployed this successfully Assink (2006), and so did the French energy SOE's in the mid-80's to mid-90's, albeit the French success was amplified by a part-privatisation drive by government (Goyer, 2001). The technology-importation strategy is also most advisable when there is a large competitive gap to foreign companies. For enduring benefits, this capability requires continuous training of local engineers, and the creation of infrastructural support on both upstream and downstream side of technology development to minimise valley-of-death failures. Driven by its need to seize opportunities, the DC's deployment is thus ensuring that the entity continuously uses the right technologies to meet customer needs, regardless of how that technology or innovation is acquired. With a DC's framework, there is very little room for the entity to prioritise anything else, e.g. political ideologies, above sustainable innovation with.

2.4.4. Marketing capability

Marketing is a necessity in order to commercialise innovation outcomes. The OECD's Oslo Manual on innovation indicators emphasis the criticality of this dimension and cautions that it is just as important as technology invention (Gault, 2013).

2.4.5. Networking and collaboration capabilities

Co-ordination by Management both within and outside the firm (with suppliers, academic and financial institutions, laboratories, private sector, other SOE's, etc) are key to successful

innovation outcomes, and this ability is even more amplified in countries with higher economic development because of the diversity of their industry portfolios (Dutta, Lanvin, & Wunsch-Vincent, 2018; Goyer, 2001). Obino (2018) further notes that SOE's managers must use for their companies' benefits (i.e. being entrepreneurship-minded) the vast benefits of public ownership, including tapping into government's repository of information from different entities (e.g. spending patterns, longer-horizon planning, government's interactions with businesses, etc). This means that in an industrially diverse country like SA, SOE's managers ought to network and collaborate more for the benefit of achieving their innovation outcomes. Failure to manage such networks, including socio-political influences, can thwart technology diffusion as also noted by Stephens, Wilson, and Peterson (2008).

In SA the delay of the RE technology adoption has been a significant example of failure(s) to manage networks, due to what some attribute to the country's apartheid history and the related links to the energy complex influencers (Baker et al., 2014). This would have been an indication of energy complex companies deploying their DC's for their benefits, and SOEs' managers that are fully appreciative of DC's ought to understand that they also need to shape the business environment, including social and political environment, to their benefit (Herrmann et al., 2017). Govender, Draai, and Taylor (2019)'s South African research found, after interviewing 112 executive and senior managers across eight SOEs and government entities, that over 30% of respondents indicated that government-shareholder involvement restricted entities' innovation, whilst over 50% of respondents confirmed that the legislative framework restricts innovation as entities prioritised compliance over innovation. This seemingly non-conducive environment for innovation does underline the importance of activation of this networking/stakeholder-management capability by Management, which sometimes might not necessarily work.

2.4.6. Managerial capabilities

These are already confirmed by many scholars as having a dominant role in DC's (Breznik & Lahovnik, 2016; Teece, 2014). As noted earlier, they encompass orchestration, entrepreneurship and leadership skills. Gershman, Bredikhin, and Vishnevskiy (2016) argue that corporate foresight is a dynamic capability for technology development as it allows entities to sense and seize business opportunities. It is the deep understanding of emerging trends through research, and then re-adapting the organisational structure, culture and strategy to capitalise on resultant business opportunities. As described and practised, corporate foresight is a DC because it engages all the elements of DC's framework to ultimately seize business opportunities. Another

trait of managerial capabilities was Shuen et al. (2014)'s quick decision-making and action orientation. In the end Senior Management is responsible for creating an innovative culture in the organisation, whose qualities include: infusing ability to learn and challenge pre-suppositions; removing excessive bureaucracy and command-and-control structures; allowing for outside fresh perspective (Assink, 2006); having personnel with attitude for innovation (e.g. built by us versus not), motivation for innovation (i.e. yearning for innovation) in addition to having the relevant skills (Dreiling & Recker, 2013); and having tolerance for risk, flexibility and diversity (Momeni, Nielsen, & Kafash, 2015). It would seem that the three skills of orchestration, entrepreneurship and leadership are broad enough to capture any traits that would enable senior management to sense and seize business opportunities through continuous internal business transformations.

As noted earlier, continuous alignment of company actions to a dynamic organisational strategy must pre-occupy Management. China's energy SOEs for instance had a strategy of aiming to be global leaders in RE technologies of PV and Wind (Prag et al., 2018), and their actions and strategies were continuously reconfigured (or transformed) towards achieving this innovation vision. This alignment to strategy brings focus to the organisation in terms of its priorities and mandate. The United Nations' energy-transition targets currently serve as such for many energy companies (Ockwell et al., 2009), and this should be the signpost that the South African energy SOEs Management should be reconfiguring around.

With the six business areas now explored in more detail, the below proposition determines the directionality of the Conceptual Framework, i.e. what kind of impact is expected from the deployment of DC's:

2.4.7. Proposition 2

The appropriate deployment of DC's in the organisation in the selected two South African SOE's led to more innovative outcomes, and alternatively the lack of deployment thereof led to the absence of innovation outcomes.

2.4.8. Conceptual Framework

We are thus able to determine from literature review the following Conceptual Framework: an entity's DC's (of sensing, transforming and seizing business opportunities) impact or influence the

innovation outcomes in that organisation. The six business areas help explain how their attendant execution, through activating DC's, will impact innovation outcomes. By way of an example, it is not sufficient for an organisation to deploy its normal HR capabilities that one generally finds in every organisation. For the presence of DC's in the HR business area, management must ensure that the HR capability contributes towards the organisation sensing business opportunities, transforming itself as a result of such opportunities, and ultimately seizing such opportunities. The DC's conceptual framework is depicted in figure 2.

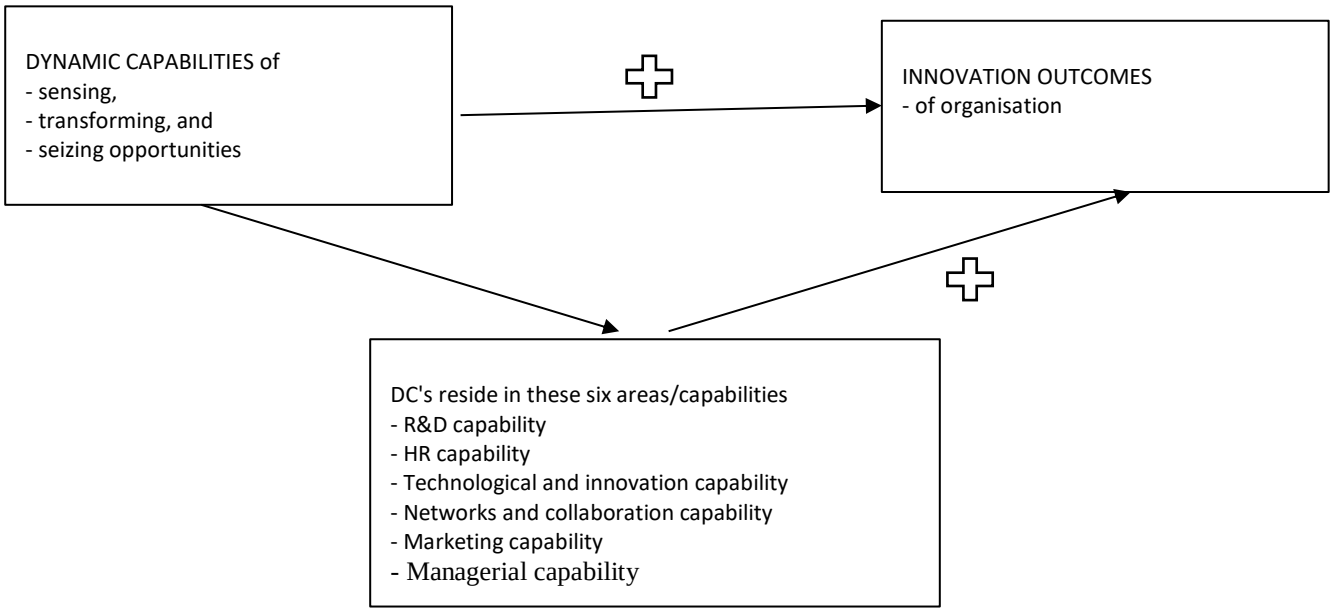


Figure 2 – Conceptual framework for DC's

2.5. Conclusion

Governance is wide and encompasses the unlocking of senior management's capabilities to increase organisational innovation sustainably. The one strategic management framework, studied extensively world-wide, that has been demonstrated to unlock such capabilities is the DC's framework. It has been proven to be effective also in the energy SOE's, where notably it has propelled Chinese energy SOE's to be world leaders in certain energy technologies. DC's are top management's abilities to **sense** and **seize** business opportunities by **transforming** competencies/resources/processes for innovative responses. They are intrinsically linked to innovation, forcing entities to continuously learn, relearn and re-innovate to meet dynamic environments such as the two industries (of oil and gas, and electricity) that the three case-study SOE's are involved in. Because the researched entities are being evaluated for innovation

organisationally, DC's deployment must be evaluated at organisational level. In this regard, there are six critical business areas (or capabilities) that DC's are to be deployed, hence proposition 1:

> *DC's are a critical component of an entity's governance and organisationally reside in the business capabilities (or areas) of HR management, Research and Development (R&D), technology/innovation, marketing, networking, and management.*

This organisational deployment of DC's involves the utilisation of the foundational tenets of managerial orchestration, entrepreneurial and leadership skills in all these six critical business areas to sense and seize opportunities through continuous innovation outcomes. With this establishment made, proposition 2 is thus:

> *The appropriate deployment of DC's in the organisation in the selected three South African SOE's led to more innovative outcomes, and alternatively lack of deployment thereof led to the absence of innovation outcomes.*

Consistency Matrix

Refer to the below table.

Table 1 – Consistency matrix

Research Objective	**State Research Question or Objective**	**State Proposition or Hypothesis**
1	To determine if DC's are a critical component of governance, and identify in which critical business areas they reside in	DC's are a critical component of an entity's governance and organisationally reside in the business capabilities (or areas) of HR management, Research and Development (R&D), technology/innovation, marketing, networking, and management.
2	To investigate if the organisational deployment of DC's, or lack thereof, impacted innovation outcomes in the three selected South African state-owned entities of Eskom, PetroSA and iGas.	The appropriate deployment of DC's in the organisation in the selected three South African SOE's led to more innovative outcomes, and alternatively lack of deployment thereof led to the absence of innovation outcomes.

2.6. Summary

Corporate governance definition includes the bureaucratic competence capability of senior management, which is a key enabler of firm performance. Many scholars have demonstrated that unlocking enterprise innovation is part of bureaucratic competence, and this thus places senior management's capabilities towards innovation as key component of corporate governance. Out of the many scholarly frameworks that seek to enhance management's bureaucratic competence towards innovation, this study has chosen the strategic management framework of DC's because of its intrinsic linkage to organisational innovation outcomes. DC's most appropriately respond to dynamic and volatile markets as they induce rapid change to business models in such times, which are the times that the energy sector has found itself in over the last decade.

Research into DC's is a challenge in that much of it is still done at a singular or isolated capability/business area (e.g. human resources). This study adds to the few studies that advocate for DC's to be assessed more holistically at an organisational level, so as to ensure successful deployment of innovation. From much literature review, it was determined through proposition one that DC's are a critical component of an entity's governance and organisationally reside in the six business capabilities (or areas) of HR management, Research and Development (R&D), technology/innovation, marketing, networking, and management. Further literature review then revealed the DC's practices within these six business areas. Whilst the six business areas themselves are specialist areas, this research objective's aim was to cover the core parts of each, guided by literature review, in as far as they relate to the DC's framework. With such better understanding of each area, proposition two was then developed to essentially ascertain that the deployment of DC's in PetroSA and iGas would have led to increase in innovation outcomes, and vice-versa.

3. CHAPTER 3 – RESEARCH METHODOLOGY

3.1. Research approach

Because of the exploratory nature of this research in the South African energy SOE's environment, a qualitative approach was deemed appropriate (Breznik 2016). DC's deal with change and the role of Senior management in effecting that change. An allowance of time must thus be incorporated into the design to assess whether such changes had the desired impact on company performances (Danilin, 2015; Muriuki, 2018). South African SOE's suffer from numerous leadership changes, and the research design offers the advantage of getting deeper understanding of prior measured outcomes over time.

3.2. Research design

A generic qualitative research design was chosen to offer an in-depth analysis of the deployment of DC's through comparative analysis of the participants' interview results, with reference to the two South African energy SOE's, by identifying common patterns and/or differences. It will also allow for the accumulation of DC's deployment data from a South African SOE's perspective.

This study thus focused on the research question "How were DC's a critical component of corporate governance that were deployed by senior management to improve company innovation outcomes in the two referenced SOE's?", by soliciting insights from people who were familiar with senior management practices of the selected SOEs regarding how they observed or effected the deployment of DC's for innovation outcomes. Where applicable, the study would be triangulated by desktop document review of the two public sources of annual reports and registered patents. Triangulation would act to support successful deployment of DC's by management, as deduced from the interviews, with reference to resultant innovation outcomes in the reference entities. The innovation outcomes however would be evaluated for true innovation definition so as to answer the question "in what way" do they meet the innovation definition.

3.3. Data collection methods

Data was collected through conducting semi-structured interviews with the research participants. DC's involve actions and dynamic decision-making by senior management to appropriately respond to opportunities presented (i.e. doing the right things). Interviews through open-ended questions allow for the purpose of clearly linking the decision-making to the intended innovation outcomes, and the semi-structured interviews allow for the capture of DC's and their related practices within each business area that may not be in the literature, based on respondents'

experiences. The questions asked would go to the core of management actions in identifying business opportunities, transforming the organisation and seizing such opportunities for improved innovation outputs, from the perspective of the participants who were in senior management and/or were in a position to observe, and therefore have intimate knowledge of, the deployment of such capabilities.

Triangulated data would be collected from secondary sources of patent registration at the Companies and Intellectual Property Commission (CIPC) and from annual reports. Such evidence of innovation outcomes would be a proxy-evidence to the successful deployment of DC's by senior management, rather than a possible imagination by the interview participants. It is possible that the innovation outcomes could have been the deployment of another strategic framework, but to the extent that the participants confirm the DC's deployment, then the triangulated innovation outcomes would be a strong indicator thereof. The CIPC search was considered a necessary parallel confirmation of innovation outcomes as annual reports can sometimes be an exercise in self-praise by Management, especially in a background of falling economic and financial performances of SOE's.

3.4. Population and sample

Data was collected through interviewing identified senior personnel who ought to have intricate knowledge of the SOE's senior management practices. The research was conducted with reference to the two entities of PetroSA SOC Ltd and IGas SOC Ltd, selected purposively on the basis of being prominent government-owned energy SOEs and having contrasting financial performances that would offer variety of DC's deployment realities, and through which cross-analysis enriched the research results (Gloet & Samson, 2016).

Snowballing sampling was also used for one participant. The interview included a researcher from CSIR, SA government's research hub that ordinarily analyses innovation technologies and was believed to have regular engagements with the energy SOE's. Boddy (2016) observes that a sample size above twelve (12) is too large if it is generally from a homogeneous group and thus considered representative of the population. Clarke and Braun (2014) also advise a sample size of six-to-fifteen (6-15) for interviews-based projects at Masters level. In other words, the sample size cannot be absolutely predetermined in qualitative research. The homogeneity of the sample comes from the fact that the referenced entities are energy SOE's and share a common shareholding-company, and thus saturation would likely be attainable. Fifty-minutes interviews

offered enough depth to solicit population-representative themes from the size of seven. Regarding accessibility of participants, a larger sample would have proven difficult due to lack of appetite from many other possible participants to participate in an exercise they may deem may have negative findings on government entities.

Table 2 - Profile of possible respondents

Description of respondent type	**Number to be sampled**
2000 to ~ 2010 era	
Former Senior Manager within:	
PetroSA	1
iGas	2
2011 to ~ 2018 era	
Former Senior Manager within:	
PetroSA	1
iGas	2
Senior Manager or Executive from CSIR	1
TOTAL RESPONDENTS AIMED FOR	**7**

It was foreseen that the researcher's shared experience of a professional association with a state-owned entity enhanced the response rate of participants. Participants who were known to have been part of, or had access to senior management were interviewed.

For the triangulated CIPC search and annual reports reviews, the population would be the registered patents and annual reports from 2000 to 2018 for the two entities of PetroSA and iGas as that would have been the period of interest for choosing interview participants. The sample however would be registered patents and annual reports in the time periods that correspond to the tenure of the interview participants, and only in instances where innovation outcomes were cited by the respective participants. The sample period would have been chosen in a manner that would not undeservedly assign innovation outcome evidences to participants.

3.5. The research instrument

Research questions were designed to unpack specifics of the six relevant competency-areas, identified in literature review, on which DC's are to be applied. The questions however did not refer to the DC's framework so as not to confuse the participants, but rather were geared towards examples on how they would have been applied, if they were applied. Examples of energy technologies were requested from the participants because the end-result of DC's application is after all the output of innovation. Refer to appendix A for the interview questions. Appendix B Consistency Matrix also aligned the interview questions to the literature and research question. An interpretivist paradigm of the semi-structured interview was justified because it allowed for the capture of participants' different meanings and experiences which would later be themed appropriately.

3.6. Procedure for data collection

Respondents were approached telephonically and electronically with a request to participate in the study after an explanation of the context of the study and the benefits of the study. Thereafter face-to-face or electronic interviews were arranged. However, interviews lasted for around fifty-minutes and were recorded. A guarantee of confidentiality and the shared prior experience in the public sector facilitate an open discussion.

Triangulation data of annual reports that correlated to the tenure of the interview participants would be analysed for the following seven innovation performance indicator phrases of: i. return on innovation spending, ii. revenues arising from new products and services, iii. new innovations, iv. new technologies, v. cost reductions, vi. enhancement to existing products and services, and vii. R&D personnel (Bortolotti et al., 2019). These indicators are consistent with the OECD's Oslo Manual (Gault, 2013). This analysis would be done by downloading annual reports (in PDF file format) from the website of these companies, and importing them into a theme/phrase analysis software called Leximancer. In the software, the seven performance indicator phrases would be searched individually and stored for further analysis. Similarly, online CIPC patent searches would be conducted per entity using the website link patentsearch.cipc.co.za. Details and registration dates of the patents would be copied into excel for further analysis.

3.7. Data analysis and interpretation

Data was analysed by way of thematic analysis (Nassaji, 2015; Thorne, 2000; Vaismoradi, Jones, Turunen, & Snelgrove, 2016) via the software ATLAS.ti. Procedurally themes were developed

through the six (6) stages as follows (Clarke & Braun, 2013, 2014). That is, recorded interviews were transcribed, and then read a few times for **familiarisation with the data** before they were imported into the ATLAS.ti software. Transcript familiarisation included keeping journal notes for observations made during and immediately after the interviews (Cypress, 2017), and included identifying early patterns and themes, outside of ATLAS.ti, from the transcripts that were relevant to the deployment of the DC's in the 6 business areas. For the **generating codes** stage, codes were iteratively created, within ATLAS.ti, to assess participants' answers for degrees of capabilities-deployment. These codes were analysed in detail and progressively allocated and categorised to the relevant and thus the correct six business areas where DC's reside.

When **constructing the themes** within ATLAS.ti, the categorised codes were analysed further for the themes of degrees of deployment (from present, to partially present and finally to non-present) (Nassaji, 2015; Thorne, 2000). **Reviewing of themes** incorporated checking in ATLAS.ti original transcripts against the themes for theming-completeness, and theme-comparisons to the earlier themes developed outside of ATLAS.ti. Short and precise abstracts of each theme were written in the **defining and naming of themes** stage, which assisted with the writing of the **final theme report**.

Regarding triangulated data of annual reports, the seven innovation performance indicator phrases stored on the software Leximancer, would be read in detail for the whole paragraph relating to those phrases. A short crisp summary of the innovation message from the paragraph would then be made in Leximancer. An evaluation would be made, against the definition of energy technology innovation, or any references to new innovation or new technology, and a "yes" or "no" indicator assigned depending on whether they met the energy technology innovation definition or not. Such identified innovation would then be assigned to a research participant. Similarly, the triangulated data of registered patents per year would be assigned to a participant. These innovation outcomes would be confirmed with the participants in the interview. Similarly, innovation outcomes that happened a year after participant had left would be verified after the interview with the participant to check if it was be an outcome that they influenced.

3.8. Limitations of the study

- Whilst the selection of long periods per entity is positive (as noted in 3.1), the downside was that due to the well-publicised constant SOE's leadership turnovers in SA, identified innovation outcomes would not be linked to interviewed participant's DC's interventions.

Explanatory or clarificatory telephone interviews with the participants would be done where applicable.

- There was some negative response rate to the research. Snowballing sampling from industry acquaintances was then be used for alternative participants who fitted the required profile (i.e. participants who were part of or had access to senior management). The initial sampling-size plan was of seven participants and included senior manager/executive of a multi-national company, but it was not possible in the end to source such a participant. This was substituted with an interview of a former Chief Executive of one of the entities. Also, a short (i.e. less than 25 minutes) interview/chat was held with one of senior managers from the CSIR, and not two as initially planned, due to the impracticalities in finding such a second person. This short interview/chat revealed an unsuccessful collaboration between CSIR and PetroSA in the early 2010's which stalled further interactions by CSIR with PetroSA therefrom. These results were considered significant for this research as it addressed one of the components of the research objective, and the results therefrom were included in chapter four.
- The identification of energy technology innovation, in the true sense of the definition, from the annual reports would pose difficulties due to the inability to assess widespread use thereof from one financial period. Application of that innovation within the researched entity's environment (i.e. a commercial marketplace) will have to suffice for the purpose of defining this technology innovation.
- Whilst the sample size of two SOC's selected is sufficient for this research report, it is a limitation because the results could be changed by analysing more companies.

3.9. Trustworthiness

3.9.1. Transferability

To ensure that this research's findings can be transferred to other potential similar contexts, potential users should take note of the following details of the context of the study (B. K. Daniel, 2019; Noble & Smith, 2015). Chapter 1 has elucidated the dire state of finances of the three researched SOE's, and indications of lack of innovation and governance failures in the recent past. The interviews happened in the backdrop of a different political administration from the previous decade, albeit from the same party, that was widely perceived to be more business friendly and thus attempting to inject this attitude into current SOE's. Many research participants would have been affected in one way or the other by these political changes in as far as their own

personal dealings with the SOE's – almost all the participants were in senior management positions of the two SOE's.

The participants that were at executive level could have been appointed with the consent of ruling political party (B. K. Daniel, 2019; Gumede, 2019). There was a national commission of enquiry investigating primarily corruption in government and many SOEs. The research methodology's data collection and analysis are also sufficiently detailed under 3.9.4 and elsewhere.

3.9.2. Credibility

The confidence in the truth of this research's findings was achieved through the following mechanisms (Cypress, 2017; B. K. Daniel, 2019; Naano, 2014). Firstly, the purposive sampling was made of participants that had either been part of senior management or had interacted closely with it, and thus had intimate knowledge of the researched phenomenon (viz the deployment of DC's for innovation outcomes). The pre-final themes were shared with the participants to solicit their comments re the interpretation, and necessary adjustments made where appropriate. For each adjustment made, an effort was made to revisit the other participant's themes and check for inconsistencies vis-a-vi the source data. Verbatim quotes were also used where appropriate, as is the norm now with qualitative research (Noble & Smith, 2015).

Special observations were made of the remarks made by participants during the unstructured part of the interview, as this deepened the understanding of their perspectives and experiences and aided the correct interpretation of their input (Cypress, 2018; Noble & Smith, 2015).These were captured in a journal.

3.9.3. Dependability

The "stability of findings over time", page 278 of (B. K. Daniel, 2019) was enhanced by the inclusion of a CSIR participant that are experts in the country's energy sector. Their insight would assist in the analysis and presentation of clear findings and thus eliminating bias (Cypress, 2017). The adequacy of the sampling size also made it difficult to insert personal biases into the findings that had a clear audit trail and whose theming results were also confirmed with the participants. One of the aims of this study was to assist stakeholders to better appreciate the applicability of DC's in SOE's, and this placed an internal expectation to truly reflect participants experiences in the findings as a part-contribution towards increasing innovation outcomes in government.

3.9.4. Confirmability

This research used three strategies to ensure accurate reflection of the research (B. K. Daniel, 2019; Naano, 2014). Firstly, thematic analysis was performed in the ATLAS.ti software that allowed for audit trail and consistent theming output. The transcripts of the recorded interviews were imported into ATLAS.ti, which allows for checking of accuracy and completeness of transcription, each time-stamp at a time. Codes were created by highlighting relevant sections in the transcripts - these were the sections that referenced participant's response to the applicability (or not) of a DC business area – e.g. in the HR area/capability, a participant's response was assessed for agreeing or not with the deployment of innovation performance targets, innovation incentives, merit appointments and entrepreneurial culture creation. A similar coding exercise was done for the other five remaining DC capabilities from literature review. New codes would be developed, where applicable, from new sections of the transcript that had not been referenced in the literature. Secondly, a reflexive journal was kept during the course of the research in order to ensure that correct analysis and interpretation of data was performed. The researcher's own theming outside of the ATLAS.ti software also formed part of this journal to verify that correct connections were made within and across the data input. Verbatim quotes were similarly used where appropriate.

The Leximancer software would be used to analyse the three cases' annual reports from 2000 to 2018 for innovation outcomes. A short crisp summary of the annual reports' innovation message would have ensured detailed understanding of the innovation outcome.

3.10. Ethical considerations

This research project was categorised as a low risk as it entailed sensitive topics for the participants, consent letters were obtained from the participants - refer to Appendix C. Confidentiality was guaranteed by restricting access to initial data that identified participants to only the interviewer, except for the one instance of snow-balling sampling. Thereafter their identifications were referenced by use of codes. Such initial data was password-protected and will be stored by the interviewer for a maximum period of four years, thereafter it will be destroyed and the participants were informed accordingly. No reference has been made on the report to actual titles of the participants nor their exact period of engagement with the SOE of interest. Situational ethical dilemmas were avoided through a personal commitment to remain neutral-bias throughout the study. Ethics approval was obtained from the University of the Witwatersrand non-medical WBS Ethics Committee with protocol number WBS/EL2368534/681 – see appendix E.

3.11. Summary

A generic qualitative research design was chosen into the research of DC's deployment in the two SOE's of PetroSA and iGas. The study focused on the research question "How were DC's a critical component of corporate governance that were deployed by senior management to improve company innovation outcomes in the two referenced SOE's?". Where applicable, the study would be triangulated by desktop document review of the two public sources of annual reports and registered patents at the CIPC. Data was collected through semi-structured interviews with open-ended interview questions. A sample size of six (6) was chosen, which was deemed appropriate for this Masters level research and also allowed for avoidance of homogeneity/saturation. The sample targeted mainly former senior managers at both entities.

Research questions were designed to unpack specifics of the six relevant competency-areas, identified in literature review, on which DC's are to be applied. Online and face-to-face interviews were conducted and lasted for around fifty minutes, and the results thereof analysed through themes within the ATLAS.ti software. The limitations of the study included a smaller participants sample size (of six) than the originally-planned size of seven, and the smaller number of SOC's that were selected.

4. PRESENTATION OF FINDINGS AND DISCUSSION

4.1. Introduction

This research paper's conceptual framework states that an entity's DC's (of sensing, transforming and seizing business opportunities), which reside in the six business areas/capabilities, influence the innovation outcomes in an organisation. This framework is captured in the two propositions, starting with proposition 1 which states that *DC's are a critical component of an entity's governance and organisationally reside in the business capabilities (or areas) of HR management, Research and Development (R&D), technology/innovation, marketing, networking, and management.* Whilst this proposition was ascertained, and therefore anchored, primarily through literature review, the participants' views and experiences do give an indication of the extent to which the entities' governance structures prioritised DC's practices or treated their practices as being critical to governance. It should be noted that government deploys a shareholder representative to the entities' Boards. Government thus exerts some influence in the workings of the Board itself and thus affects the competency thereof (Kikeri, 2016). The effect thereof on findings 1 and 2 will be become apparent from the research findings in this chapter.

The second proposition states that *the appropriate deployment of DC's in the organisation in the selected two South African SOE's led to more innovative outcomes, and alternatively the lack of deployment thereof led to the absence of innovation outcomes.* The findings pertaining to this proposition will be discussed with the end goal of summarising the DC's in the six business areas into the three categories of present, partially present, or not present. At times the participants made it very clear as to the presence or otherwise of such DC's practices, but sometimes a conclusion could be drawn by this researcher from the examples cited and/or strong language used by the participants as to which category the participant was leaning towards.

4.2. Findings and discussion pertaining to Proposition 1

Proposition 1 in essence contains two parts, the first pertains to DC's being a critical component of governance. All but one participant agreed that in both entities some Boards and the shareholder could have done a lot more to prioritise innovation capabilities and outcomes at those levels. One participant noted that *"you cannot have an organisation running at 100 kms/hr whilst*

the Board is running at 5 kms/hr", making an analogy of the debilitating delays that Management was sometimes confronted with from the Board and/or shareholders. Another participant noted *"unlike previously, the King IV report now has it correct by focusing on the capability of the Board to run the business"*, in reference to the previous King III report that did much for traditional corporate governance task of compliance (van Vuuren, 2020) (e.g. the annual planning cycles, IT governance, the reporting cycles, etc) but as noted earlier these do very little for innovation outcomes (Asensio-López et al., 2019; Belloc, 2014). This emphasis on capabilities by King IV is a tacit acknowledgement of SA corporate failures resulting from the focus on traditional corporate governance models to sustain performance through innovation. Teece (2014) emphasises that for DC's to work, there must be alignment between strategy, business model and business opportunities, and so if DC's activities like innovation targets and incentives do not find expression at the highest governance level, viz the Board, as the research results show, then there is no such alignment.

Another participant captured this alignment as follows: *"the type of governance at Board level and above gives a licence to the organisation to operate in a particular way"*. The governance structure thus must recognise its role in unlocking innovation both from within the organisation and from the outside. An example of the latter is the recognition that the public sector regulatory environment is not always supportive of innovation – one example cited being that "*the annual corporate planning cycle makes it hard for an entity to be responsive to in-year innovative business opportunities for fear of adverse findings from the Auditor-General for not meeting initial plans".* This relates to the well-known innovation-inhibitor that is often cited by public sector practitioners, viz the rigidity and inflexibility of the current procurement regulations (Manyathi, Burger, & Moritmer, 2021). Kikeri (2016) acknowledges what she calls a heavy compliance burden for SA SOE's and the negative impacts thereof on their performances. Whilst the compliance burden is designed no doubt to improve accountability, transparency and fairness, it once again emphasising the problem of excelling at traditional corporate governance by the two entities without impacting innovation outcomes. If Boards are not actively working to remove such impediments through legal means, then they are not exploiting their external links for the benefit of the entities (Mishra & Kapil, 2018), and thus are not aiding the prioritisation of DC's. The failure in the entities' innovation endeavours is further described in section 4.3 below, but the research findings show that the first part of proposition 1 was not achieved in that the DC's have not been treated as a critical component of governance. There is only one respondent that felt strongly that there was sufficient government support for innovation projects, but even after four years of their

relationship with iGas, there was still no tangible actioning of innovation proposals by government, bringing to question the level of seriousness behind that government support.

The second part of proposition 1 pertains to the identification of the six business areas/capabilities for organisational DC's, which were determined in the literature review chapter. This was re-affirmed by the participants who generally could not identify any additional business areas or capabilities, except for one participant who suggested the difference between a *"growth business and an operating business"* assists with shifting the mindset of management towards that of being more pro-innovation. However this aspect is already catered for in DC's framework through the managerial capability (Breznik & Lahovnik, 2016; Teece, 2014) that requires management to continuously re-organise the business and its strategy to capture business opportunities. As reported in section 4.3 below, not all the six capabilities were observed to have been deployed by the two entities, and this will have resulted in lack of innovation outcomes consistent with the holistic DC's view (Alves et al., 2017; Breznik & Lahovnik, 2016). This holistic application view gives an answer to possible public confusion as to why some of these entities have failed to innovate even seemingly with government support – one participant observed that "*PetroSA would need a Doctorate of research to fully understand what went on".* Another participant noted that they felt *"iGas individually had many of these capabilities at that time"* but recognising that they had no innovation output to show for it. These observations resonate with the known problem of looking at governance solutions through siloed lenses. They indeed re-emphasise the need to fully deploy all the component-capabilities of the DC's framework, and thus the research findings that confirm the six business areas/capabilities for DC's.

4.3. Summary of Findings pertaining to Proposition 1

The six business areas of HR Management, R&D, technological and innovation, marketing, networking and collaboration, and managerial capabilities, wherein DC reside were determined via literature review and were validated by all the participants as they did not identify any additional areas or capabilities. At face value it may appear that entities are doing everything right to produce innovation outcomes, as was observed by the participants to be the case for iGas and PetroSA at some point. However, without the holistic, or organisational, deployment of all the six DC's practices, the DC's framework does not foresee innovation outcomes and this has indeed proven to be the case for the two entities. The research findings point towards governance levels of the Board and/or government shareholder being overwhelmed or pre-occupied with the traditional

corporate governance tasks of accountability, responsibility, fairness and transparency, at the expense of prioritising the DC's practices as a critical component of governance. When this prioritisation is missing at Board level, which is a structure that executive management is accountable to, it is not surprising that there would be certain DC's practices that are not fully deployed, as the next section will detail.

4.4. Findings and discussion pertaining to Proposition 2

The results of the research are presented below in accordance to the three categories of DC's, and the six business areas (i.e. themes) wherein DC's reside are **bolded** for easier identification, those being **HR Management, R&D, technological and innovation, marketing, networking and collaboration, and managerial** capabilities.

Dynamic capability of sensing business opportunities

The research findings suggest that sensing of business opportunities was initiated from the **managerial action** of annual assessments of market developments through the annual corporate planning cycles. No reference was made to formal corporate foresight tools like scenario analysis, working with analogies, systems-dynamic mapping, etc (Rohrbeck & Kum, 2018) as suggested by (Gershman et al., 2016), and so there is a risk that the evaluation of future trends was not deep enough. However, it was observed that the planning cycles are hugely supplemented by the benefit of having highly-qualified employees in these SOE's who ordinarily keep abreast with industry developments through attendance of conferences, reading industry documents, engagements within the industry, etc, and thereby de-risked the entities from unforeseen trends. One participant noted that *"for PetroSA, the responsibility of being the first entity in the world to have started the use of Gas-To-Liquid technology, spurred the **intrinsic desire** by employees to find innovative technologies and business models to sustain the business"*. From these two opportunities-sensing sources there seems to have been no shortage of innovative business opportunities' proposals for the Board and shareholder. There is no observance of a specifically targeted management programme to translate this bottoms-up competence to an **intrinsic belief** by employees to be drivers of innovation (Bernier, 2014; and Gronblom & Willner, 2014 as cited in (Florio, 2014) with one participant noting that *"there was no HR-driven initiative"* for this. Another participant noted *"it was generally our desire to make a difference in the country".*

All participants noted that there **were never organisational incentives or targets for innovation,** as advised by Geddes et al. (2018). This poses the risk that the Board itself is not driven to timeously approve bottoms-up proposals (Arundel, Bloch, & Ferguson, 2019). So, whilst employees/management could come up with innovation proposals themselves due to their intrinsic beliefs in innovation, the Board could be intransigent to such because they themselves had not set organisational targets. In fact, one participant said that "*none of the different projects I proposed over a 12-year period came to fruition, and this is the only entity I experienced such"*. This has the effect of deflating the innovation desire in the long run.

Another **managerial action** seems generally to be the non-formalisation of **the R&D** division in the two entities, which is a well-entrenched input into innovation outcomes (Meissner et al., 2019). In iGas *"there was no such a division formed mainly due to its sole focus on the one investment asset"*. iGas thus remained a smaller employee-base entity. Hameed, Basheer, Iqbal, Anwar, and Ahmad (2018) and Álvarez Jaramillo, Zartha Sossa, and Orozco Mendoza (2019) advise though that even with smaller entities there needs to be external knowledge, internal innovation and a dedicated R&D function as ingredient inputs towards innovation in small and medium entities. In PetroSA, the R&D function was "*not completely embedded in the organisation"*, as per one participant whilst another one noted that the organisation *"was internally focused at that time, with a trading division formed to purchase products externally. In other words, whilst this trading division was not called R&D it could be likened to one".* This non-formalisation of this critical function is also reflected in the entities' non-collaboration with SA government's CSIR institute, whose mandate is to research, develop, localise and diffuse technologies for SA's eventual benefit. The interview with the CSIR-participant revealed that their last interaction with PetroSA was that of a failed hydrogen-energy proposal in early 2010's, whereby PetroSA was requested to consider investing towards a green Hydrogen venture. The participant observed that *"there seems to be a worry in CSIR that the organisation has not engaged with PetroSA for so long since then"*. This is a lost opportunity to sense future trends and begin to respond innovatively and appropriately as an SOE – Anadón (2012) and Gershman et al. (2016) demonstrated that many countries have built their innovation successes through working with mission-oriented government research organisations like the CSIR. R&D deployment is thus summarised to be partially present and not present at PetroSA and iGas respectively.

There are mixed research results regarding **management's** strategic intent to close the technological gap through partnerships, joint ventures and the like as proposed by Assink (2006).

On the one hand, at Executive level there was deliberate intent to swiftly bring in innovative technologies or business models to the business. One participant noted an example of a proposition "*to add a service component to PetroSA's business model in partnership with an American company using the licenced catalyst technology".* Another participant cited the example of iGas *"building up a war-chest for potential acquisitive targets or partnerships with identified industry players or competitors"* – it is noted that this referred to the post 2016 era, and could be because of Sasol's depleting gas reserves in Mozambique as publicly announced in the last few years*.* On the other hand however, the pre-2016 Board and/or government shareholder for iGas seemed to have hindered innovation greatly through either not supporting proposals or causing lengthy delays to approval. As one participant recalled regarding iGas, "*government and the shareholder were not interested in innovation".* This could have been caused by many reasons, including *"the absence of a guaranteed off-taker – iGas was the ham in the sandwich"* as noted by a participant. But the creation of such an off-taker would be totally within government's sphere of influence. In fact, it re-enforces the one concern that came up repeatedly from participants, that being the restrictive and rigid entity **mandates** and the **Boards' and government's** inability or disinterest in exploring the extent to which the proposed business opportunities could be accommodated by the existing entity-mandates. The issue was not so much the mandate itself, as participants noted that the entities themselves believed that the mandates were *"very empowering".* Rather, the issue was that when the innovation proposals involved a deviation from the historical business models, the Board at times and the government-shareholder did not readily agree with management's views. One participant observed regarding iGas that *"mandate-decisions by the Board and government many a times took years of debates, hesitation and seeking of legal opinion, and by that time the opportunity has passed"*. Another comment was that *"the mandate was designed for a static environment, and not a dynamic one"*. The historical business model performance seemed to lull the iGas shareholder into a *"laid-back attitude towards innovation"*.

Government however was very supportive of PetroSA, although this was not unfettered. In the early 2010's, government *"actively supported PetroSA's exploration of using a new licensed catalyst technology for plant operations outside SA and thereby add a service component to its business model, although that opportunity did not materialise"*. PetroSA's reserves had reached end of life at that time, and this seemed to not only have galvanised the organisation but government too in ensuring that *"it finds innovative ways to survive*", as put by one participant. In the late 2000's however Board and government support was stymied by the rigid regulatory

framework, one interviewee puts it "*half-way through a certain project the company realised it needed to use newer technology than the conventional one, but the rigidity of the procurement process, getting approvals and so on – the system does not support innovative thinking and implementation".* Another example of a long-delayed and eventually unapproved business model proposal, was PetroSA's Management intention to acquire a "*ready-made downstream distribution business"*. These suggests that the Board and government stand ready, albeit take long, to support existing business-model innovations, but innovations beyond that are not seen favourably unless and until the entities are under existential threats. This is in stark contrast to an innovative company that embraces corporate foresight as a DC where future trends are anticipated and pro-actively managed(Gershman et al., 2016). This resembles Eskom's experiences and the tale of the long-delayed approval of the new capacity-build programmes, for which the President apologised publicly to the country. Shareholder support is thus assessed at partial.

Dynamic capability of transforming organisational resources

The participants general consensus is that both entities had **capacitated themselves with highly skilled employees** (including management) from across the globe as advised by Anadón (2012) and Geddes et al. (2018), and more so PetroSA where a *"dedicated project budget was adequately resourced for insourcing the requisite skills"* as one participant put it. The insourced skills at PetroSA would be *"rotated across departments so as to ensure that **learning culture** and skills are devolved for the benefit of the organisation"*. This allowed the organisation to then reap the benefits of global thinking and ideas. Another interviewer observed that "*PetroSA did not have a problem in this regard*" as PetroSA sent many of their Managers and Executives to *"Ivy-league universities"*. In this era, the continuous learning advocated by Gloet and Samson (2016) and Dreiling and Recker (2013), was part of many employees' Key Performance Indicators at PetroSA. However *When it came to utilising employees' ideas,* another interviewee observed that the learning culture was *"not always embedded enough because these insourced highly-skilled individuals did not broaden the skills-base".* Assink (2006) underscores that skills transfer is critical for sustained entity innovation, and the general presence thereof in PetroSA would have contributed positively to innovation ideation at least. Generally, it would seem there was some determined effort by Management to inculcate a learning culture throughout the organisation. The iGas team was much smaller, and *"lean and mean"* as noted by one interviewer, so it was a lot easier to share information and thus create a **learning culture**. But learning culture was needed

at a Board level as well – one participant noting *"the Board were out of their depth",* resulting in an assessment of partial deployment generally.

In both companies there was openness towards **partnerships with other firms** to advance the entities' business models and pursue other innovation opportunities (as supported by Dutta et al. (2018)) at least at Executive management level because they saw these *"entities being involved in a global business"*. Many of the ventures proposed b Management to the Board involved business partnerships with other energy firms, some examples being PetroSA's proposed partnership with a US company for a catalyst technology, iGas' proposal to venture with an Australian and a US company in the Western Cape in order to monetise the gas, and many others. Another benefit of having highly skilled people is that both companies do not seem to have had any problems when it comes to continuously **upgrading internal technology capabilities** (as noted by (Guan & Yam, 2015; Meissner et al., 2019), with many participants confirming the deployment of this practice. These included both the general communications and IT systems, and the more complex systems like the oil-fields servicing technology that Meissner et al. (2019) were also referring to. These capabilities worked very well in **streamlining decisions** up to Executive levels, but did very little to speed them up at Board level as noted below. Generally, the participants observed a presence of the DC's of transforming organisational resources, and this could mainly be because these areas are totally within the control of management and need very little Board or shareholder level.

Dynamic capability of seizing business opportunities

Timeous management decision-making (Shuen et al., 2014) was the one area that was highlighted as being problematic by almost all the interviewees. Board and government (i.e. Ministerial) approvals either took too long and many a times their practices or behaviours too restrictive of the required innovative ventures. One participant observed that *"you cannot have fifty-two (52) board meetings in a year? When do you get to do your own work?"*, whilst another one noted that *"an indecision is a decision itself".* These either suggest a crippling level of information asymmetry between the Boards and Management, and even if this is so, Alsartawi (2018) notes a negative effect on entity performance due to higher Board meetings. Or this could suggest non-commitment by the Board (not challenging, or questioning, or informing, etc) (Roberts et al 2005), and could bring doubt as to the Board's own role and time in linking up the entities to external links for the betterment of entity-performance (Mishra & Kapil, 2018). Whatever the reasons were, one has to wonder if such delays were warranted in the face of management

proposals given that there have not been tangible results of the entities' innovation outcomes. This supports Govender et al. (2019)'s research of government-shareholder involvement restricting innovation.

As proposed by Stephens et al. (2008), all but one participants believed that there was adequate **marketing**, lobbying for innovation opportunities to government, and **critical stakeholders** engagement. Lots of energy were expended here by Management - one interview put it as *"we believed we did enough, but if you ask did we do enough lobbying? What then is enough?".* The participant cited the well-publicised example of Eskom which unsuccessfully requested for government approval of an earlier power-plant build programme to replace the ageing coal power-plants fleet. The SA president in the end had to apologise publicly for that delayed approval. The researcher however observes that the CSIR participant interview confirmed that CSIR has had no interaction with PetroSA for quite some time, and we noted earlier the innovation-benefit that PetroSA would have had from such similar interaction (Gershman, Roud, & Thurner, 2019). In iGas, there seems to be conflicting results: post 2016 one participant confirmed that lots of work and collaborative studies were done with CSIR, whereas prior to 2010 that interaction does not seem to have been there with one participant noting *"iGas operated in a very closed government society where there were lots of politics".* So, the presence of critical stakeholder engagement varies across the participants.

Triangulation outcome

With all the interviewees, it was difficult to ascertain those innovation outcomes that were successfully deployed in the entities. Much of the innovation projects cited by the participants for iGas related to business models – two participants noted *"there is not much to innovate with oil and gas as in the main it's just pipelines and compressors",* whilst another participant noted that most of the projects proposed to Management and the Board related mainly to expanding the current customer partnerships to beyond the one-asset model. However, none of these materialised, and thus there was no need for triangulation. Similarly, with PetroSA, the participants noted the two non-successful innovation attempts of project iKhwezi and the technological partnership on a catalyst technology. From public records it is also known that project iKhwezi was a R23 billion failed project. Similarly, there was no need for triangulation in PetroSA. There is some ray of hope though, as one iGas interviewee noted that *"there are imminent projects that will be announced by the Government"* in the near future, and many of these projects were initially pursued during the post-2010 research era. The fact that such projects

would be taking off many years after the responsible management/team had left the organisation is yet further proof of the tardiness and long lead-times in obtaining government approvals.

4.5. Summary of Findings pertaining to Proposition 2

The summarised research results for proposition two are presented in table 2 below, with the ticks in the table representing each participant's response regarding their observed degree of presence of particular DC's practices. The 2010 year was chosen as a general marker of the change in government administration, albeit both administrations came from the same governing party. There is no observable trend between these two eras, whereby one could say in this era there is unanimous consent amongst the participants that DC's framework practices were deployed as opposed to the other era. Rather it is evident in both entities and in both the pre and post 2010 periods that not all organisational DC's practices are present, and it would be difficult to have expected the entities to have been organizationally innovative given the fact that DC's framework requires all these practices to have been present or deployed. It can be seen in table 2 that generally both entities' Management are very good in transforming organisational resources as there are very few observed "non-present" DC's practices. With regards to sensing and seizing business opportunities capabilities, there are some few "non-present" practices which include incentivisation of innovation, deployment of a dedicated R&D function and a non-responsive mandate or government support. Because of this non-holistic deployment of DC's framework, it is no surprise that indeed the participants did not identify any commercially-successful innovation project that was deployed by the entities despite many proposals by Management, thus confirming proposition two in that the lack of holistic organisational-deployment of DC's negatively impacted innovation outcomes in the two selected South African state-owned entities of PetroSA and iGas. Because there was no innovation outcome identified in the interviews, it could not be definitively determined that the deployment of DC's as observed by the participants led to innovation outcomes, i.e. the first part of proposition two cannot be affirmatively determined from the results.

Table 3 – Results of the deployment of DC's practices in PetroSA and iGas

DC's and their practices	PetroSA						iGAS					
Overall responses leaning towards present, partial or not	**Not Present**		**Partial**		**Present**		**Not Present**		**Partial**		**Present**	
Participants were referencing pre (<) or post (>) 2010	**< 2010**	**> 2010**	**< 2010**	**> 2010**	**< 2010**	**> 2010**	**< 2010**	**> 2010**	**< 2010**	**> 2010**	**< 2010**	**> 2010**
DC's of Sensing business opportunities												
Employees having intrinsic belief to drive innovation					√	√					√√	√√
Systemised innovation culture (e.g. incentives/KPI's)	√	√					√√	√√				
Deployment of R&D division			√	√			√√	√√				
Strategic intent to close tech gap												
- at Management level					√	√			√√			√√
- at board level					√	√	√√			√		√
Shareholder/mandate support	√			√			√	√	√			√
DC's of transforming organisational resources												
Capacitation with best minds					√	√					√√	√√
- these used for business solutions and learning culture			√			√			√	√	√	√
Robust internal tech capability					√	√			√	√	√	√
- to facilitate timeous decision-making			√	√						√	√√	√
Attitude of insourcing tech capabilities					√	√			√		√	√√
DC's of seizing business opportunities												
Timeous decision-making to act on opportunities		√	√				√		√ √	√		√
Adequate marketing and lobbying					√	√	√		√			√ √
Critical stakeholders for sustainable benefits	√	√			√	√	√		√			√√

√ are the results of the interview with the CSIR manager.

4.6. Conclusion

The results show overwhelmingly that the Board and/or the government shareholder did not take timeous decisions to facilitate seizing of identified business opportunities. Such identified opportunities needed those prompt approvals in terms of the entities' legal mandates, their regulatory framework and governance framework. But it was observed that this support was only forthcoming when the entity was in serious existential crisis and by then it was too late. These actions go against the requirements of the DC's framework, and show that the DC's were not prioritised by the governance structures of the Board, and further by the government due to their significant influence of entity-performance. The six business areas wherein the DC's reside were also confirmed by the participants, who could not could not identify any further areas. The research results therefore confirm proposition 1.

Regarding proposition 2, both entities' Management seem to have been very good in transforming organisational resources to be ready for innovative proposals. This is also supported by their capacitation by highly capable and skilled employees who had the intrinsic desire to sustain organisational performance through innovation. Where they definitely lacked is the non-deployment of a systemised innovation-culture through incentives and KPI's, non-deployment of a dedicated R&D department or function, and generally having an intransigent or non-responsive Board and/or shareholder. In both entities, there are examples of many innovative-proposals that sought to expand existing partnerships and/or seek new business models, but these were met by long and tardy Board and (government) shareholder approvals. Assink (2006) and Dreiling and Recker (2013) describes an innovative culture as that whose qualities include amongst others: ability to challenge pre-suppositions; removing excessive bureaucracy and command-and-control structures; allowing for outside fresh perspective, a yearning for innovation, and having tolerance for risks. This research was a reminder of how much governance support (meaning Board or government support) that the energy SOE's need for their projects, and thus to what extent that bureaucracy at that level will quickly dampen any innovation outcomes, thus supporting Govender et al. (2019)'s findings that . There were also a few other DC's practices that were only partially deployed, including strategic intent to close technological gap to competitors, robust internal capabilities, and a few others. It is this non-holistic deployment of DC's practices that can be attributed to the innovation failures as described by the participants, thereby proving proposition two as follows:

The lack of deployment of DC's in the organisation in the selected two South African SOE's led to the absence of innovation outcomes

In other words, for successful organisation innovation it is not good enough to excel only in one or few DC's practice or dimension. However, there was no evidence, from the interviews, of successful innovation outcomes during the interviewees' reference tenures despite many attempts at least by Management to pursue such innovative technologies or business models for the entities. Therefore, a causal link between the deployment of DC's and innovation outcomes cannot be clearly determined, meaning that the first part of proposition two could not be determined.

4.7. Comparison of literature review and own findings

Refer to table 3 below for the consistency table comparing research answers with those from literature.

Table 4. Comparison of literature review and findings

RO #	Research Objective	Proposition	State Proposition	Findings from own study
1	To determine if DC's are a critical component of governance, and identify in which critical business areas they reside in	1	DC's are a critical component of an entity's governance and organisationally reside in the business capabilities (or areas) of HR management, Research and Development (R&D), technology/innovation, marketing, networking, and management	The full set of DC's practices in the six business areas was not consistently prioritised as a critical component of the governance structures of the Board and/or government shareholder at iGas and PetroSA.
2	To investigate if the organisational deployment of DC's, or lack thereof, impacted innovation outcomes in the two selected South African state-owned entities of PetroSA and iGas.	2	The appropriate deployment of DC's in the organisation, in the selected two South African SOE's led to more innovative outcomes, and alternatively lack of deployment thereof led to the absence of innovation outcomes.	The lack or incomplete deployment of the full set of DC's practices in the six business areas in the two selected SOE's led to the absence of innovation outcomes.

4.8. Summary

As summarised in section 4.3, all the six business areas of HR Management, R&D, technological and innovation, marketing, networking and collaboration, and managerial capabilities, wherein DC reside were confirmed by the participants. However whilst this was the case, there was no evidence of the governance structures of the Board and/or government shareholder prioritising their holistic deployment as a critical component of governance. This is because of the structures' pre-occupation with the traditional corporate governance tasks. Hence proposition 2 was partly achieved for PetroSA and iGas. With regards to proposition two, section 4.5 summarises that for both pre- and post-2010 interview periods, not all the DC's practices were deployed for these two entities. Practices associated with the DC of transforming organisational resources was well executed by Management. However the sensing and seizing DC's were not fully deployed due to inadequacies in areas such as innovation incentives, formations of dedicated R&D functions, and non-responsiveness of government support or mandate. This non-holistic deployment of DC's explains the lack of commercially-successful innovation projects identified by the participants. It is for this reason that triangulation was not possible.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions regarding research objective 1

Research objective 1 was to determine if DC's are a critical component of governance, and identify in which critical business areas they reside in. DC's are a firm's top management's abilities to **sense** and **seize** business opportunities by **transforming** competencies/resources/processes for innovative responses in rapidly changing business environments. David Teece, the founder of the DC's framework, states that this framework covers the critical management capabilities that are needed to sustain a firm's competitive edge. This means that DC's must be viewed from an organisational perspective with reference to their intrinsic innovation success. And yet much of research into DC's has been at an isolated capability (or business area) level. Through primarily literature review, this research's findings have contributed towards locating organisational DC's in the six business areas (or capabilities) of HR Management, R&D, technological and innovation, marketing, networking and collaboration, and managerial capabilities, which need to be deployed holistically to have an impact on innovation outcomes. The findings from this research's participants have not only confirmed these six capabilities, but have shown that isolated deployment of capabilities in the two entities of PetroSA and iGas did not have a positive impact on innovation outcomes.

Traditional corporate governance has long been the pre-occupation of many governance structures, including at Board levels. Literature however has not found a link between this model and innovation outputs. Many scholarly articles nowadays place the bureaucratic competence of unlocking innovation outcomes at the centre of entities' governance structures. This means the prioritisation of DC's, because of their intrinsic link to innovation outcomes, by the governance structures. This prioritisation role by the governance structures is thus complementary to the holistic deployment of DC's by the organisational management, serving as a final accountability mechanism. This research found that at the two entities there was no prioritisation of DC's at the governance levels. This was due primarily to a) Board being pre-occupied with the traditional corporate governance tasks of compliance, b) due to the Board not aligning corporate strategy to innovation outcomes through measures such innovation targets and incentives, and c) the Board doing very little to unlock the heavy compliance-burden that SA SOE's are generally subjected to. These actions were indications of the two entities' Boards not treating DC's as critical components of governance.

5.2. Conclusions regarding research objective 2

Research objective 2 was to investigate if the organisational deployment of DC's, or lack thereof, impacted innovation outcomes in the two selected South African state-owned entities of PetroSA and iGas. From scholarly articles on DC's, this research has identified the individual practices that are found in the six business areas wherein DC's reside. A determination was made from the research participants whether the individual practices' deployment was present, partially present or not present. The findings show that DC's were not consistently deployed by the two organisations' management in all the six business areas of HR, Research and Development, technology and innovation, marketing, networking/collaboration, and managerial capabilities. The findings show that management performed better with the DC's of transforming organisational resources because individual practices were mostly present. This was driven by the entities' capacitation with the best minds, mainly because these resources are totally within their control and does not require Board or shareholder approvals. With the DC's of sensing business opportunities, the practices that were not deployed were the incentivisation of innovation and the deployment of a dedicated R&D function. This action meant that there is no strategic alignment to business models, in the sense that innovative business solutions were proposed by the highly skilled employees and/or Management, but were not readily approved and deployed by the Board and/or government because these structures themselves had no approved targets to account to.

Regarding the DC's of seizing of identified business opportunities**,** the results show overwhelmingly that the Board and/or the government shareholder did not take timeous decisions with regards to prompt approvals for legal mandates, or offering regulatory and governance framework support. The two capabilities that require Board and/or shareholder approvals or interventions, viz DC's of sensing and DC's of seizing business opportunities, have generally been the main cause of missed opportunities. The research results' answer to the research objective is that DC's were not holistically deployed by the two SOE's of iGas and PetroSA. Because of this, the entities could, rather expectedly, not have had innovation outcomes and this was indeed proven to be the case.

The findings however do not positively link DC's deployment to innovation outcomes as there was no successful innovation outcome that came out of the interviews.

5.3. Overall conclusions regarding research objectives

The DC's framework has scarcely been researched in SA and this research offered an opportunity to add to such research work. It is also known that SA compares favourably internationally when it comes to traditional corporate governance models, which are embedded in legislative frameworks such as the PFMA (Public Finance Management Act, 1999 (Act of No.1 of 1999) for public entities. However, consistent with prior research results, this research has shown that this traditional governance has not unlocked innovation outcomes in the two entities of PetroSA and iGas. Whilst the DC's of transforming organisational resources was performed well by management, the two capability-practices that the research found to be responsible for lost innovative business opportunities were generally the two areas that needed Board interventions/actions. These were the DC's of sensing and seizing business opportunities, and the inadequate Board included very long-lead times for approvals, not setting up innovation targets and incentives, and no prompt approval of queries relating to entity-mandates. This research sheds light on the reasons for the lack of innovation, and thus the contributory effect to the prolonged financial losses that have been incurred by PetroSA over these years. iGas' private-public-partnership with Sasol has shielded it from such losses, however as the Sasol gas reserves begin to deplete, iGas' lack of organisational DC capabilities will spell disaster for future financial well-being.

Another area of concern that came up repeatedly is the lack of Board/shareholder support which manifested itself through very lengthy processes of decision-making that invariably led to lost opportunities. Government was also cited not to be ready to support non-historical business models that would have expanded businesses and partnerships. This was done through not fully exploring the entities' legal mandates beyond the historical business operations, which also invariably lost the entities business opportunities. These findings support previous researches that found that government-shareholding and legislative framework were restrictive to innovation outcomes. It would seem government is willing to support historical or original business models up until the juncture where such entities face existential threats. This research demonstrates the inextricable link between the institutional (or political or shareholder) governance and the entities' performances and their innovation outcomes, and the need for the prioritisation of DC's at shareholder level as well for energy SOE's. If this is not done, all innovative endeavours by the SOE's could seriously be in jeopardy as was the case in these two entities.

Table 5. Consistency table: research questions, conclusions and contribution to knowledge

#	Research Objective	Literature-based proposition	Conclusions from own research	Key differences between initial proposition and my findings
1	To determine if DC's are a critical component of governance, and identify in which critical business areas they reside in	DC's are a critical component of an entity's governance and organisationally reside in the business capabilities (or areas) of HR management, Research and Development (R&D), technology/innovation, marketing, networking, and management	The full set of DC's practices in the six business areas was not consistently prioritised as a critical component of the governance structures of the Board and/or government shareholder at iGas and PetroSA.	None.
2	To investigate if the organisational deployment of DC's, or lack thereof, impacted innovation outcomes in the two selected South African state-owned entities of PetroSA and iGas.	The appropriate deployment of DC's in the organisation, in the selected two South African SOE's led to more innovative outcomes, and alternatively lack of deployment thereof led to the absence of innovation outcomes.	The lack or incomplete deployment of the full set of DC's practices in the six business areas in the two selected SOE's led to the absence of innovation outcomes.	There was no successful innovation evidence to prove that deployment of DC's indeed leads to innovation outcomes.

5.4. Recommendations

The researched SOE's have shown to have a few elements of the DC's that they deploy successfully already. This research outcome will assist many SOE's managements and Boards in identifying the missing elements in their own entities so as to close that deployment gap. These include mainly the areas of incentivising innovation, a delegated R&D function, and facilitating (if possible) more timeous decision-making at either the Board of shareholder levels. It is recommended that the SOE's Executive managements introduce these missing practices in their entities so as to help increase innovation outcomes in their entities. The lack of Board and/or shareholder support has been shown to also hamper innovation outcomes, and this is driven mainly by their non-prioritisation of DC's practices. It is recommended that non-executive Board members also prioritise DC's by including/merging them into their bureaucratic-competence measurement tools. These interventions will benefit SA innovation output in the end for the betterment of socio-economic and environmental performances.

Policymakers are also urged to have a better appreciation of the DC's framework given their inextricable influence that these policymakers extend over these SOE's. Once done, it is recommended that they then prioritise such practices so as to act as enablers of innovation in their respective SOEs. It is also recommended that both entity-Boards and policymakers will foster more meaningful partnerships between these energy SOE's and CSIR so as to better close the area of insourcing technological capabilities into those entities.

5.5. Suggestions for further research

As stated earlier, this research does not definitively link deployment of DC's to innovation outcomes. In order to address this, it is suggested that in the future energy SOE's with proven commercial innovative energy technologies or business models must be deliberately sampled for inclusion in the study, and then a determination made whether their deployed management practices mirror those of the DC's framework.

The research findings show that that even if all the DC's were holistically deployed by management, if the shareholder support is not forthcoming then the successes of innovation proposals will be in jeopardy. This research had delimited such institutional influence, but because of its significant influence on the energy SOE's innovation performance, any further

research into SA energy SOE's has to consider this dynamic in the entities' innovation performances.

REFERENCES

Abrami, R. M., Kirby, W. C., & McFarlan, F. W. (2014). Why China can't innovate. *Harvard business review, 92*(3), 107-111.

Albertus, R. W. (2019). Diffusion of the Ethical Philosophy of Good Governance at the National Oil Company of South Africa. *Indian Journal of Corporate Governance, 12*(1), 59-70.

Albort-Morant, G., Leal-Rodríguez, A. L., Fernández-Rodríguez, V., & Ariza-Montes, A. (2018). Assessing the origins, evolution and prospects of the literature on dynamic capabilities: A bibliometric analysis. *European Research on Management and Business Economics, 24*(1), 42-52.

Alsartawi, A. M. (2018). Board independence, frequency of meetings and performance. *Journal of Islamic Marketing, 10*(1), 230-303.

Álvarez Jaramillo, J., Zartha Sossa, J. W., & Orozco Mendoza, G. L. (2019). Barriers to sustainability for small and medium enterprises in the framework of sustainable development—L iterature review. *Business Strategy and the Environment, 28*(4), 512-524.

Alves, A. C., Barbieux, D., Reichert, F. M., Tello-Gamarra, J., & Zawislak, P. A. (2017). Innovation and dynamic capabilities of the firm: Defining an assessment model. *Revista de Administração de Empresas, 57*(3), 232-244.

Anadón, L. D. (2012). Missions-oriented RD&D institutions in energy between 2000 and 2010: A comparative analysis of China, the United Kingdom, and the United States. *Research Policy, 41*(10), 1742-1756.

Arundel, A., Bloch, C., & Ferguson, B. (2019). Advancing innovation in the public sector: Aligning innovation measurement with policy goals. *Research Policy, 48*(3), 789-798.

Asensio-López, D., Cabeza-García, L., & González-Álvarez, N. (2019). Corporate governance and innovation: A theoretical review. *European Journal of Management and Business Economics, 28*(3), 266-284.

Assink, M. (2006). Inhibitors of disruptive innovation capability: a conceptual model. *European journal of innovation management, 9*(2), 215-233.

Baker, L., Newell, P., & Phillips, J. (2014). The political economy of energy transitions: the case of South Africa. *New Political Economy, 19*(6), 791-818.

Baker, L., & Shen, W. (2017). China's involvement in South Africa's wind and solar PV industries. In *Working Paper No. 2017/15. China Africa Research Initiative, School of Advanced International Studies*. Washington, DC: Johns Hopkins University.

Belloc, F. (2012). Corporate governance and innovation: A survey. *Journal of Economic Surveys, 26*(5), 835-864.

Belloc, F. (2014). Innovation in state-owned enterprises: reconsidering the conventional wisdom. *Journal of Economic Issues, 48*(3), 821-848.

Bezuidenhout, M. L., Bussin, M. H., & Coetzee, M. (2018). The chief executive officer pay–performance relationship within South African state-owned entities. *SA Journal of Human Resource Management, 16 (1)*, 13-20.

Bidandi, F., Anthony, A. N., & Mukong, C. (2022). Collaboration and partnerships between South African higher education institutions and stakeholders: case study of a post-apartheid University. *Discover Education, 1*(1), 1-14.

Boddy, C. R. (2016). Sample size for qualitative research. *Qualitative Market Research: An International Journal, 19*(4), 426-432.

Bootz, J.-P., Monti, R., Durance, P., Pacini, V., & Chapuy, P. (2019). The links between French school of foresight and organizational learning: An assessment of developments in the last ten years. *Technological Forecasting and Social Change, 140 (2019)*, 92-104.

Bortolotti, B., Fotak, V., & Wolfe, B. (2019, 3 Sep). Innovation at State-Owned Enterprises. *BAFFI CAREFIN Centre Research Paper.* Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3150280 on 20 Mar 2021

Breidenich, C., Magraw, D., Rowley, A., & Rubin, J. W. (1998). The Kyoto protocol to the United Nations framework convention on climate change. *The American Journal of International Law, 92*(2), 315-331.

Breznik, L., & Lahovnik, M. (2016). Dynamic capabilities and competitive advantage: Findings from case studies. *Journal of contemporary management issues, 21*(2016 Special issue), 167-185.

Burkhardt, P. (2019, 30 July). Eskom, Sasol Emit Over Half of S. Africa's Greenhouse Gas. *Bloomberg*. Retrieved from https://www.bloomberg.com/news/articles/2019-07-30/eskom-sasol-emit-over-half-of-south-africa-s-greenhouse-gas on 13 Mar 2021

Chen, Y., Wang, Y., Nevo, S., Benitez-Amado, J., & Kou, G. (2015). IT capabilities and product innovation performance: The roles of corporate entrepreneurship and competitive intensity. *Information & Management, 52*(6), 643-657.

Cinar, E., Trott, P., & Simms, C. (2019). A systematic review of barriers to public sector innovation process. *Public Management Review, 21*(2), 264-290.

Clarke, V., & Braun, V. (2013). Teaching thematic analysis: Overcoming challenges and developing strategies for effective learning. Retrieved from https://uwe-repository.worktribe.com/outputfile/937606 on 26 May 2021

Clarke, V., & Braun, V. (2014). Thematic analysis. In T. Teo (Ed.), *Encyclopedia of Critical Psychology* (pp. 17-37). New York: Springer.

Council, W. E. (2020). World Energy Trilemma Index 2020. *World Energy Council: London, UK.* Retrieved from https://www.worldenergy.org/publications/entry/world-energy-trilemma-index-2020

Creamer, T. (2021, 26 January). Eskom approaches court to have R23bn equity injection added back this year. *Engineering News*. Retrieved from https://www.engineeringnews.co.za/article/eskom-approaches-court-to-have-r23bn-equity-injection-added-back-this-year-2021-01-26/rep_id:4136 on 20 Feb 2021

Creamer, T. (2021, 17 September). PetroSA mulls geothermal as way to offset 'decommissioning liability monster'. *Engineering News*. Retrieved from https://www.engineeringnews.co.za/article/petrosa-mulls-geothermal-as-way-to-offset-decommissioning-liability-monster-2021-09-17/rep_id:4136 on 05 Mar 2022

Crompton, R., & Matsika, R. (2021). Energy in South Africa. In A. Oqubay, F. Tregenna, & I. Valodia (Eds.), *The Oxford Handbook of the South African Economy* (1st Edition ed., pp. 283-304). Oxford: Oxford University Press.

Cypress, B. (2017). Rigor or reliability and validity in qualitative research: Perspectives, strategies, reconceptualization, and recommendations. *Dimensions of Critical Care Nursing, 36*(4), 253-263.

Cypress, B. (2018). Qualitative research methods: A phenomenological focus. *Dimensions of Critical Care Nursing, 37*(6), 302-309.

Daniel, B. K. (2019). *What constitutes a good qualitative research study? Fundamental dimensions and indicators of rigour in qualitative research: the TACT framework.* Paper presented at the European Conference on Research Methodology for Business and Management Studies, Johannesburg.

Daniel, J., & Lutchman, J. (2006). South Africa in Africa: scrambling for energy. In S. Buhlungu, J. Daniel, R. Southall, & J. Lutchman (Eds.), *State of the nation: South Africa 2005-2006* (pp. 484-509). Michigan: Michigan State University.

Danilin, I. V. (2015). State-Owned Enterprises as innovation agents in Russia: new developments or innovation deadend? Retrieved from https://www.imemo.ru/files/File/ru/conf/2015/IVDanilin%202015%20ISA.pdf on 10 Mar 2021

Della Corte, V. (2013). Value creation, value distribution and the talented CEO. *Corporate Ownership & Control, 11*(1), 493-534.

Doz, Y. L., & Wilson, K. (2012). *Managing global innovation: Frameworks for integrating capabilities around the world*. USA: Harvard Business School Publishing Corporation.

Dreiling, A., & Recker, J. C. (2013). *Towards a theoretical framework for organizational innovation.* Paper presented at the 25 June Proceedings of the 17th Pacific Asia Conference on Information Systems (PACIS), Queensland University of Technology., Australia.

Dutta, S., Lanvin, B., & Wunsch-Vincent, S. (2018). *Global innovation index 2018: Energizing the world with innovation* (11th Edition ed.). Ithaca, Fontainebleau, and Geneva: Cornell University, INSEAD, World Intellectual Property Organisation.

Dutta, S., Lanvin, B., & Wunsch-Vincent, S. (2020). *Global innovation index 2020* (13th ed.): SC Johnson Cornell University.

Enterprises, D. o. P. (2002). Protocol on Corporate Governance in the Public Sector, p. 54 pp. Retrieved from https://www.gov.za/sites/default/files/gcis_document/201409/corpgov0.pdf on 20 Feb 2021

Filatotchev, I., Aguilera, R. V., & Wright, M. (2020). From governance of innovation to innovations in governance. *Academy of Management Perspectives, 34*(2), 173-181.

Florio, M. (2014). Contemporary public enterprises: innovation, accountability, governance. *Journal of Economic Policy Reform, 17*(3), 201-208.

Florio, M., Ferraris, M., & Vandone, D. (2018). Working Paper - State-Owned Enterprises: Rationales for Merges and Acquisitions. *CIRIEC Paper*(2018/01). Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3202219 on 29 Sep 2020

Forum, W. E. (2021). Fostering effective energy transition 2021. Retrieved from https://www.weforum.org/reports/fostering-effective-energy-transition-2021 05 March 2022

Gakusi, A.-E., Sartori, D., & Asamoah, J. (2015). Fostering Regional Integration in Africa: Lessons from Sasol Natural Gas Project between South Africa and Mozambique. *Open Journal of Social Sciences, 3*(10), 187-204.

Gallagher, K. S., Grübler, A., Kuhl, L., Nemet, G., & Wilson, C. (2012). The Energy Technology Innovation System. *Annual Review of Environment and Resources, 37*(1), 137-162.

Gallagher, K. S., Holdren, J. P., & Sagar, A. D. (2006). Energy-technology innovation. *Annual Review of Environment and Resources, 31 (2006)*, 193-237.

Gault, F. (2013). Handbook of innovation indicators and measurement. In. Massachusetts, USA: Edward Elgar Publishing.

Gault, F. (2018). Defining and measuring innovation in all sectors of the economy. *Research Policy, 47*(3), 617-622.

GCIS. (2021, February 19, 2021). Investment in research, development declines. Retrieved from https://www.sanews.gov.za/south-africa/investment-research-development-declines on 04 Mar 2022

Geddes, A., Schmidt, T. S., & Steffen, B. (2018). The multiple roles of state investment banks in low-carbon energy finance: An analysis of Australia, the UK and Germany. *Energy Policy, 115 (2018)*, 158-170.

Gershman, M., Bredikhin, S., & Vishnevskiy, K. (2016). The role of corporate foresight and technology roadmapping in companies' innovation development: The case of Russian state-owned enterprises. *Technological Forecasting and Social Change, 110 (2016)*, 187-195.

Gershman, M., Roud, V., & Thurner, T. W. (2019). Open innovation in Russian state-owned enterprises. *Industry and Innovation, 26*(2), 199-217.

Gloet, M., & Samson, D. (2016, 5-8 Jan 2016). *Knowledge and innovation management: Developing dynamic capabilities to capture value from innovation.* Paper presented at the 2016 49th Hawaii International Conference on System Sciences (HICSS), Koloa,HI, USA.

Goffin, K., & Mitchell, R. (2005). *Innovation management: Strategy and implementation using the pentathlon framework*. New York: Palgrave Macmillan.

Goffin, K., & Mitchell, R. (2016). *Innovation management: effective strategy and implementation* (3rd ed.). United Kingdowm: Macmillan International Higher Education.

Govender, K., Draai, E., & Taylor, D. (2019). The Influence of Legislation and Regulation on Strategy in Public Entities. *Journal of Reviews on Global Economics, 2019*(8), 449-457.

Goyer, M. (2001). Corporate governance and the innovation system in France 1985-2000. *Industry and Innovation, 8*(2), 135-158.

Guan, J., & Yam, R. C. (2015). Effects of government financial incentives on firms' innovation performance in China: Evidences from Beijing in the 1990s. *Research Policy, 44*(1), 273-282.

Gumede, W. (2019). Broken Corporate Governance: South Africa's municipal state-owned entities and agencies. In D. Everatt (Ed.), *Governance and the postcolony: Views from Africa* (pp. 194-213). Johannesburg: Wits University Press.

Guo, Y., & Zheng, G. (2019). How do firms upgrade capabilities for systemic catch-up in the open innovation context? A multiple-case study of three leading home appliance companies in China. *Technological Forecasting and Social Change, 144*(2019), 36-48.

Hameed, W. U., Basheer, M. F., Iqbal, J., Anwar, A., & Ahmad, H. K. (2018). Determinants of Firm's open innovation performance and the role of R & D department: an empirical evidence from Malaysian SME's. *Journal of Global Entrepreneurship Research, 8*(1), 1-20.

Herrmann, J. D., Sangalli, L. C., & Teece, D. J. (2017). Dynamic capabilities: Fostering an innovation-friendly environment in Brazil. *Revista de Administração de Empresas, 57*(3), 283-287.

Jia, N., Huang, K. G., & Man Zhang, C. (2019). Public governance, corporate governance, and firm innovation: An examination of state-owned enterprises. *Academy of Management Journal, 62*(1), 220-247.

Kanyane, M. H., & Sausi, K. (2015). Reviewing state-owned entities' governance landscape in South Africa. *African Journal of Business Ethics, 9*(1), 21-41.

Katsamunska, P. (2016). The concept of governance and public governance theories. *Economic alternatives, 2 (2016)*, 133-141.

Kikeri, S. (2016). An Incomplete Transition: overcoming the legacy of exclusion in South Africa. In G. Chortareas & E. Noikokyris (Eds.), *Republic of South Africa - Systematic Country Diagnosis*. South Africa: World Bank.

Larsen, T. H., & Hansen, U. E. (2020). Energy and Industrial Policy Failure in the South African Wind Renewable Energy Global Value Chain: The political economy dynamics driving a stuttering localisation process. *PRISM Working Paper, 2020*(3), 1-20.

Leifer, R., O'connor, G. C., & Rice, M. (2001). Implementing radical innovation in mature firms: The role of hubs. *Academy of Management Perspectives, 15*(3), 102-113.

Lutzenhiser, L. (1994). Innovation and organizational networks Barriers to energy efficiency in the US housing industry. *Energy Policy, 22*(10), 867-876.

Mabena, N. (2005). *Operating The Worlds Largest GTL Facility (Natural Gas-to-Liquids).* Paper presented at the 18th World Petroleum Congress.

Maeko, T. (2020, 19 Sep). Former iGas member accuses Gwede and CEF of interfering. *Mail & Guardian*. Retrieved from https://www.africa-energy.com/article/south-africa-cef-fills-vacant-ceo-posts on 2 April 2021

Mahlangu, B. P. (2014). *The impact of the maintenance management system on production output and profitability at the petroleum oil and gas corporation of South Africa (petrosa) gtl refinery.* (MComm in Business Management). University of South Africa, South Africa.

Manyathi, S., Burger, A. P., & Moritmer, N. L. (2021). Public sector procurement: A private sector procurement perspective for improved service delivery. *Africa's Public Service Delivery & Performance Review, 9*(1).

McGregor, L. (2014). Can South African State-owned Companies Succeed? *University of Stellenbosch: Hans Seidel Foundation. Retrieved July,* p. 2017. Retrieved from https://portal.regenesys.net/course/discussions/editors/kcfinder/upload/files/McGregor%2C%20L.%202015.%20Can%20State%20Owned%20Companies%20succeed.%20USB..pdf on 20 March 2021

Meissner, D., Sarpong, D., & Vonortas, N. S. (2019). Introduction to the Special Issue on "Innovation in State Owned Enterprises: Implications for Technology Management and Industrial Development". *Industry and Innovation, 26*(2), 121-121.

Mekwe, L. (2015). *A critical review of corporate governance reforms relating to South African state-owned enterprises.* (Mini Thesis for LLM Degree). University of the Western Cape, South Africa.

Mishra, R. K., & Kapil, S. (2018). Effect of board characteristics on firm value: evidence from India. *South Asian Journal of Business Studies, 7*(1), 41-72.

Momeni, M., Nielsen, S. B., & Kafash, M. H. (2015, 10-12 September 2015). *Determination of innovation capability of organizations: Qualitative meta synthesis and delphi method.* Paper presented at the 25th Annual RESER Conference, Denmark.

Moolman, S. (2015, 20 Mar). Infographic: Eskom tariff increases vs inflation since 1988 (with projections to 2017). *Power Optimal.* Retrieved from https://www.poweroptimal.com/infographic-eskom-tariff-increases-vs-inflation-since-1988-projections-2017/ on 11 March 2021

Muriuki, B. K. (2018 6 March). *Dynamic Capabilities as a Precursor to Corporate Innovation and Competitive Advantage: The Role of Human Capital.* Paper presented at the Proceedings of the 2nd Innovation Research Symposium, Nairobi, University of Nairobi.

Mustapha, N., Kruss, G., & Ralphs, G. (2018, March 2018). The future of state-owned enterprises in South Africa: Why R&D matters. *HSRC Policy Brief.* Retrieved from https://www.researchgate.net/profile/Nazeem-Mustapha-2/publication/324249080_The_future_of_state-owned_enterprises_in_South_Africa_Why_RD_matters/links/5ac761efaca272abdc5cde6c/The-future-of-state-owned-enterprises-in-South-Africa-Why-R-D-matters.pdf?origin=publication_detail on 10 Feb 2021

Naano, A. V. (2014). Ensuring the quality of the findings of qualitative research: Looking at trustworthiness criteria. *Journal of Emerging Trends in Educational Research and Policy Studies, 5*(2), 272-281.

Nassaji, H. (2015). Qualitative and descriptive research: Data type versus data analysis. *Language Teaching Research, 19*(2), 129-132.

Nem Singh, J., & Chen, G. C. (2018). State-owned enterprises and the political economy of state–state relations in the developing world. *Third World Quarterly, 39*(6), 1077-1097.

Noble, H., & Smith, J. (2015). Issues of validity and reliability in qualitative research. *Evidence-based nursing, 18*(2), 34-35.

Obino, E. (2018). *Relationship between Corporate Governance and Financial Performance of State Owned Entities in the Ministry of Industrialisation, Trade and Co-oparatives.* (Masters research). University of Nairobi, Nairobi.

Ockwell, D., Ely, A., Mallett, A., Johnson, O., & Watson, J. (2009). Low carbon development: The role of local innovative capabilities. In *Innovation, sustainability, Development: A New Manifesto*. Brighton: STEPS Centre and Sussex Energy Group.

Pachauri, R. K., Allen, M. R., Barros, V. R., Broome, J., Cramer, W., Christ, R., . . . Dasgupta, P. (2014). Climate change 2014: synthesis report. Contribution of Working Groups I, II and III to the fifth assessment report of the Intergovernmental Panel on Climate Change. In (pp. 151 pp). Geneva, Switzerland: Ipcc.

Pereira, V., Mellahi, K., Temouri, Y., Patnaik, S., & Roohanifar, M. (2019). Investigating dynamic capabilities, agility and knowledge management within EMNEs-longitudinal evidence from Europe. *Journal of Knowledge Management, 23*(9), 1708-1728.

Prag, A., Röttgers, D., & Scherrer, I. (2018). State-owned enterprises and the low-carbon transition. In *OECD Environment Working Papers* (Vol. 129). Paris: OECD Publishing.

Pretorius, P. (2018). *The implications of comprehensive and incremental approaches to public sector reform for the creation of a developmental state in South*

Africa: Case study of the Oceans Economy Operation Phakisa. (Master of Philosophy in Development Policy and Practice). University of Cape Town, Cape Town.

Priem, R. L., & Butler, J. E. (2001). Is the resource-based "view" a useful perspective for strategic management research? *Academy of management review, 26*(1), 22-40.

Rohrbeck, R., & Kum, M. E. (2018). Corporate foresight and its impact on firm performance: A longitudinal analysis. *Technological Forecasting and Social Change, 129*(2018), 105-116.

Rothstein, B. O., & Teorell, J. A. (2008). What is quality of government? A theory of impartial government institutions. *Governance, 21*(2), 165-190.

Saadatmand, M., Dabab, M., & Weber, C. (2018). *Dynamics of competition and strategy: A literature review of strategic management models and frameworks.* Paper presented at the 19-23 Aug Portland international conference on management of engineering and technology (PICMET), Honolulu, USA. IEEE.

Sagar, A. D., & Holdren, J. P. (2002). Assessing the global energy innovation system: some key issues. *Energy Policy, 30*(6), 465-469.

Shuen, A., Feiler, P. F., & Teece, D. J. (2014). Dynamic capabilities in the upstream oil and gas sector: Managing next generation competition. *Energy Strategy Reviews, 3*(September 2014), 5-13.

Singh, D. A., & Gaur, A. S. (2013). Governance structure, innovation and internationalization: Evidence from India. *Journal of International Management, 19*(3), 300-309.

Sipos, G. L., & Ionescu, A. (2018). The innovation-corporate performance relationship in emergent countries. *Procedia-Social and Behavioral Sciences, 238*(2018), 124-132.

Steffen, B., Matsuo, T., Steinemann, D., & Schmidt, T. S. (2018). Opening new markets for clean energy: The role of project developers in the global diffusion of renewable energy technologies. *Business and Politics, 20*(4), 553-587.

Stephens, J. C., Wilson, E. J., & Peterson, T. R. (2008). Socio-Political Evaluation of Energy Deployment (SPEED): An integrated research framework analyzing energy technology deployment. *Technological Forecasting and Social Change, 75*(8), 1224-1246.

Swilling, M., Musango, J., & Wakeford, J. (2016). Developmental states and sustainability transitions: prospects of a just transition in South Africa. *Journal of Environmental Policy & Planning, 18*(5), 650-672.

Teece, D. J. (2014). A dynamic capabilities-based entrepreneurial theory of the multinational enterprise. *Journal of international business studies, 45*(1), 8-37.

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic management journal, 18*(7), 509-533.

Thorne, S. (2000). Data analysis in qualitative research. *Evidence-based nursing, 3*(3), 68-70.

Ting, M. B. (2019, 1 June). Multiple Regime Interactions, Conversion, and South Africa's Liquefied Natural Gas. Retrieved from https://www.researchgate.net/publication/333696649_Multiple_Regime_Interactions_Conversion_and_South_Africa's_Liquefied_Natural_Gas on 25 Mar 2021

Ting, M. B., & Byrne, R. (2020, Feb). Eskom and the rise of renewables: Regime-resistance, crisis and the strategy of incumbency in South Africa's electricity system. *Energy Research & Social Science*. Retrieved from

https://www.sciencedirect.com/science/article/pii/S2214629619303275?casa_token=yk4AYmMPPXEAAAAA:a0y09IzEKIWyGa8VmF3ONgwZNGHUUJbu-xlQBfLvTq4LmrXCMNqRNbcb00P2hkUGwJT8_rSSNltG on 25 Mar 2021

Vaismoradi, M., Jones, J., Turunen, H., & Snelgrove, S. (2016). Theme development in qualitative content analysis and thematic analysis. *Journal of Nursing Education and Practice, 6*(5), 100-110.

van Vuuren, H. J. (2020). The Disclosure of Corporate Governance: a Tick-Box Exercise or Not? *International Journal of Business and Management Studies, 12*(1), 50-65.

Villasalero, M., Pinar, J. M., & García, F. P. (2011). Technological innovation and dynamic capabilities in the Spanish wind energy business. *Journal of Euromarketing, 20*(3-4), 18-38.

Walwyn, D. R., & Brent, A. C. (2015). Renewable energy gathers steam in South Africa. *Renewable and Sustainable Energy Reviews, 41*(2015), 390-401.

Waweru, N. (2014). Determinants of quality corporate governance in Sub-Saharan Africa. *Managerial Auditing Journal, 29* (5), 455-485.

Wei, S.-J., Xie, Z., & Zhang, X. (2017). From" Made in China" to" Innovated in China": Necessity, prospect, and challenges. *Journal of Economic Perspectives, 31*(1), 49-70.

West, E. (2019, 11 Sep). PetroSA reports R382.3 million net loss, will run out of gas reserves next year. Retrieved from https://www.iol.co.za/business-report/economy/petrosa-reports-r3823-million-net-loss-will-run-out-of-gas-reserves-next-year-32758229 on 10 Jan 2021

APPENDIX A – INTERVIEW GUIDE

Actual Research instrument

Research questions and prompts

Further probing may occur depending on how the interview progresses.

1. Please confirm the start and end dates, in months and years, that you were involved with the entity? [Please note the below questions are in reference to this tenure].

DC's of sensing business opportunities

2. How did management **sense** business opportunities (e.g. energy technologies of interest) and which tools (e.g. corporate foresight) did it use for assistance in this regard?
    a. how did management systemise an innovation culture to enable better economic performance?
    b. How was R&D internally aligned to responding to customers' needs on a continuo basis?
    c. How did management improve employees' intrinsic belief in their abilities to be the drivers of innovation?
    d. What was management's strategy towards closing the technological gap to the entity's competitors?
    e. How did the entity's legal mandate and/or Ministerial and shareholder compacts stimulate or stifle innovation goals and/or culture?

DC's of transforming organisational resources

3. How was management able to **transform** its internal resource base's capabilities to better adopt to approved company innovations?
    a. Why was it important that highly-skilled personnel embrace the continuous learning culture?
    b. How did management ensure company was capacitated by the best engineering minds, and how were their good ideas sourced and put to good use?

c. What was management's views on partnering with other energy technology firms or partners for new technology acquisition, adoption or deployment?
d. How was internal technology capability upgraded to facilitate timeous information-sharing and relevant decision-making?
e.

DC's of seizing business opportunities

4. How did management ensure that identified innovative business/innovation opportunities were **seized** and timeously?
    a. How was management decision-making facilitated to timeously respond to presented business opportunities?
    b. How was marketing used to ensure success of such opportunities?
    c. How did management identify critical stakeholders and sustain collaborations for sustainable mutual benefits?

5. The above practices are DC's found in the six business areas from literature review – can you think of any additional DC's, and explain how they would have been deployed?
6. Do you believe/think that the capability-practices described above (i.e. DC's practices) were or are part of an entity's governance responsibilities?

APPENDIX B – CONSISTENCY MATRIX

RQ #	State Research Question or Objective	State Proposition	DC's subset	Data collection detail	Data analysis method
1	To determine if DC's are a critical component of governance, and identify in which critical business areas they reside in	DC's are a critical component of an entity's governance and organisationally reside in the business capabilities (or areas) of HR management, Research and Development (R&D), technology/innovation, marketing, networking, and management	N/A	Interview questions 5 and 6	Thematic analysis
2	To investigate if the organisational deployment of DC's, or lack thereof, impacted innovation outcomes in the two selected South African state-owned entities of PetroSA and iGas.	The appropriate deployment of DC's in the organisation, in the selected two South African SOE's led to more innovative outcomes, and alternatively lack of deployment thereof led to the absence of innovation outcomes.	Are DC's practices part of governance	Interview question 6	Thematic analysis
			Sensing business opportunities using corporate entrepreneurship at managerial levels, creating an innovation culture, and adopting the strategy and business model accordingly	Interview question 2	Thematic analysis
			Transforming organisational resources of HR, R&D, technology and innovation, marketing, collaboration and management to respond appropriately through a learning culture.	Interview guide question 3	Thematic analysis

			Seizing business opportunities through entrepreneurship and collaboration and networking with stakeholders.	Interview guide question 4	Thematic analysis

Appendix C – Consent Form

CONSENT FORM

I hereby agree to participate in a research study about the deployment of dynamic capabilities by management in the selected state-owned entities of PetroSA SOC and IGas SOC to increase innovation outcomes and performance therein. This study will help policymakers, academia and South African state-owned Entities' management to better appreciate the applicability of the broader dynamic capabilities in State Owned Entities to improve innovation outcome and thereby lead to their business sustainability.

I understand that I am participating voluntarily and under no duress and agree to the interview being audio-recorded. I understand that I can withdraw from the study at any time and this decision will not in any way affect me negatively. I understand that this is a research project whose purpose is not to benefit me personally.

I understand that my participation will remain confidential and my name will not be mentioned in the research report or presentation.

_____

Participant's signature

Date:

Appendix D – Participation information sheet

Governance and Dynamic Capabilities in South African state-owned energy companies

I am inviting you to take part in the above-titled research study which I believe will add to the cumulative study of a topic that is less researched in South Africa, whilst helping to bring light to innovation capabilities needed at senior management level in the public sector.

My name is Xola Stock and I am undertaking this research as part of the completion of the Masters in Energy Leadership course at the Wits Business School. This research looks into how governance can be used to unlock bureaucratic competence in senior management of state-owned energy companies to unlock innovation outcomes therein. In particular, the research explores how the deployment of dynamic capabilities or lack thereof, which have been proven successful elsewhere internationally, impacts innovation outcomes in the two South African energy entities of PetroSA and iGas.

Your choosing to participate in this research will involve an interview with myself at a location or technology platform of your choice. The interview will focus on your knowledge/observance of the deployment, or lack thereof, by senior management of innovation-unlocking capabilities. These capabilities will have been expected in the areas of HR, Research and Development, innovation/technology, marketing, networking and management. Permission to audio-record the interview will be requested from you, however anonymity and confidentiality will be guaranteed.

You have been selected to participate in this research because of a reasonable expectation of your knowledge of senior management practices, given your association and/or interactions with the researched entities. Your participation is completely voluntary and thus you have the right to refuse participation, refuse any question and withdraw at any time without any consequence whatsoever.

Confidentiality will be guaranteed by restricting access to audio records to only the interviewer, and deleted once they are transcribed anonymously using codes instead of names. Such initial transcripts will be password-protected and stored in my hard drive for a maximum period of four years, thereafter it will be destroyed and you will be informed accordingly. No reference

will be made whatsoever on the report to your details. Similarly, the signed consent forms will be retained in my home office until after my degree has been conferred.

The final report of the research, which will be shared with you, will be used for submitting to Wits Business School for degree finalisation purpose.

Thank you.

Kind Regards
Xola Stock
072 332 8255

Appendix E – Ethics Clearance Letter

Graduate School of Business Administration
University of the Witwatersrand, Johannesburg

Wits Business School Ethics Committee
Constituted under the University Human Research Ethics Committee (Non-Medical)

Ethics Clearance Certificate

Ethics protocol number: WBS/EL2368534/681

This certificate is only valid with a legitimate ethics protocol number and signed by the Researcher (below).

Project title	Governance and dynamic capabilities in South African state-owned energy companies
Investigator / Researcher	Mr Xola Stock
Nature of Project	MM (Energy Leadership)
Decision of the Committee	Approved, provided stakeholders and participants are guaranteed confidentialty.
Issue Date of Certificate	2021-11-30
Expiry date	Date of submission of the project report
Chairperson	Prof Anthony Stacey ☎ +27 11 717 3587 +27 82 880 4531 anthony.stacey@wits.ac.za

Declaration by Researcher

One copy must be signed by the Researcher and returned to the Chairperson of the Wits Business School Ethics Committee.

I fully understand the conditions under which I am authorized to carry out the abovementioned research and I guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I undertake to resubmit the protocol to the Committee.

Signature

01 Dec 2021
Date: