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An Investigation into Modes of Technological Disruption in South African Businesses

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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 the field of Digital Business

Johannesburg, 2021

ABSTRACT

The term and understanding of disruption remains an engaging and expansive space. Seminal works of literature ranging from Joseph Schumpeter to Clayton Christenson have introduced the concept of technology disruption and its subsequent effects.

However, this research has predominately been focused on the pre-digital era. Technology advancements have created tectonic changes in the business world and resulted in a myriad of outcomes in what is being termed the 'era of digital.'

To date, the literature on technological disruption in this digital era has been filled through thought-leadership and point-of-view pieces by leading consultancy and professional service organisations and revealed a gap in the theoretical applications of technological disruption in the business world.

This study followed a constructivist paradigm and positioned whether technology disruption can be explained in terms of a market engagement, demand, and production disruption model.

A purposive sampling method was executed using the researcher’s professional network across a set of 11 interviews. The sample represented an adequate number of male and female respondents, senior executives, mainly over the age of 40, from multiple South African industries, occupying various C-Suite roles. The results of the survey supported the model and the interlinkages between the different technology modes. These findings have implications on how technological change creates disruptive opportunities or threats for firms and how they can take advantage of it. Suggestions for future research are provided.

KEY WORDS

Disruption, Modes, Technology

DECLARATION

I, _____Nahim Yusuf Bassa_____, declare that this research report 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 the field of Digital Business 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: N. Y. Bassa Signature: 

Signed at ……Johannesburg, South Africa……..…

On the ……16th…….. day of ……October…… 2021.

DEDICATION

I want to dedicate this research report to my parents, Mr. Yusuf Abdul Hack Bassa and Mrs. Dellarose Bassa.

ACKNOWLEDGEMENTS

This work would not be possible without the unwavering support of my wife, Basheera Bassa, and my family and the sacrifices they have made in the pursuit of these studies.

In addition, special thanks to Professor Brian Armstrong for his supervision and guidance, without which this report would not be possible.

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CHAPTER 1. INTRODUCTION

1.1 Purpose of the study

The purpose of this study is to theoretically ground a framework on the 'modes' by which industries and firms are subjected to technological disruption, or conversely, can exploit technological change to disrupt sectors or markets in their favour.

The underpinnings of disruption can be traced back across decades - featuring seminal works such as Schumpeter's 'Gales of Creative Destruction' (Schumpeter, 1942) and Christensen's 'Innovation Dilemma' (Christensen, 1997).

However, the rapid deployment of new technologies and novel business models in this new digital era has introduced previously inaccessible industry entry points and the targeting of non-customers (McGrath, 2020).

This has led to a spate of new literature on technological disruption, but one that has been dominated by management consultancy thought-leadership and point-of-view pieces, resulting in a slew of opinions and conceptual approaches without the appropriate theoretical underpinnings and applications in the digital era.

Therefore, this research seeks to understand how technological change creates disruptive opportunities or threats for firms and how they can exploit technological change to disrupt sectors or markets in their favour.

1.2 Context of the study

The term disruption is quoted frequently in academic literature, business circles, and personal settings but is often misunderstood, misused, or misplaced (Christensen, McDonald, Altman, & Palmer, 2018). This has led to a dilution of disruption theories and results in people and organisations making confusing decisions that are strategically incongruent (Markides, 2006).

In a recent interview, Clayton Christensen claimed that people "misunderstand disruption" and that "it does not mean "breakthrough" or "new and shiny with "far too many people assume that disruption is an event" (Christensen, 2020).

The demise of Eastman-Kodak (Shih, 2016) and the rapid growth of Uber (Moon, 2015) can serve as examples of this confusion when it comes to disruption. The former can be argued to be a technological disruption due to not commercialising a newer technology (and subsequent cannabilisation of the existing business) while the latter being a business-model disruption (as it reconfigured via an app how riders engaged with taxi transportation). However, this is dependent on whose interpretation of 'disruption' is being applied (Hopp, Antons, Kaminski, & Oliver Salge, 2018).

It may also demonstrate the relative position being taken and the ongoing nature of disruption. For example, in the case of Uber, the disruption can also be argued to be 'disruptive' against private limousine services while more 'sustaining' against yellow or black-cab taxi services (Christensen, Raynor, & McDonald, 2015).

People and organisations can also struggle to correctly attribute the mechanism and response to the type of disruption they face, as its impact can vary by sector and industry (Schumpeter, 1942).

In the case of Yellow Pages, print directories were displaced by internet search engines. However, it could be argued that this was down to Yellow Pages exceeding customer needs, as Christensen's Theory of Disruptive Innovation would suggest. Still, a case could also be made that they were displaced because the companies producing the Yellow Pages simply did not have the ability to respond economically (King & Baatartogtokh, 2015).

The Theory of Disruptive Innovation would also suggest that the response to displacement by the US Postal or Canada Post firms to email would have required them to establish their server capabilities in response to AOL Inc. Still, it can also be presented that neither firm had control over the means to access the new capabilities and required resources to compete in this new digital world (King & Baatartogtokh, 2015).

Therefore, technology disruption cannot be understood using one approach or response mechanism under a set of limiting pre-defined conditions. This is even more crucial when dealing with the pace and interconnectedness of change that disruption brings.

Emerging digital technologies such as automation, blockchain, artificial intelligence, distributed cloud computing, internet-of-everything, and autonomous things (Gartner, 2020) impact industry value creation and business structures (Matt, Hess, & Benlian, 2015).

These technologies allow entry points into new or adjacent industries increasingly characterised by convergence (Hacklin, Battistini, & Krogh, 2013). They also enable new business models that target non-customers (Christensen, 2020) and simultaneously reduce customer friction points and improve efficiencies (McGrath, 2020).

Digitalisation has therefore changed the traditional market-based views of the structure of industries and the basis of competitive advantage. Industry boundaries that have previously defined businesses by their attractiveness and ability to generate monopoly 'rents' (Porter, 1980) have become blurred.

With physical assets becoming increasingly dematerialised, the drivers of distinctive competitive advantage - scale and scope - have now become parity factors. Industries are blurring due to technological convergence of digitalisation and the internet - thus requiring a broader view of the competitive landscape beyond narrowly defined industry boundaries and the drivers of competitive advantage (Venkatraman & Subramaniam, 2002) and importantly, the growing appreciation of the role of complementors.

Digitalisation has also dynamically changed the relative power of market participants and the likelihood of new industry actors. The increasing capacity and capabilities of smart, connected products reshape competition within industries and expand industry boundaries. This, in turn, raises a new set of strategic choices about how value is created and captured, how companies work with traditional and contemporary partners, and how they secure a competitive advantage in this new landscape (Porter & Heppelmann, 2014).

Digitalisation has equally impacted the resource-based view of competitive advantage and strategy. As some resources become more scarce, more valuable, and more strategic - thus disrupting 'Ricardian rents' (Grant, 2017) - others are becoming more abundant, allowing small and medium enterprises to rapidly enter and scale into international markets (Lee, Falahat, & Sia, 2019).

The rise of the platform business models has also been argued to 'invert' strategy (Van Alstyne, Parker, & Choudary, 2016) with network effects and reduced friction costs being the primary drivers, resulting in the obsolescence of value-chain business models. Technologies such as the internet of things, artificial intelligence, and blockchain are projected to significantly impact the development and shape of the future platform economy (Moser, 2018).

These could be argued to be disruptive on the essence or basis of competitive advantage and strategy and organisations. Christensen was also aware of the fact that technology-driven changes left space for further study. In the same interview quoted earlier, he stated, "certainly the fact that digital platforms can emerge and expand is something that I just had not conceived of early in our research and deserved further study" (Christensen, 2020).

This research, therefore, seeks to contribute to an understanding of *how* technological change creates disruptive opportunities or threats for firms by:

a. Postulating an intuitively deductive framework for the modes of technological disruption;
b. Exploring the theoretical foundations and merits of the framework; and
c. Assessing the applicability of the framework via expert interviews.

If found to be valid and generally applicable, the benefit of this framework is that it would provide insight into how firms could identify and respond to opportunities and threats arising out of profound technological change.

1.3 Research problem

Organisations face a plethora of challenges due to rapidly changing technologies that impact business models in the new digital era (Teece, 2009). Increased competition

in the form of digitally led, mobile-first start-ups (CB Insights, 2020) and the technology convergence of industries (Webb, 2020) have exacerbated the need amongst business managers to respond using new strategic frameworks and models built for the digital era.

Seminal works ranging from Schumpeter's 'Creative Destruction' (Schumpeter, 1942), Rogers' Diffusion of Innovation (Rogers, 1995), Teece's 'Profit Model' (Teece, 1986), Utterback-Abernathy's 'Dominant Design' (Utterback & Abernathy, 1975), Henderson-Clark's 'Architectural Innovation' Model (Henderson & Clark, 1990), Christiansen's 'Disruptive Innovation' (Christensen, 1997) and Markides' 'Strategic Innovation' (Markides, 2006) have all played a critical role in seeking to explain disruption across multi-disciplinary communities in a pre-digital era and will be discussed in the Literature Review (refer Figure 1: page 22).

However, managers of today are required to operate in a new digital context with increasing pressure to calculate the value to be 'won' in the digital market, how best to leverage existing capabilities, and how to work collaboratively (King & Baatartogtokh, 2015) to achieve superior and sustainable results.

Therefore, a gap exists between the theoretical expositions of the seminal works and their application in the practical strategic processes of today. This gap has been filled with a plethora of thought-leadership and point-of-view articles that describe how new technologies may impact the market but without the robustness or validity of a theoretically grounded model.

1.4 Research question

Based on the research topic stated above, the research question has been formulated as follows:

1.4.1 Sub-problem 1: Can technology disruption be explained in terms of market engagement, demand, and production disruption?

This research aims to find out if a model could be postulated that focuses on the modes of disruption. This paper thus is based on corporate South Africa as the best

opportunities for the application of the model. The author chose an approach that centered on the intersection of technology and business, which then required the research question to be further defined into a set of subsequent sub-questions that will need to be addressed:

1. What are the extraneous drivers of technological change?
2. What is technology disruption, and how does it manifest?
3. What are the modes by which extraneous technological change can disrupt an industry or firm?
4. What are the different outcomes of these technological changes?
5. Why are there different outcomes of these technological changes?

1.5 Significance of the study

This study seeks to achieve the following theoretical and empirical objectives:

1.5.1 Theoretical Significance

- To review the literature on the definition and theories of disruption;
- To review the literature on how technologies are disruptive; and
- To review the literature on the impacts of technological disruption.

1.5.2 Empirical Significance

- To investigate the role of disruption in the era of digital;
- The creation of a theoretically sound framework based on deductive reasoning; and
- Conduct an exploratory study to assess the applicability of the framework on the modes of disruption.

1.6 Practice-oriented utility significance

Though there is a vast body of work in recent (since 2010) academic literature on disruption theory (>520k search results on google scholar) and the diffusion of technology (>980k search results on google scholar) – it remains nascent as a

coherent body of work when it comes to technology-based disruption in the digital era (<17k search results on google scholar).

By contrast, there are over 120 million search results on google.com when it comes to technology-based disruption. These results mainly focused on digital transformation and are dominated by thought-leadership contributions and opinion pieces of leading consultancy/professional services firms (Tolboom, 2016).

The emergence and expansion of digital platforms into other arenas has been visibly demonstrated by Google's self-driving vehicles, Amazon's foray into the delivery of shopping by drones, and leading pharmaceuticals investing in the potential of 3-D printing medication at home (WEF, 2016). This has created an opportunity for further research and discussion within the existing body of disruption literature (Christensen et al., 2018).

So, how these technological changes create disruptive opportunities or threats for firms becomes an important and interesting question to be answered.

1.7 Delimitations of the study

This study is delimited to the following:

I. There are many causes of disruption; the focus of this paper is technology disruption in the era of digital;
II. Though there are many theories, models, and frameworks, this study aims to bridge the gap between the existing literature and applications in the digital era;
III. This study proposes a theoretically grounded framework on the modes of technology disruption; and
IV. The framework will be tested for feasibility using expert interviews to test the modes of disruption.

1.8 Definition of terms

This study has the following important terms that need to be defined:

Disruption: a situation in which it is difficult for something to continue in the normal way; the act of stopping something from continuing in the normal way (Oxford Advanced Learner's Dictionary, 2020).

Innovation: Any improvement that results from purposive design in search of profit (Francois & Lloyd-Ellis, 2003).

Invention: Formulation of new ideas for products and services (Spencer & Kirchoff, 2006).

Non-customer: A three-tier segmentation of a market cohort currently not consuming a product or offering (Kim & Mauborgne, 2004).

1.9 Assumptions

For this study, the following assumptions were made:

I. Existing disruption theories do not extend particularly well in the era of digital;
II. A gap exists in the literature between the theory and applications;
III. Though there are many forms of disruption, the proposed framework can be feasibly tested based on expert interviews of technological disruption; and
IV. The framework can aid strategic decision-making on how technological change creates disruptive opportunities or threats for firms.

CHAPTER 2. LITERATURE REVIEW

2.1 Introduction

In today's era of digital, companies are buffeted by economic, social, and political headwinds. Profits and revenue streams are increasingly under threat with the need to drive value creation using new technologies. These technologies, ranging from social media, mobility, analytics, and cloud computing, have a disruptive effect on the economic profit equation and create new products and services (Atluri, Eaton, Kamat, Rao, & Sahni, 2018).

The literature review begins by defining the extraneous drivers of change, specifically focusing on technology and its sub-drivers that cause a firm to respond to these changes.

The author then explores what technology disruption is and how it manifests. This is important as it addresses the fundamental question of disruption and its effects on the profit equation.

This is followed by the modes by which extraneous technological change can disrupt an industry or firm.

This leads to the exploration of the different outcomes of those technological changes, focusing on examples of technology and the impacts that they have had on specific companies, sectors, and industries. While there is wide-ranging evidence of obsolesce and bankruptcy, there is also evidence of resource migration towards creating new ventures and alternate markets (Pe'er & Vertinsky, 2008).

The author also explores why there are different outcomes of these technological changes. Specifically, why do some changes have disproportionate impacts while others lead to more measured outcomes? Are there any inferences that this can gain, and how do these connect with the nature of disruption?

The literature review is then concluded by looking at what does this all mean? Can a framework be posited to understand how technological change creates disruptive opportunities or threats for firms and how they can exploit technological change to

disrupt sectors or markets in their favour? What would the hypothesis be to test the working of the framework?

2.2 Definition of topic or background discussion

Digital disruption is an ambiguous buzzword being used to describe changes in firms and industries by the introduction and influence of digital technologies. Academics and management practitioners have all referenced disruption without a clear definition or one that is widely adopted. These references are primarily hand-picked or curated examples of the individual underlying technologies rather than a conceptual understanding of the term and its applications (Caylar, Noterdaeme, & Naik, 2016).

But what are these digital technologies? Management consultancy firms such as Accenture, PWC, and KMPG recognise social, mobile, analytics, and cloud computing (SMAC) as digital technologies driving business innovation affecting social and economic life (Forbes, 2016).

However, there are other views of what is classified as 'digital' technology. In the narrow sense, 'Digital' could be argued to be technologies related explicitly to computation, data storage, and networking. It would include embedded and real-time operational applications of information technology (IT). This narrower interpretation has artificial intelligence, the internet of autonomous things, big data, and blockchain (Westerman, Bonnet, & McAfee, 2014).

'Digital,' in the broader sense, can be extended to include other fields of technological innovation, for example, including 3-D printing, drones, robotics, the transformation of energy and propulsion technologies, neuro-tech and biotech, and genomics. In this sense, it is used synonymously with technological innovation (Westerman, Bonnet, & McAfee, 2014).

This choice of digital technology definition is crucial as in almost every instance; disruption is precipitated by a new technological opportunity, which entrepreneurs exploit via different paths, depending on their decisions (Gans, 2020).

Equally important is the acknowledgment that technology on its own cannot fully exploit its intended effects. It needs to be balanced amongst the changes its usage

creates, the changes it promulgates in value creation, the resultant structural changes of the firm or industry it drives, and the effect of changes on the financial dimensions. With many diverse technologies in use and the many different forms of value creation, a structural change is often required to provide a new operations foundation to generate different financial outcomes (Matt, Hess, & Benlian, 2015).

Thus, technology in the digital era has become an interdisciplinary topic, frequently mentioned but rarely analysed and, therefore, by extension, poorly understood (Teece, 2009).

Clayton Christensen reemphasised this by stating, "certainly anomalies are waiting to be discovered, and further research into digital-focused firms will yield profound insight into the boundaries of disruptive innovation theory" (Christensen, 2020).

Historically, the literature on disruption can be traced back to Schumpeter's old linear models (pre-1950's to 1970s) and the technology-push versus demand-pull nature of technology consumption. This was followed by the conceptual approaches (between the 1970s-1990s), highlighting the learning effects and curves, followed by the systems approach of the 1990s-2000s. This last phase can be classified as systemic and hierarchical innovation, which focuses on disruption and technology transition theory (Greenacre, Gross, & Speirs, 2012).

The literature and discussion up to the early 2000's focused mainly on the value and delivery of technology. Still, it could also have an equally transformative effect on the economics of a firm and industry. It can be argued that after the turn of the millennium (post-2000), heightened competition drove profit-seeking firms to meet varied and aggregated consumer wants through constant invention and presentation to the consumer on new value propositions.

In Figure 1, these are visually clustered into periods of disruption theory, which reveals repeating patterns of technological revolutions that have created new and profitable commercial possibilities (Denning, 2014).

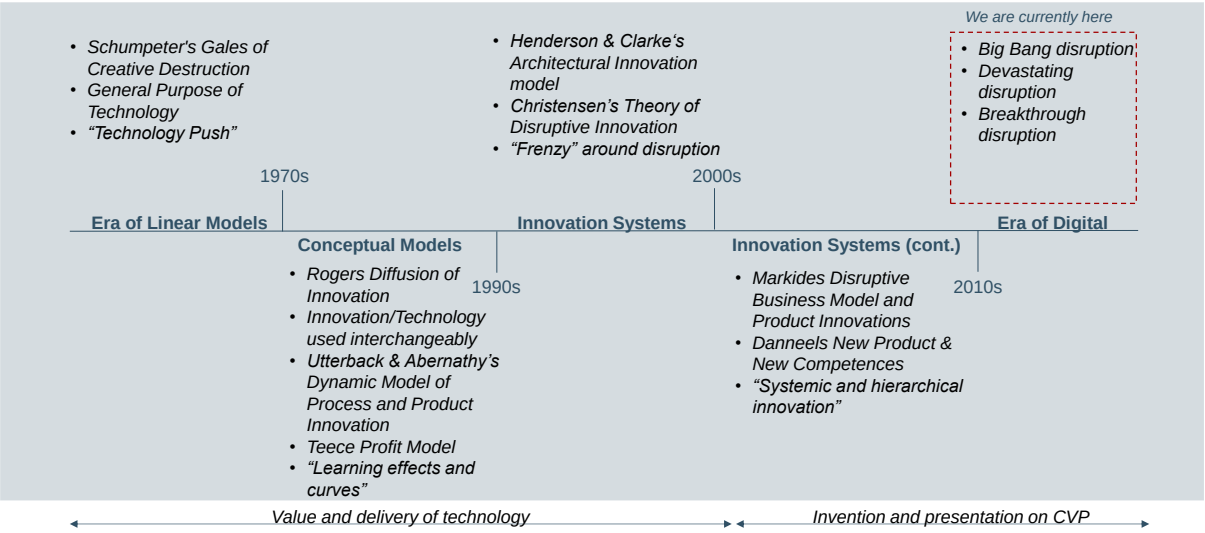

Figure 1: Historic Literature Contextualisation

These are exhibited through the novel uses of technology, the changes in business models, and the onboarding of new sources of revenue while reducing costs (Teece, 2009). With this in mind, the question of whether technology disruption can be explained in terms of the modes of disruption, namely market engagement, demand, and production disruption, is explored.

2.3 Can technology disruption be explained in terms of the modes of disruption, namely market engagement, demand, and production disruption?

2.3.1 *What are the extraneous drivers of technological change?*

The increasing use and diffusion of digital technologies are changing industries and, ultimately, our everyday lives (Yoo, 2010). The technologies are described as a combination of mobile internet, cloud technology, processing power, big data, new energy supplies, the internet of things, the sharing economy, artificial intelligence, biotechnology, and advanced materials (WEF, 2016). Their strength is not in the technology themselves but in how organisations integrate them to transform businesses and operate in the future (Kane, Palmer, Phillips, Kiron, & Buckley, 2015).

The primary use and the associated value of the human resource using these new technologies will radically change as these technologies mature (WEF, 2018). In the future, companies' work and money generation will be very different from the industrial era, where scale was required to drive efficiencies, and value was relatively simple to capture (Teece, 2009).

As Christensen pointed out in his Theory of Disruption Innovation, disruption starts with low prices. It initially offers performance attributes that are not fully valued on the performance dimensions of the traditional market. As time passes, these new entrepreneurial ventures improve and eventually rise and eat into the existing market (Christensen, 1997).

This is a definitive explanation of how the internet and web-enabled services had disrupted many conventional media and publishing businesses when the internet was a pre-commercial endeavour (Crémer, Rey, & Tirole, 1999).

However, the introduction of digital technologies such as machine learning and artificial intelligence can be game-changers. New technological entrants (such as Picnic or Hema) have the power to rapidly scale and expand into other markets and businesses such as online retail and physical grocery stores (Cusumano, Yoffie, & Gawer, 2020). The recent rise of blockchain has also visibly demonstrated the capacity for a new digital technology to disrupt an industry – in this case, financial services (Ito, Narula, & Ali, 2017).

Therefore, technology has become intertwined with disruption and created anxiety amongst business leaders. These changes lead to resources being deployed more dynamically and creating industries with "few big winners" for firms effectively exploiting change and "many small losers" for those who do not. This is known as the 'Superstar Firms' effect (Kurz, 2017; Bajgar, Calligaris, Criscuolo, Marcolin, & Timmis, 2019), with resources flowing to the firms that can better exploit them.

The novel coronavirus (COVID-19) is an example of how a tremendous shock to world economies has directly acted as a catalyst to allocate resources from traditional, face-to-face contact to digital business and the provision of services for both profit and non-profit organisations alike (Accenture, 2020). Technology, in this sense, is not just a

disruptive force or enabler of macroeconomic change but rather the connective fabric linking businesses, governments, and societies (Webb, 2020).

Previously, the underlying drivers of technological change were due to one or a combination of factors, including increasing maintenance costs of the technology estate, the effects of global competition, and changing economies of scale alongside shifting social conditions (King & Baatartogtokh, 2015).

However, when it comes to disruption and its determinates, there is a need to understand the underlying drivers and not just the role of technology disruption (Bradley & O'Toole, 2016). Technology-based and report-styled consultancy views alongside academic reports have attempted to categorise technological disruption's value and sources to varying degrees.

By way of example, Accenture has identified five sources of change for the forthcoming decade. These include digital experiences, artificial intelligence, intelligent things, robotics, and continuous innovation (Accenture, 2020), highlighting some of the technology clashes expected in the future and how businesses should be prepared to respond.

McKinsey, in turn, has proposed that technology can have up to eight value levers that can generate an economic impact (Caylar, Noterdaeme, & Naik, 2016). These technology value drivers range from time-to-market, service & aftersales, resources and processes, asset utilisation, labour, inventories, quality, supply and demand, with businesses using social technologies to collaborate and develop new services delivered through the cloud (McKinsey, 2011).

On the other side of the coin, academic literature has focused primarily on the interplay between technology and other factors such as politics, economics, and social aspects, but they can be independent variables.

Webb, in Figure 2, identified eleven sources of disruption (Webb, 2020), such as wealth distribution, infrastructure, educations, government, geopolitics, economy, demographics, environment, media, and telecommunications, which drive technology-based disruption.



Figure 2: Future Forces Theory (Webb, 2020)

In his Theory of Jobs To Be Done, Christensen emphasized that the critical technology driver is one of being an experience disrupter (Christensen, Hall, Dillon, & Duncan, 2016). Other academics have positioned that regulation and legal structures dictate and allow change to occur (Teece, 2009).

The research has revealed many identifiable sources of change and disruption, with technology being one of several drivers. None of these extraneous drivers are independent of each other and appear to be strongly linked by technology. The challenge here is that no rooted objective framework exists, so it is unclear if the linkage is grounded, are just propositions, hypotheses, or superfluous.

COVID-19, as mentioned previously, could be the single biggest extraneous disruptor for the last 50 years. Still, it is arguably less structurally disruptive than the cumulative impact of the last decade's worth of technology change. This can be evidenced by the rapid collaboration, new ways of work, and innovation that is currently being undertaken (McKinsey, 2020)

Ironically, though the virus has caused significant economic dislocation, technology stocks for e-commerce, streaming, online food delivery, gaming, and cloud companies have seen increasing demand and emerged as 'structural' winners (CNBC, 2020).

Thus, it can summarise that digital technologies differ from other macro extraneous drivers by providing open and flexible environments that allow organisations to break from their current constraints and rapidly shape new ways of doing things. This is particularly important as the driver of technological change as they influence both the potential path and impact that the technology may have on a business and industry (Piccinini, Gregory, Hanelt, & Kolbe, 2015).

2.3.2 *What is meant by disruption, and how does it manifest?*

Disruptive technology and disruptive innovation were seldom used before Clayton Christensen. To understand its context, there is a need to go to the roots of disruption, which can be traced back to the linear model ear of the pre-1950's to 1970s when Joseph Schumpeter introduced his famous 'Gales of Creative Destruction' (Schumpeter, 1942).

Schumpeter argued that the role of new technologies led to the redistribution of costs and benefits within an industry. This had connotation to the General Purpose of Technology Theory which implied a new production method and inventing that is important enough to have a protracted aggregate impact (Jovanovic & Rousseau, 2005). It could profoundly affect the industry and economic impact by introducing new technology via an entrepreneur or entrepreneurial venture.

Schumpeter emphasised that the forces of 'creative destruction' were a vital part of any economy because they "washed away businesses with obsolete capabilities" and could destroy entire industries (King & Baatartogtokh, 2015).

These forces of creative destruction led to the shift in thinking from external shocks being the sole cause of a disruption to the static price-equilibrium view of the world. Schumpeter argued successfully that internal shocks rather than external shocks alone could cause a move from price (i.e., the ability to minimise cost) to non-price attributes (i.e., capabilities and performance) driven by entrepreneurial ventures in new technology-based firms (NTBF).

This technology push by NTBF's created a discontinuous leap, thus making existing incumbents obsolete. The NTBF's were not hampered by any pre-existing customer

base using old technology, nor held back by legacy technology or organisational inertia, thus propelled the cycle of wealth through the economy (Spencer, 2006).

However, the dissemination of knowledge caused by new technology implementations had some drawbacks. Firstly, it eventually leads to improvements that limit a successful entrepreneur's time of incumbency (Francois & Lloyd-Ellis, 2003). Secondly, technological innovation alone is not a guarantee of success. The lack of a viable commercialisation strategy to' capture value' and the absence of a' go-to market' plan is likely to lead to the (self-) destruction of creative enterprises as it is to their profitability (Teece, 2009).

This period of linear models was followed by conceptual models between 1970-1990, most notably the S-curve and adopter categorization concept defined by the Diffusion of Innovation Theory (Rogers, 1995), which has been widely used and referenced.

Rogers argued that for disruption to happen, there needs to be an improvement curve because of the assumption that incumbents' rate of sustaining innovation is going up faster than the consumer's ability to absorb those improvements (Rogers, 1995). This assumption is critical because it creates the expectation that disruptive threats will emerge amongst the low-end, over-served customer and has linkages to Christensen's work that followed later.

Rogers also used the terms' innovation' and 'technology' interchangeably and pointed out that he "defines a 'technology' as a design for instrumental action that reduces the uncertainty in the cause-effect relationships in achieving the desired outcome." In this sense, a 'technology' is not necessarily limited to hardware but can also be "almost entirely composed of information" (Rogers, 2005). These statements are profound as it highlights the challenge of retrofitting existing theory with the forthcoming data-driven digital era.

The dynamic model of process and product innovation (Utterback & Abernathy, 1975), was also introduced in the conceptual period. The model outlined the characteristics of the innovative approach that will systematically correspond with the stage of development exhibited by the firm's production process technology and its strategy for competition and growth. This model was vital in identifying critical technological features that become the 'dominant design,' which competitors and innovators must

adhere to. It affects further technical advances and the resulting industry structure and competitive dynamics. This is important as enforcing or encouraging standardization and production; other complementary economies can be achieved while creating barriers to entry and mobility (Utterback & Suárez, 1993).

However, the substantial step of linking innovation and profit was undertaken by David Teece. To help entrepreneurs and strategists figure out appropriate business models/designs and technology strategies by delineating the essential features of business model choice and predicting the outcomes from those choices, innovators could then capture value from innovation (Teece, 1986).

A period of innovation systems approach was then entered into. Between 1990-2010, numerous terms were used interchangeably before the frenzy around 'disruption.' This started with the emergence of radical and incremental innovation. Incremental innovation being improvements within a given frame of solutions (i.e., "doing better what we already do"), and radical innovation dealt with a change of structure (i.e., "doing what we did not do before"). These are similar to Christensen's Theory of Disruptive Innovation, which was specific to a set of three conditions for disruption to occur (Norman & Verganti, 2014).

However, Rebecca Henderson and Kim Clark's 'Architectural Innovation' model (Henderson & Clark, 1990) introduced a modular and architectural change that revoked this traditional categorization of innovation as either incremental or radical. They argued that these terms were incomplete and potentially misleading, and that innovation was a change in the architecture of a product without changing its core components. They distinguished between a product and its ways of integrating into the overall system as key to disrupting a market.

They achieved this by highlighting how architectural innovations destroy the existing competency and knowledge of the incumbent firm, which is, in most cases, terminal. The destruction is difficult for incumbent firms to recognize and respond to and thus has many competitive implications.

This leads to Christensen's original idea that disruption required four conditions to be met. Namely that incumbents in a market are improving along a trajectory of sustaining innovation, secondly that they overshoot customer needs and thirdly that they possess

the capability to respond to disruptive threats, and lastly, that incumbents end up floundering as a result of the disruption (Christensen, Raynor, & McDonald, 2015).

The Theory of Disruptive Innovation highlighted that excessive reliance on current customers' known and presumed needs could be harmful when a novel technology disrupts the market. The conflict between old and new conditions may lead to the incumbents concentrating on serving the existing customer needs. In contrast, the new players capture a significant portion of the market (by serving new needs) and unseat much larger and better-capitalized incumbents. In contrast to Schumpeter, Christensen argues that leading companies often have the resources and capabilities needed to succeed but lack the values, modes of interaction, and decision-making (King & Baatartogtokh, 2015).

This process of whereby a novel technology that offers a similar service at a lower price point and begins to eat away the bottom of the incumbent's market, and then begins to expand upmarket while maintaining that competitive advantage resulting in more and more of those customers abandoning the traditional incumbent was coined 'disruption' (CB Insights, 2020).

However, there were many critiques of this definition of disruption, such as “cherry-picking” and the lack of distinction between the types of innovation and how disruption is measured and assessed. The main criticisms were that Christensen indulged in 'cherry picking' cases (King & Baatartogtokh, 2015). The purpose of disruptive 'technology' and general classification of disruption is still vague, even if the general rationale behind it is well understood (Danneels, 2004). According to its use or context, the critical question of whether a technology is inherently disruptive or whether its disruptiveness may differ between markets and industries remains open.

Costas Markides attempted to position a different perspective on the definition of disruption, suggesting that a distinction should be made between disruptive business model innovations and product innovations, as they are entirely different in their impact on established firms (Markides, 2006).

Markides criticises Christensen's concept for not making enough distinction between different types of innovation. He argues that disruptive technological innovation is a fundamentally different phenomenon from disruptive business-model innovation and

disruptive product innovation: These innovations arise in different ways, have other competitive effects, and require different responses from incumbents (Markides, 2006).

Erwin Danneels also critiqued Christensen's theory by challenging how disruption gets measured and assessed (Danneels, 2004). He argued that firms should extract more value from their existing competencies by leveraging their technologies and customers. Specifically, he argued that existing firms could build new products and competencies, which serve as a tool for exploring new customers and new technologies (Danneels, 2002).

The rise in the popularity of continuous and discontinuous innovation was then added to the disruption lexicon, as demonstrated by the prominence in the literature (Kaplan, 1999). However, the conceptual understanding remained similar (if undefined) till the 2010s.

Two other and alternate views of disruption then appeared, with Jill Lepore critiquing the lack of accuracy in predicting innovation and, by extension, disruption. New terms such as 'big bang' disruption, 'devastating' innovation, and recently 'breakthrough' innovation abound without clarity into what it means explicitly or usefulness in a forward-looking (rather than a backward-looking) context (Lepore, 2014). Perhaps more importantly, recent studies suggest that technological innovation may play a limited role in disruptive innovation theory, focusing on competitive dyads instead of systemic impacts on firms and industries (Skog, Henrik, & Sandberg, 2018).

In most of the definitions outlined above, the proponents defined disruption by searching for the expected pattern, indicator, or denominator in a set of disruptions. Some have defined innovation as having a significant impact on a market and on the economic activity of firms in that market (Selhofer, Arnold, Lassnig, & Evangelista, 2012). Others have focused on performance metrics, such as "a disruptive technology being a technology that changes the bases of competition by changing the performance metrics along which firms compete" (Danneels, 2004). Alternatively, it could be one that "had simply assumed that the objective function of management should be to maximize shareholder value" (King & Baatartogtokh, 2015).

It can thus be inferred that disruption erodes competitive positions and breaks and reforms linkages in the value chain, often reconfiguring relationships, and transactions. Crucially, though a single agent may be the disruptive initiator, their value creation and capture effects are system-wide.

2.3.3 *What are the modes by which extraneous technological change can disrupt an industry or firm?*

As the research on the seminal works has noted, the drivers of technological change include the technologies themselves, plus a range of factors that influence the impact and pace of change. These digital technologies ultimately introduce incumbents to a new journey path while creating new pathways for new entrants (Bradley & O'Toole, 2016).

This, in turn, requires both sets of organisations to have much quicker cycle times and a higher information metabolism. This enables them to learn about customers' needs, the supply chain changes, and redesign products (Brynjolfsson, 2010).

Ultimately, the aim is to create value for the customer, entice payments and convert payments into profit (Verhoef, et al., 2017). These are enabled by selecting technologies embedded in new products and services, resulting in a shift of strategy from long-term planning towards a series of sense and response experiments.

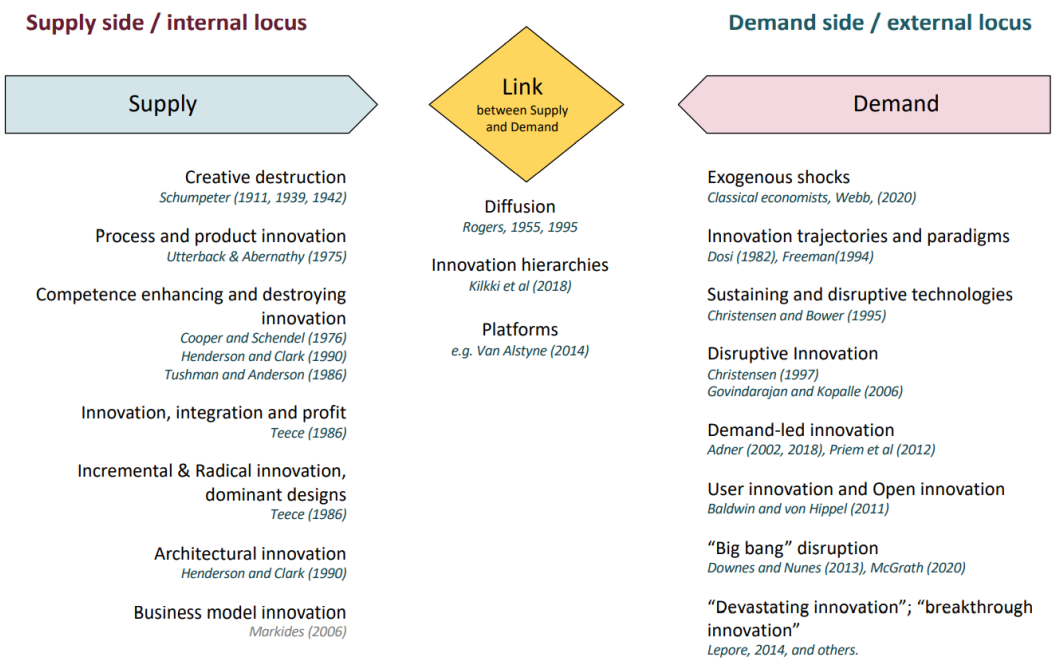

Figure 3: Demand, Supply, and the Market Interface (Armstrong & Lee, 2021)

This section seeks to understand the underlying mechanisms of technological change that can cause disruption using selected company, sector, and industry examples. As Figure 3 (Armstrong & Lee, 2021) displays, the literature and cited examples can be framed within three 'modes' of disruption (as none readily exist) of demand disruption, production disruption, and market engagement disruption.

Demand disruption:

The first mode of technology disruption deals with demand disruption. The demand side of disruption moves away from the resource-based view of the world and more towards the demand-pull innovation cycle (Baldwin & Hippel, 2010).

Demand-pull innovations have defined those innovations driven by the goals of either meeting current consumer needs in an entirely new way of identifying and satisfying new needs (Priem, Li, & Carr, 2012).

The new digital technologies eliminate friction points and specifically the 'middleman,' thus creating opportunities for disintermediation and the opportunity for both up and downstream substitution (Waldfogel & Reimers, 2015).

By cutting out the middleman and creating a direct relationship with customers, interactive and robust feedback loops are generated, one in which organisations can rapidly experiment, iterate, and customize offerings with far more flexibility than a traditional firm.

This drives a new mechanism of disruption – mobility. The new breed of firms couples cheap, mobile infrastructure to make customer interaction a 24-hour, always-on experience, making the new entrant an easy and accessible partner for transactions and support (McGrath, 2020).

A modern example of disintermediation is Airbnb. As a new digital entrant, it has built-in digital processes which enable a connected ecosystem of travel services. Thus, these new digital companies can virtually and visually mine data to acquire new customers, identify traveller needs, optimise experiences, run experiments, and analyse risk exposure. Traditional players such as travel agents and hotel incumbents may attempt to re-architect their operating model to respond to these new data-driven growth machines (Iansiti & Lakhani, 2020). Still, they may lack the vision or appetite to commence this journey.

Interestingly, new pay-per-usage models and subscriptions, and freemium models have also reduced the need for intermediaries (Granados & Gupta, 2013), thereby decreasing intermediation fees and creating a dynamic link market engagement disruption stemming from demand disruption.

The scalability of new technologies is another mechanism that is used to disrupt industries through substitution. For example, Google's search engine and Alibaba's Alipay payment app can scale infinitely, link to a broad and diverse network of complementary businesses, and constantly improve (Iansiti & Lakhani, 2020). This virtually eliminates the need for alternative and expensive data sources or banking infrastructure, physical cards, and point-of-sale (POS) devices to meet the requisite needs of customers.

Technology can also transform the shopping experience and create substitution effects by eliminating many of the frictions of conventional retail. In the 2010s, there was an explosion of direct-to-consumer products such as Warbly Parker (founded in

2010) and Dollar Shave Club (2011), to name a few, which twinned exceptional customer experiences with scale technology (McGrath, 2020).

Tesla has demonstrated that a new technology-based start-up can enter and disrupt an established industry, but it can also have a significant downstream substitution effect (Stringham, Miller, & Clark, 2015). Tesla electric vehicles and newer fuel cell vehicles have radically reduced the demand for catalytic converters and, by extension, platinum. However, it should be noted that it also drove up the need for cobalt, nickel, and manganese (Hardman, Shiu, & Steinberger-Wilckens, 2015).

What can be summarised from existing literature is that the degree of preference overlap between the new technology's existing customers and the incumbent's segment specifies the magnitude of the impact that sustaining innovations along the preference lines of one segment will have on consumer evaluation. Secondly, the degree of preference asymmetry establishes firms' differential incentives to compete for new market segments. Finally, critical to a disruptive outcome is the price at which the invader offers its product. The attacking firm must have the incentive and ability to offer its technically inferior yet satisfactory product at a sufficiently lower unit price to consumers than its rival (Adner, 2002).

While traditional wisdom from the technology-push perspective suggests that incumbents must transform themselves and embrace new technology to compete, there are two alternative options. Firstly, the 'technology retreat' allows incumbent firms to proactively cope with the emergence of disruptive innovations by repositioning their 'old' technologies in the marketplace (Adner & Snow, 2010). The other option, which is enacted by price, means incumbents can compete on the price trajectories of the competing offer (Adner, 2002).

Production disruption:

Academic literature highlights that markets arising out of technological change share specific characteristics (Klepper & Simons, 2000). These characteristics result from supply-push processes and encourage multiple new firms to enter these newly created markets. These new entrants also demonstrate numerous product varieties and follow the typical industry lifecycle view – where the rate of innovation is highest - followed by the shake-out phase. The shake-out phase is generally followed by a 'dominant

design that correlates with industry growth. As Markides pointed out, "the industry is fluid and has many entrants and exists" (Markides, 2006).

Teece also reinforced the view that technology evolution has lowered the costs attributable to information and customer solutions. These developments require businesses to re-evaluate the value propositions with the supply-side-driven logic of the industrial era no longer viable (Teece, 2009).

Thus production-led technological disruption can be viewed as core production substitution, automation, resource utilisation, supply disruption, and distribution.

An example of core production substitution is 3-D printing, which allows for mass customization and other manufacturing processes with custom-build products in small quantities as if mass production were used. This dramatically reduces cost, and designs can be easily shared and downloaded. Practical applications include dentistry and bridge construction. However, the technology is still nascent and plagued by lower accuracy and scarcity of choices regarding materials (Berman, 2012).

Automation in factories from industrial robots has led to flexible production systems that have driven the economic value of technology (Carlsson, 2012). The computerisation of administrative and sequenced tasks in white-collar jobs, such as banking, has led to improved output, faster processing, and improved customer experience. Still, they have also increased the threat of job displacement. This is even more so with algorithms that can replicate human decisions in the form of trading decisions. For example, pension fund contribution and asset allocation reduce the need for expensive, 'highly specialised' and opaque asset management fees (Autor, 2015).

Improved resource allocation asset utilisation was at the forefront of the Airbnb marketplace model, where excess capacity is a consumer asset. This new technology-based disrupter eliminated risk and complexity by offering instant refunds and strong signals to the customer, such as host ratings, and negatively impacted many established brands.

Traditional organisations have used their wholly owned assets to create competitive differentiation and establish entry barriers in terms of strategy and resource

deployment. However, the new digital-based native companies participate on digital platforms that can virtually represent both sides of an on-demand transaction, thus removing friction and risk. This allows them to scale rapidly and carries the downside risk that their business models are easy to copy and leads to a situation where a category is flooded with new entrants (McGrath, 2020).

Another example of this type of disruption is supply disruption, such as Facebook acquiring the rights to La Liga (Oxford Analytica, 2018) with streaming services provided through the Facebook Live app of La Liga (Alcolea-Díaz & García-Santamaría, 2019). Amazon is responding by acquiring the rights to the Premier League (Koutroumanides, Alexopoulos, Laios, & Douvis, 2019), thereby disrupting the traditional media houses and creating branded content with the content provider.

A final example of production disruption is distribution. Unlike in the traditional economy, where companies require expensive physical investments to build out their business models, in the digital world, companies can grow rapidly through a combination of data, software, and ecosystem strategies. The use of AI and machine learning to produce significant improvements in platform operations and capabilities has powered both improved interactivity and dematerialisation in the form of Netflix (Cusumano, Yoffie, & Gawer, 2020). However, content creation remains problematic, with licensing fees increasingly costly.

Market Engagement disruption*:*

The introduction of 'disruptive' technology into an existing or mature market creates windows of opportunities across a set of new capabilities. These include market access through new channels, new pricing models, and customer insight (Deloitte, 2013; BCG, 2017).

The introduction of technology opens new positioning avenues or channels by providing unique service interactions. These include differentiated pricing to a firm (Padgett & Mulvey, 2007) which changes the technology/product paradigm impacting the firm's decisions to commercialise a particular product.

These firms can gain a competitive advantage by using technology to either improve the economics of their service delivery system or as a means of differentiating their service offering by adding value to existing services (Fleming, 1991).

This creates a change in the market structure, introducing new and different suppliers into the market and creating different outputs amongst the remaining suppliers. The new technology also makes a change in customer benefits through users/adopters having to change their behaviour (Kassicieh, et al., 2002)

However, to ensure that the value is unlocked, technology must be leveraged via links to what customers value or perceive to value (Padgett & Mulvey, 2007).

This can be evidenced by the birth of freemium models, where a product or service is given away for free and then supported by premium-priced value-added services or an enhanced version of the service to the customer base. This is most evident in the Flickr business model (Shuen, 2008), which has a core module for free and several streams of paid features. This 'freemium' model has also been adopted by Adobe and Skype, with low-entry cost channels and multiple revenue streams such as video editing, personalisation and sharing, B2B and B2C usage (Teece, 2009).

Other and newer 'digital' native companies such as Airbnb, Google, Alibaba, Amazon, or Lyft are built on integrated digital foundations. These digital foundations are embedded with artificial intelligence, or machine-learning algorithms, which drive value for the customer (Iansiti & Lakhani, 2020) enabled through new access channels, sales, and ordering processing twinned with customer insights.

The value in this sense is found in the production of search results, the setting of prices at an optimum level, and the proactive identification and recommendation of products, creating market disruption. This leaves traditional businesses vulnerable as value pools are being attacked by highly scalable data-driven companies whose operating models leverage network effects (Iansiti & Lakhani, 2020).

Ownership models and packaging also highlight asset sharing, where business models can capture value from technological innovations such as 'cloud-based computing models. These have removed the need for small companies to invest upfront in expensive servers and allows for a new instance of innovation. This

innovation transforms the revenue side of the profit equation (volume and price) by moving the price lever from 'fixed plus variable' cost models into entirely variable cost models, significantly improving efficiency and reducing capital requirements (Teece, 2009).

These new companies have also taken the risk out of the concern for traditional high-cost purchases. This can be evidenced in the new subscription-based models such as Software-as-a-Service (SaaS) or Infrastructure-as-a-Service (IaaS), where essentially one is leasing or renting an asset at a fraction of the cost while enabling rapid scalability (McGrath, 2020).

This scalability is significant. Recent studies have found that the S-curve diffusion of technology is not consistent with its constant performance path. New technologies follow irregular paths that may never intersect or intersect at multiple points, leading to a change in strategy. Though the S-shape exists, it is neither linear nor consistent but punctuated by performance jumps (Tellis, 2006).

This makes it difficult for both the incumbents and new entrants to understand how the exogenous technology will disrupt its orientation and projected path. One way to deal with this is to proactively search for disruptive technology and systematically plan to put one or more of the new technologies together (Kostof, Boylan, & Simons, 2004) as a response mechanism.

Summary

Digital technologies have emerged in many forms of disruption, from capital and asset-light or ecosystems built on shared digital platforms and infrastructure. These companies have social media, digital channels, and online influencers to develop brands and superior customer experience, thereby rapidly invading new and existing markets (McGrath, 2020).

Technology, coupled with financing, talent, and experience-seeking consumers, contributes to disruption, and drives the rush of competitive value propositions at a rapid scale (McGrath, 2020).

However, as attractive as these start-ups can be, these technological shifts can be treacherous, as they involve different engineering skills, new product designs, and new production facilities for incumbent firms (Iansiti & Lakhani, 2020).

Markides foresaw this challenge and suggested that "response does not necessarily mean incumbents have to adopt the disruptors technology or business model. The 'disruptive' start-up may grow only to a certain percent of the market, without fully substituting the existing way" (Markides, 2006).

Therefore, there are different modes by which industries and firms are disrupted by technology. However, there is no guiding framework for the underlying mechanisms, making it problematic on multiple fronts. Firstly, they are difficult to relate to the theories of disruption advanced in the previous section; secondly, they are challenging to assess systematically and practically apply. Thirdly, it is difficult to check whether there are any gaps or overlaps.

2.3.4 *What are the different outcomes of these technological changes?*

Technology allows for a change in customer demand and behaviour and how an organisation can respond to it (Westerman, Bonnet, & McAfee, 2014) which may lead to outcomes such as business bankruptcy or industry obsolesces (Thornhill & Amit, 2003).

One of the significant effects of changing and influencing customer demands is the exponential competitive effect on the profit equation that technology creates. In this sense, technology drives new business and operating models which enable value creation. Therefore, incumbent firms are likely to be challenged in sustaining a profitable offering with the value-capture space beginning to shrink.

When it comes to organisations, the situation is more complex as it affects firms and industries at different levels. On the industry layer, new products may cause changes in the structure of the value networks (Allee, 2000) and result in mergers, acquisitions, and bankruptcies.

Sometimes, the new product or solution may pass through the initial industry level without affecting the industrial architecture. However, if the product creates significant

demand amongst consumers, the technology push may turn into a market pull, and the disruption can diffuse back into the industry and firm layers (Henderson & Clark, 1990).

This creates three main insights. Firstly, creating new intellectual property and licensing is a significant factor, especially regarding content, as licensing is highly margin profitable due to low reproduction costs. Still, there are ethical and regulatory issues to be aware of (Braddick & Ramarohetra, 2020).

Secondly, technology enables the digitalisation of processes and thus reduces costs and drives an improved data-driven customer experience. Building new automated processes - with data captured at the right junctures – enables organisations to deliver insights to managers and respond quickly to market and consumer shifts (Porter & Heppelmann, 2014).

Thirdly, the new digital players do not compete on an asset-for-asset basis but rather by extracting consumer value through the customer experiences. This means that traditional profit pools will continue to migrate to the 'software layer' (Iansiti & Lakhani, 2020) rather than physical assets.

As outlined in the research problem, many 'anecdotal' studies describe the result or outcomes of disruption at a firm level. Thus, there is a need to understand how social media, mobility, analytics, and cloud computing impact industries.

Firstly, consumer demands are constantly changing. As new technologies such as social media campaigns, mobile marketing, and multiple online channel presence emerge, retailers must be prepared to focus on customer experience excellence. Being aware of trends and finding opportunities to surprise and delight customers is a crucial step towards success.

Customers are also becoming hyper-aware of new products and services (KPMG, 2018) due to a multiple online channel presence enabled by social media campaigns and mobile marketing (McCaffee, Ferraris, Bonnet, Calméjane, & Westerman, 2011). This leads to instant and direct communication to the customer, with brand awareness and responsiveness being highlighted (Gürhan-Canli, Hayran, & Sarial-Abi, 2016).

Secondly, mobility is the core characteristic of digital disruption. With an estimated 3.5 billion smartphones globally (Statista, 2020), new and existing products are much more easily accessed through digital devices and channels than traditional means (Ross, et al., 2016).

Mobility also changes how the world works with the virtualization of work processes, reducing physical facility costs and enhancing collaboration and knowledge-sharing using cloud-based tools such as Salesforce and Slack (Hawilo, Shami, Mirahmadi, & Asal, 2014).

Thirdly, analytics capabilities and the ability to gather data through big data improve organisations understanding of customer behaviour and needs (McCaffee, Ferraris, Bonnet, Calméjane, & Westerman, 2011), their willingness to pay, and the ability to craft products for segments of one (Ross, et al., 2016).

Also, supporting technologies such as artificial intelligence will spawn a range of new products, platforms, and services. It will also enable new capabilities that create, enhance, and destroy existing businesses and disrupt today's 'disrupters.

This is no more demonstrated than in ride-sharing platforms, where autonomous vehicle technology will reduce the marginal cost of transportation services for ride-sharing platform owners (Cusumano, Yoffie, & Gawer, 2020).

Crucially, linking analytics and mobility allows the exploitation of customer knowledge to co-create new products and services (Thomke & Hippel, 2002).

Fourthly, the availability of cloud computing and the integration of big-data sets have led to improved and personalised sales and support processes within organizations (McCaffee, Ferraris, Bonnet, Calméjane, & Westerman, 2011). Cloud technologies have enabled the reduction of costs through SaaS and IaaS, which has led to a decrease in physical resources and an increase in intellectual resources.

Lastly, these technologies also allow applications to collect and use a large amount of private information, thus prompting user privacy concerns (Rainie & Duggan, 2016). Political parties and affiliates, intelligence agents, terrorists, financial launderers, and traffickers have all found ways to use digital platforms to their

advantage (Cusumano, Yoffie, & Gawer, 2020). The recent interference in the US election by non-state cyber-aggressors is a case in point (Mueller, 2019).

These concerns lead to calls for enhanced monitoring and regulations, spurring on new rules. Still, these themselves are complicated, as Edward Snowden has highlighted in his exposures of the role of state-sponsored surveillance (Verble, 2014) and Facebook's Cambridge Analytica scandal (Isaak & Hanna, 2018).

2.3.5 *Why are there different outcomes of these technological changes?*

Technology disruption has created massive industry upheaval ranging from Kodak to Uber and Airbnb. However, spotting the disruption is difficult, as recently as 2013, the CEO of Australian media company Fairfax Media told the International News Media Association World Congress, "We know that at some time in the future, we will be predominantly digital or digital-only in our metropolitan markets." (Atluri, Eaton, Kamat, Rao, & Sahni, 2018).

The struggles of many traditional print firms are widely acknowledged. Still, the success of the Washington Post may be a guide for how organisations can successfully identify and respond to disruption (Hess, Matt, Benlian, & Wiesböck, 2016) by incorporating and complementing new technology.

So why do many firms not recognise or respond to disruption? The change requires incumbents to cannibalise their existing revenue streams, but many continue to seek out synergies (Bradley & O'Toole, 2016) while others seek to grow new radical businesses inside. Markides argues that established companies should aim to create, sustain, and nurture a network of feeder firms—rather than attempting to go it 'alone' (Markides, 2006).

Why these organisations choose to respond in this manner or why the technological change results in different outcomes can be seen through the dimensions of pricing, business model innovation, and customer experience, which impact legacy costs, changing scale economics, and the laws of probability (King & Baatartogtokh, 2015).

Grocery retailers Aldi and Ocado have used price as their primary competitive advantage through their product white-labelling and supply chain optimisation (Suel & Polak, 2017).

Amazon uses a data-centric operating platform to transform the retail experience. Its retail supply chains became centred on software, shifting labour from the core of the process to the edge, which removed traditional bottlenecks and scale constraints. This inevitably led to the demise of Toys R Us, Sports Authority, Sears, Nine West, Kmart (Iansiti & Lakhani, 2020)

Changing the perspective of technological innovation can also play a key role in how businesses respond. Jeff Bezos recently stated that "If customers like Prime, the demand will go up," this enabled the fly-wheel effect of growth (CB Insights, 2020) and the building of more fulfilment centres.

While price and platform-ification appear as key to why technology has different impacts and outcomes, there is a third factor to consider – one of having an unrivalled customer experience with highly integrated products and superior user experience as exhibited by Apple and Warbly-Parker (CB Insights, 2020).

Being the disrupter is no guarantee of not being disrupted. Netflix is at the opposing end of the innovator's dilemma. It is now required to pay higher fees to stock high-demand, licensed content while competitors like Disney, Apple, NBCUniversal, and Warner Media (HBO) enter the sector. Netflix's business largely depends on content from these new competitors and has recently begun producing its propriety content (CB Insights, 2020).

The last reason technology disruption may have an alternate effect is that it fundamentally enables a new business model. Salesforce is an example of this new business model shift by being a cloud-based provider with a subscription model, which eschews technical innovation favouring business model innovations powered by technology (CB Insights, 2020).

When faced with technological disruption, resource allocation from traditional established businesses towards the new economic engine (Bradley & O'Toole, 2016) is required. Still, many companies measure and incentivise short-term and quarterly

results. It is difficult for managers to move away from traditional products and solutions, and even then, success is not guaranteed (Danneels, 2010).

One interesting finding in the literature is that new start-ups can pivot away from disruption. A technology disruption may provide a clear strategic path for a start-up, but an incumbent might see the threat and opt to cooperate rather than compete with the entrepreneur. This is similar to Markides' view, which promotes cooperating while enticing new customers with the improving technology. This means that even if entrepreneurs start on a disruptive path, disruption might be forestalled as incumbents see that cooperating is in their interests (Gans, 2020).

To conclude, technology allows for different outcomes. However, organisational responses to these technological changes have been varied and thus diluted. This is due to the lack of identification of these technological changes and the unwillingness for organisations to sacrifice their short-termism,

2.3.6 *The case for the introduction of the model*

The following material draws from work done with Professor B. Armstrong (Armstrong & Lee, 2021). Through the progression of the literature review, there have been some exciting discoveries. These range from technology being the key determinant of change, the lack of common understanding or definition of disruption, and the lack of coherency regarding a framework on the modes and, by extension, the underlying mechanisms of disruption. It is also clear that the different outcomes are not attributable, and the literature populated by case examples under selected conditions may be circumstantial rather than clinical.

The literature has also provided rich and valuable insights into the roots and process of disruption. However, it is increasingly challenged on having practical relevance due to the pace of technological change where strategy has to keep pace with the exponential rate of technology discovery and application. With so many viable paths and options available, how best do organisations choose which pathways to pursue innovation and seek to be disruptors rather than disrupted? This is further complicated because not all firms nor industries are exposed in equal measures to technological disruption (Armstrong & Lee, 2021).

To help address these practical questions, a framework is required that takes into account the three ‘modes’ of disruption - namely the supply (production) factors, demand factors and factors relating to the link between supply and demand (market engagement) – and the resulting mechanisms that result in the outcomes of technological disruption (Armstrong & Lee, 2021).

The Oxford online dictionary describes disruption as a situation in which it is difficult for something to continue in the usual way, the act of stopping something from continuing in the normal way (Oxford Advanced Learner's Dictionary, 2020). The Cambridge online dictionary states that disruption is the action of preventing something, especially a system, process, or event, from continuing as usual or as expected (Cambridge Online Dictionary, 2020).

The question then arises: what, in the context of industries or firms, constitutes "preventing something, ... from continuing as usual or as expected"?

The author proposes that it is essential to have an objective foundation from which to explore this question, and therefore propose to anchor the response on the fundamental simplicity of the profit-equation: if the profit-generating potential of a firm or industry is prevented from continuing materially, as usual, then the framework suggests that the industry or firm will be 'disrupted' (Armstrong & Lee, 2021).

To objectively resolve this issue, the profit-equation-based model is introduced. The traditional objective of strategy is to find positions of sustainable competitive advantage to generate superior sustainable profits. It is, therefore, logical to suggest that disruption becomes real when the profits of firms or industries are materially impacted (Armstrong & Lee, 2021).

Thus, the proposed view of disruption is that the profit equation - the heart of the model - is the key determinant of disruption:

$$\text{Profit} = (\text{Volume} \times \text{Price}) - \text{Cost}$$

This immediately leads to the next level of analysis. Suppose any of the critical variables of profit are disrupted. In that case, the profit equation is disrupted, and so too the firms or industries to which a particular set of variables of the profit equation

applies. At a firm level, different executives in different organisations and industry sectors could have a different perspective on what levels of profit change would be 'disruptive.' Changes of single-digit percentages would not typically be considered disruptive. However, profit disruptions in multiple of 10 percentage points are difficult to argue against. These effects are easily noticeable at an industry level or economic level due to the aggregated effect of all the players in a specified market (Armstrong & Lee, 2021).

This proposed definition of disruption can map to the drivers of the profit equation and the constituent parts of Volume, Price, and Cost levers.

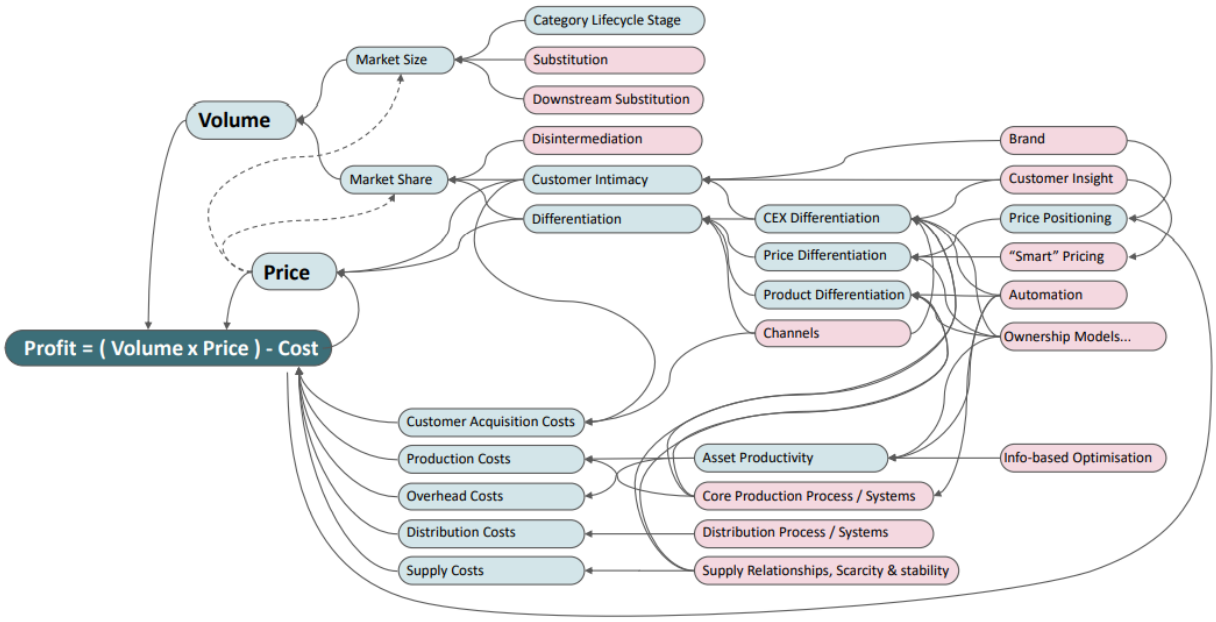

Figure 4: Profit Equation-based model (Armstrong & Lee, 2021)

Figure 4 (Armstrong & Lee, 2021) outlines the three fundamental tenants/levers of the profit model, which are Volume multiplied by Price minus Cost.

The model commences with unpacking the Volume part of the profit equation and its parts. Volume is influenced by the market size and market share (this depends on whether these are new or existing markets). Volume, simply put, is the product of overall market size and market share.

The market size, in turn, is affected by the category lifecycle growth/decline, substitution, and downstream substitution. Four factors affect the market size, viz the industry lifecycle stage (introduction, growth, shakeout, maturity or decline); products substitution, downstream substitution, and pricing impacts due to elasticity.

Four factors also influence the market share. These are price, product differentiation, customer intimacy, loyalty, and potentially disintermediation. Customer intimacy is affected by customer insight, which is impacted by brand, which feeds into price positioning and, in turn, price differentiation. This ultimately influences the differentiation lever for the Price component of the profit equation.

Customer intimacy is the accumulation of a differentiated customer experience, brand projection, and perceptions, enhanced by customer insight that enables personalised experiences.

The third leg of customer intimacy impacts customer acquisition cost, directly affecting the Cost lever.

Differentiation is influenced by customer experience differentiation, price differentiation, product differentiation, and channels. The customer experience differentiation is controlled by the core production processes/systems, which impact production costs and, ultimately, the Cost lever. Differentiation can be derived from product differentiation, including premium pricing. In addition, there is customer experience through the various journeys they undertake with the brand. It can be argued that channels are a distinct source of differentiation as they directly impact customer acquisition costs and differentiation of the customer.

Price differentiation and its link with 'smart pricing' and product differentiation have been covered. Product differentiation is impacted by the core production processes/systems, affecting production costs and ultimately the Cost lever. Product differentiation is also affected by supply relationships, scarcity, and stability, influencing supply costs and the Cost lever. Still, it can also branch back towards the price lever.

This has a reinforcing effect on both price differentiation when it comes to channels, directly impacting the cost and the volume via market share. Channels also influence the customer acquisition costs, which in turn drives the cost lever.

Price is the second part of the profit equation. Price is influenced by customer intimacy, differentiation and supply relationships, scarcity, and stability. As previously mentioned, the inter-linkages between these when discussing the volume lever and its tentacle effect.

The third part of the profit equation is Cost. Cost is influenced by customer acquisition, production, distribution, overhead, and supply costs. Customer acquisition has been previously covered, so the focus moves to production costs. Production costs are impacted by asset productivity and core production systems (which have previously been covered).

Asset productivity has three elements to it, information-based optimisation, ownership models & packaging, and automation. Information-based optimisation has a direct link, unlike the other two elements. Ownership models & packaging, for example, impact product differentiation, price differentiation, and customer experience differentiation, ultimately rolling up into the Volume and Price levers.

Automation similarly impacts product and customer experience definition and, once again, rolls up into both Volume and Price levers.

Thus, it can glean from this because disruption can attack many parts of the profit equation, resulting in immediate and knock-on effects across the value levers of the equation. This makes digital disruption in the digital era so powerful; it can dramatically shift the dynamics of competitive advantage and how organisations seek to survive and thrive.

This approach resolves a few of the apparent dichotomies with models of disruption referenced before:

Disruption does not depend on whether it is a product or process innovation at play; whether it is ecosystem vs. single actor innovation; or whether it is business model vs. product innovation; whether it arises from linear or dynamic conceptual models;

whether it is continuous or discontinuous; big bang or breakthrough; technology push or market pull. All of these will apply in different circumstances (Armstrong & Lee, 2021).

The profit-equation model offers an objective framework for decomposing how technological innovations may disrupt a firm or an industry. It highlights that disruption can attack many parts of the profit equation, resulting in immediate and knock-on effects across the value levers of the equation. This makes digital disruption in the digital era so powerful; it can dramatically shift the dynamics of competitive advantage and how organisations seek to survive and thrive (Armstrong & Lee, 2021).

Therefore, a more conceptual view can be proposed through Figure 5 (Armstrong & Lee, 2021) – which articulates the profit equation model into a 3-dimensional framework and its linkages with demand and supply.

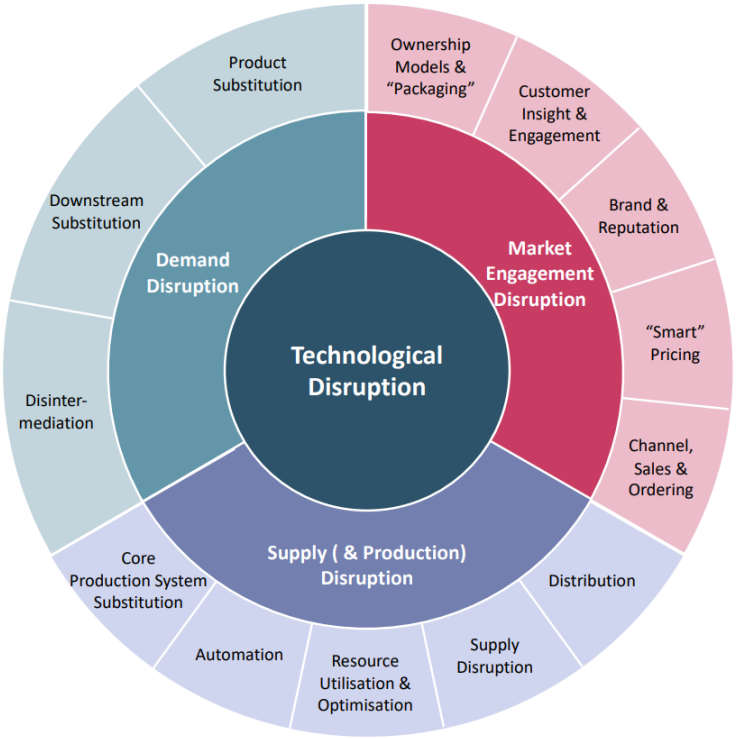

Figure 5: The Conceptual Framework (Armstrong & Lee, 2021)

The profit equation model has been explained. The representation of the model is based on the available literature review and the proposed understanding of the framework.

The framework consists of three layers: The core being a technologically based view of disruption in the digital era model. This second layer has the three modes (market engagement, demand, and production disruption) of technological change. Finally, the outer layer is made up of the thirteen mechanisms of these technological changes.

Table 1 (Armstrong & Lee, 2021) below shows that these mechanisms are classified according to their modes. For Market Disruption, these are ownership models and 'packaging,' customer insight and engagement, brand and reputation, 'smart' pricing and channels, sales, and ordering.

For Demand Disruption, these mechanisms are disintermediation, downstream substitution, and product substitution.

The last mode is Production Disruption, which includes the mechanisms of core production substitution, automation, resource utilisation and optimisation, supply disruption, and distribution on production disruption.

Mode	**Mechanism**	**Definition**
Market Engagement Disruption	Access: Channel, sales, and ordering process	Digital channels, integrated customer value chains
	Ownership models and packaging	Pay per use and subscription instead of ownership Asset Sharing
	Price Differentiation & disruption	Data & insight-driven price differentiation, or price disruption through unit cost base transformation
	Brand and reputation	A step-change in the perceived brand or reputation of an organization
	Customer Insight: loyalty, Value Management & translation	Mass customization Individualized engagement "Segments of 1" Insight translation to other business opportunities
Demand Disruption	Disintermediation	Customers bypassing the business and going directly to the source

	Substitution	Demand for legacy products declines due to the availability of a new product that satisfies the same need
	Downstream Substitution	Demand for a product decreases because the downstream product is substituted or disintermediated
Production Disruption	Core Production Systems & resources	Improved production (efficiency, quality, throughput) through the introduction of new modes of production
	Automation	Automation of core production processes and ancillary & back-office processes
	Improved resource allocation/ utilization	Improved resource utilization, allocation, and productivity through real-time and rich data
	Supply	Disruption to availability, price, or security of critical input materials, products, or services
	Distribution	More efficient distribution through the adoption of alternative product embodiment, packaging, and new delivery technologies

Table 1: Disruption Modes and Mechanisms (Armstrong & Lee, 2021)

As highlighted earlier, there is also a dynamic between Production disruption and Demand disruption. This elicits another exciting discovery on the supply and demand consideration - one that has economic undertones as echoed by Schumpeter (Aghion, Akcigit, & Howitt, 2014) and impacts at a firm and industry level; meaning that the thirteen mechanisms are derived from the profit equation.

2.3.7 *Hypothesis 1: A model can be proposed that explains technology disruption in terms of market engagement, demand, and production disruption*

The main objective of the literature review was to understand and theoretically ground a framework on the ‘modes’ by which industries and firms are subjected to technological disruption, or conversely, can exploit technological change to disrupt sectors or markets in their favour in terms of the thirteen mechanisms.

To achieve this, the author defined the primary exogenous driver of change as technology and unpacked the definition of disruption and its history and contextualisation in the seminal works. The preliminary finding was that the term ‘disruption’ is open to different viewpoints. The applicable theories are subjected to pre-defined conditions that have proven to have cracks due to the pace and diffusion of technologies in today’s digital era.

The author then investigated and classified the nature of disruption, being extraneous and specific to technology, with a clear set of drivers attached from both an academic and consultancy perspective. The resulting view is that technology affects both business and consumer behaviour.

Thirdly, the author searched through and classified how technological inputs transform the industry or affect a firm’s disruption outputs. However, as the model posits to present a general framework, there is also a need to consider scientific and applied processes to these mechanisms. This results in the classification of change mechanisms under three broad categories: market engagement disruption, demand disruption, and production disruption.

This also highlights the different outputs under these conditions. There are linkages to each of the mechanisms and uncovering why these outcomes may differ.

The author then proposed a primary definition and determinate of disruption being the profit equation and then building this out into a conceptual framework. This framework visually describes the profit-equation model and encompasses the definitions and classifications applicable to the three-dimensional framework's various layers.

2.4 Conclusion of Literature Review

The literature review in the previous section demonstrated the numerous viewpoints and methods to assess disruptive innovations. However, these are dependent on the specific views and strategic backgrounds, which can be based on market views, resource views, dynamic capabilities, or platform/ecosystem views.

In contrast, the aim is to build a framework that makes it possible to flexibly choose among different viewpoints and methods and even use several of them in parallel. The framework consists of three layers: The core being a technologically based view of disruption in the digital era model, a second layer with the three modes of technological change, and finally, the outer layer made up of the thirteen mechanisms by which these changes occur.

The framework details will be tested on the profit equation being the key determinant of disruption. This will be focused on the modes (market disruption, demand disruption, production disruption) and triangulating the outcomes based on interviews with senior executives (or experts).

CHAPTER 3. RESEARCH METHODOLOGY

Thus far, this research study has explored the extraneous drivers of technological change, technology disruption, and the modes by which disruption can occur, and its resulting outcomes.

The literature review identified a gap in existing research. There was ample evidence for the need for a theoretically grounded model to assist organisations in understanding how technological change can create disruptive opportunities and threats and how they can exploit this change to disrupt sectors or markets in their favour.

Therefore, the opportunity to synthesize the various pieces of literature and propose a model contributes significantly to the study of disruption in general and contributes to a richer understanding of why companies and individuals fail to recognise and respond to it adequately.

By bridging theory with practice – i.e., comparing the literature review findings with the 'real world' – the aim is to gain a fuller understanding of disruption and contribute helpful knowledge concerning changes in industries and, by extension, at a firm-level

A valuable outcome of this process leads to the case for and the introduction of a three-dimensional framework—this framework centres the profit equation as the key determinate of disruption.

This section – research methods – will provide the details of the research strategy adopted to test the proposed model and collect data for analysis, including sources and sample selection and the analysis approach to be adopted. Finally, the issue of potential limitations and problems with the chosen research strategy and its implementation will be documented

Therefore, this chapter describes the methods and procedures used to investigate the applicability and usefulness of the model amongst senior and seasoned business executives in South Africa. Thus, the focus is to assess the feasibility of the framework through an exploratory study on the modes of disruption, which requires a constructivist paradigm using a qualitative research methodology.

To do this, there will be a need to address the actual functioning of the framework and leveraging the constant comparison method to analyse the predicants responses across five (5) main areas:

- What are the extraneous drivers of technological change?
- What is technology disruption, and how does it manifest?
- What are the modes by which extraneous technological change can disrupt an industry or firm?
- What are the effects on the profit equation in your industry?
- What are the different outcomes of these technological changes?

3.1 Research approach

Though there are many research strategies, there is no overall or over-arching theoretical perspective for technology research articles. Instead, it is a set of philosophical assumptions regarding the nature of the phenomena studied and what constitutes valid knowledge (Orlikowski & Baroudi, 1991).

This study used a phenomenological strategy to explain the model's functioning, applicability, and validity based on the constructivist paradigm.

The constructivist approach focuses on understanding and reconstructing the meanings people hold about the phenomenon being studied (Schwandt, 1994) to create a new body of knowledge through dialogue and reasoning as the primary methods of investigation.

The constructivism philosophical paradigm is associated with the qualitative research approach. This is the case because the paradigm seeks to understand a phenomenon under study from the experiences or angles of the participants using different data collecting agents, hence the need for interviews.

Additionally, the researcher frequently returns to the data sources, asking what they meant to the participant and integrating those with their meaning to the researcher (Rowley, 2012).

In the quest to explore the feasibility of the proposed framework, there is a focus on the profit-equation model. However, though the profit equation is at the heart of the framework, profit in itself is a lagging metric. Thus, the need to focus on the drivers/ parts of the profit equation as the leading metrics for disruption.

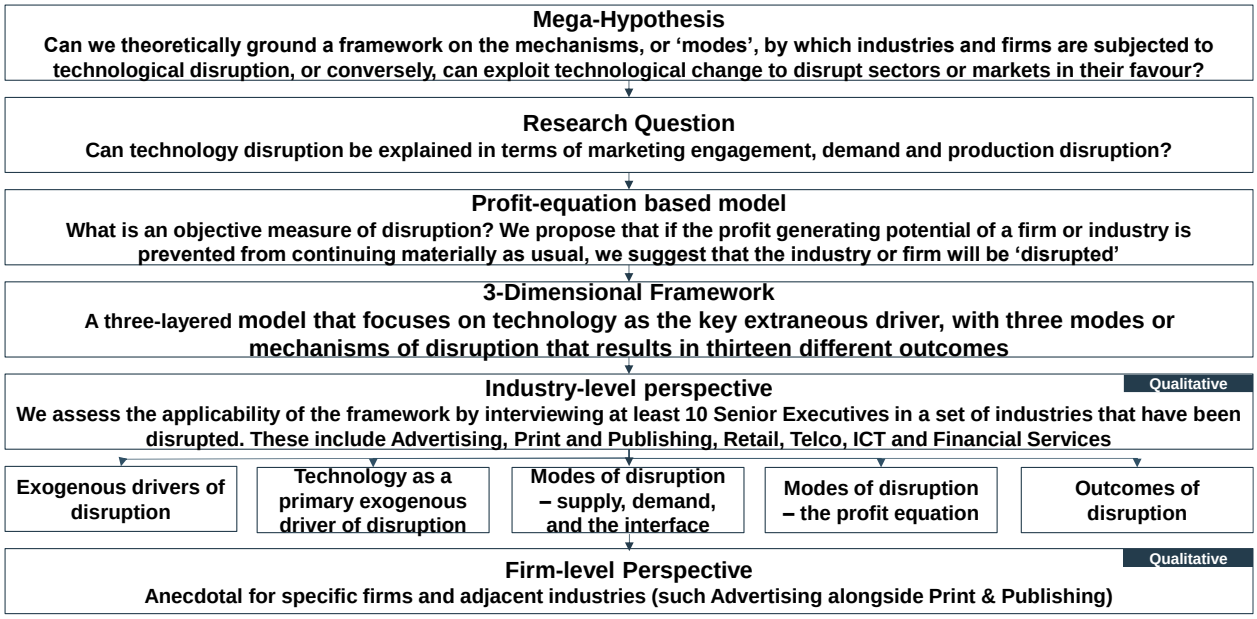

Figure 6: Research Approach

As per Figure 6, the research approach is focused on two main areas of exploration.

Firstly, theoretically grounding a framework on the 'modes,' by which industries and firms are subjected to technological disruption, or conversely, can exploit technological change to disrupt sectors or markets in their favour; by leveraging the thirteen mechanisms is posited. The research question then becomes, "Can technology disruption be explained in terms of market engagement, demand, and production disruption?"

Does this lead to what is an objective measure of disruption? Suppose the profit-generating potential of a firm or industry is prevented from continuing materially. In that case, the model suggests that the industry or firm will be 'disrupted.' A three-layered model that focuses on technology as the key extraneous driver, with three 'modes' and thirteen different mechanisms, is then posited as the framework for analysis.

This framework's applicability is assessed by interviewing at least ten (10) senior executives (experts) across a set of industries that have been disrupted. These include Print and Publishing, Financial Services, Advertising/Marketing, FMCG/Retail and Information, communication, and technology to verify the framework through:

- Confirming the exogenous drivers of disruption;
- Establishing technology as the primary exogenous driver of disruption;
- Exploring the modes of disruption;
- Exploring disruption in terms of how it manifested in the profit equation; and
- The outcomes of disruption

These industries have arguably been vividly quoted as disruption examples ranging from Newspapers in Print & Publishing, the Yellow Pages in Advertising, and Edcon in Retail, to name a few.

The interview participants were gleaned from the author's professional network and those referred by C-level executives. Participants were approached via email and then followed by a telephone call confirming availability and consent.

Individual firms or firms in adjacent industries affected by technological change events while holding other external disruptive forces - social, political, or regulatory – constant are then explored.

Ultimately, the empirical research in this study is interested in whether the framework can aid strategic decision-making on how technological change can create disruptive opportunities or threats for firms.

In this instance, the underlying logic of the research is qualitative, emphasizing deductive reasoning (Bell, Bryman, & Harley, 2018). It is set within the real world of the South African economy and specifically the businesses it comprises.

The primary focus will be on how technology has affected demand and production, the connection (what is currently termed "marketing-engagement") between them, and how these have affected the core dimensions of the profit equation, namely volume, price, and cost.

Which type of research strategy is best suited to facilitate this study as it spans multiple industries and variables but requires a focus on the lenses of disruption to promote focus?

Historical research, as a strategy, is not appropriate to this research work as it is normally associated with looking at non-contemporary phenomena. Similarly, survey-based research fails to address the aim of dealing with a variety of industry variables (such as the shifts in standard macroeconomic and microeconomic factors.) in depth.

Action research and grounded theory have appeal. It involves an in-depth analysis of a current problem and can best be solved by close collaboration between the literature and real-world trends. Such an approach is iterative. Data is collected, analysed, the problem is revisited, more information is collected, analysed further, revisited, and so on until an agreed solution to the problem is achieved. However, this research work may be broad and require sophistication that may not be appropriate at this juncture.

A case study could have resonance in explaining the phenomenon of the framework. Still, it may require a single location or highly ring-fenced boundaries, which could cause biases to arise (Tellis, 1997).

Experimental research may be more appropriate at this moment as it concentrates on causal relationships and, in attempting to achieve objectivity, separates phenomena from their social context (this empirical research centres disruption within industries by using the profit equation).

Thus, though there are many options for this type of study, the phenomenological strategy was selected to enable a qualitative research approach. This is important as we can discover the meaning people give to events they experience in conjunction with the deductive reasoning method to refine the analysis. (Merriman & Grenier, 2019)

Specifically, the phenomenological method was used to understand how executives make meaning of the phenomenon – in this case, technology disruption and its interaction with the profit equation - to understand the dynamics of disruptive innovation in a corporate structure (Nonaka & Takeuchi, 1995).

3.2 Research design

The research question of “can technology disruption be explained in terms of market engagement disruption, demand disruption, and production disruption?” remains but an investigative one when assessing the framework on the modes of disruption. The literature review has highlighted the many conflicting views of disruption and its varied effects on industries. This challenge is further exacerbated by the abundance of anecdotal reference and the lack of robust empirical data (King & Baatartogtokh, 2015)

As mentioned previously, To address this initial part of the study, the author proposes testing the proposed framework on the profit equation, which is made up of three levers of Profit = (Volume x Price) – Cost. Though profit is a lagging indicator, its constituents can be deemed leading indicators for demand disruption.

The core input / independent variables will be the market share and market size. The industry output/dependent variables being price and cost.

The literature review shows that these variables are essential; in that average profits decrease in disrupted industries. At the same time, concentration ratios increase when there is the presence of ‘superstar’ firms. There is also an increasing pattern of churn for older, established firms (being displaced by new technology-based start-ups).

If the linkage is proved successful, the profit equation can be affirmed for each of the thirteen mechanisms of disruption at an industry level to triangulate the study on technological events and understand any other distinguishing features (such as different types of outcomes). If unsuccessful, then the premise of the profit equation being the core determinate is deemed invalid or insufficient.

3.3 Data collection methods

This research paper seeks to generate interpretations of the world to have a framework that can assist organizations in identifying and responding to disruption within their industry. Thus the data collection will be a qualitative study.

In collecting qualitative data, attempts will be made to gather supporting data for integrity and robustness references.

The primary data collection technique will be interviews with a set of ten (10) senior executives (experts) in the industries that have been affected by disruption in the last twenty years. The South African economy and the businesses were selected as the frame of the study for multiple reasons. Firstly, South Africa is a diverse economy and interconnected with the global economy. Secondly, it is highly sophisticated in its financial services and agricultural sectors (DAFF, 2017). Lastly, it is also highly regulated with robust reporting and governance mechanisms for the corporate sectors (IDSA, 2016), with many pursuing adoption and purchasing new technology solutions.

However, it also suffers from one of the highest Gini co-efficient in the world a chronic lack of skills and a young, growing population which can exacerbate the impact of technology implementations, thereby resulting in high quality (if exaggerated) outputs for this study (Economic Policy, 2019)

Hence, the interviewees would be seasoned business executives whose availability would be limited and require significant coordination. The interviews are held over Zoom (a cloud-based remote working and videoconferencing solution) and at least 60 minutes in duration. The session was scheduled via Calendly (a cloud-based diary management system), and sessions were automatically transcribed through Otter.ai (a cloud-based transcription service), enabling rapid assessment of results and ease of use to capture key themes, quotes, and observations.

It is hoped that the results of this study will provide the reader with a three-dimensional framework of demand disruption and its overall validity. Additionally, it adds to the tapestry of knowledge forming around the field of technology disruption in the digital era. This study is not intended to be an exhaustive study of all types of disruption occurring in the South African economy but rather a framework that can bridge the gap between the concept of disruption and its effect on leaders' and managers' strategic choices.

3.4 Population and sample

3.4.1 *Population*

The population for this research is the formal businesses comprising the South African economy and, specifically, corporate industries. The reasoning behind this population is that it will present a macro-view of the shifts occurring intra and inter industries.

3.4.2 *Sample and sampling method*

Purposive or selective sampling in the form of non-probability sampling is what the author relied on. Therefore, judgment was crucial for choosing population members to participate in the interviews. This was selected as it enabled the author to squeeze much more information out of the collected data. The sample comprises interviewing at least eleven (11) Expert Senior Executives in a set of industries that have been disrupted. These include Advertising, Print and Publishing, Media, Banking, Retail, Telco, ICT, and Financial Services.

Table 2 below outlines the selected industries and targeted interview participants. Each is highly regarded in their field and are commonly acknowledged as experts and seasoned business leaders in their respective fields:

Participant	Industry	Role	Gender	Race	Age
Participant 1	Print & Publishing	Editor	Female	Indian	40
Participant 2	Print & Publishing	CEO	Male	Indian	43
Participant 3	Financial Services	COO	Male	Indian	40
Participant 4	Financial Services	CFO	Male	White	59
Participant 5	Advertising	Director	Male	Coloured	46
Participant 6	Advertising	Director	Male	White	49
Participant 7	Professional Services	Partner	Male	Black	49
Participant 8	FMCG	Director	Male	Coloured	43
Participant 9	ICT	CEO & Professor	Male	Indian	60
Participant 10	FMCG	CMO	Female	Coloured	43

Participant 11	Telco	CEO	Male	Black	43

Table 2: Expert Interviews

3.5 The research instrument

The collection of the type of data is essential. As such, the use of primary (interview) data will be sought and supplemented with secondary data due to its relevance, lack of bias, and immediate applicability to the profit equation.

Primary data will provide an objective view of the profit equation and its subsequent impact on disruption. Primary data collection has been selected to allow for a historical viewpoint and additional perspectives that raw empirical data may not elicit.

In this instance, the research instrument will comprise fifteen (15) open-ended questions with experts engaged in an interview lasting no more than 60 minutes each.

The research instrument was constructed with the completeness, precision, accuracy, and confidentiality required to ensure a highly detailed and valid set of qualitative data is collected and transcribed effectively.

The questions were co-created with the supervisory professor and benchmarked against identification, item construction, validity testing, and reliability testing. Notably, the outcome of these interviews assisted in grounding the model. Interviewee responses started with the variables of disruption and concluded with its impact on the profit equation.

3.6 Procedure for data collection

Data will be gathered directly from the interviews. The interviews are classified according to the sub-research areas. As per Table 3, they highlight the open-ended questions that will be asked of participants.

Construct	Code	Sub-Questions/Hypothesis	Interview Questions
Drivers	ED	Exogenous drivers of disruption	ED1: In your industry, what have been the main exogenous sources of disruption in the last 20 years?
			ED2: How have these disrupted your industry (manifestations, not mechanisms, eg. market size industry structure, industry profits, churn e
			ED3: In your firm, what have been the main exogenous sources of disruption in the last 20 years?
			ED4: How have these disrupted your firm (manifestations, not mechanisms, eg. market share, revenue, costs, profits, customer loyalty, etc..)?
echnology	TD	Technology as a primary exogenous driver of disruption	TD1: Over the last 20 years, how has technology disrupted your industry
			TD2: How have these disrupted your industry? (Manifestations)
			TD3: Over the last 20 years, how has technology disrupted your firm
			TD4: How have these disrupted your firm? (Manifestations)
Modes	TM	Modes of disruption – supply, demand, and the interface	TM1: How has tech change affected demand factors in your industry in general, and your firm in particular?
			TM2: How has tech change affected supply factors in your industry in general, and your firm in particular? Supply factors includes how you produce your product or service.
			TM3: How has tech change affected how supply and demand are connected, in your industry in general, and your firm in particular?
ofit Equation	PE	Modes of disruption – the profit equation	PE1: How has tech change affected volumes in your industry in general, and your firm in particular?
			PE 1.1 Follow-up: why did volumes [rise/fall/not change]? Was it market size or market share, and why? [The intent here is to draw out substitution, downstream substitution and disintermediation]
			PE2: How has tech change affected prices in your industry in general, and your firm in particular?
			PE 2.1 Follow-up: why did prices [rise/fall/not change]? Was it related to industry structure, or was it cost-related, differentiation related, o other customer factors? And what caused this? [The intent here is to draw out the driving factors of price change]
			PE3: How has tech change affected costs in your industry in general, and your firm in particular?
			PE3.1 Follow-up: why did costs [rise/fall/not change]? Was it related to customer acquisition costs, production costs distribution costs, overhead costs or supply (input materials) costs? And what caused this?
Outcomes	TO	Outcomes of disruption	TO1: At an industry level, what evidence have you seen of the impact of technological disruption on industry structure, considering the following indicators: 5.1.1 Total market size / industry turnover 5.1.2 Industry concentration 5.1.3 Industry churn 5.1.4 Industry profitability 5.1.5 Industry employment 5.1.6 Industry investor attractiveness 5.1.7 Industry valuations 5.1.8 Any Others?
			TO2 Optional: You may wish to probe /validate the extent to which these observed manifestations are the result of tech change vs other

Table 3: Open-Ended Interview Questions

The questions were designed to elicit and probate the framework's validity and comprise fifteen (15) key questions and three (3) additional optional variation questions.

3.7 Data analysis and interpretation

Data analysis was done using thematic analysis. The approach is to validate the modes of disruption framework. The analysis was then supplemented with any recommendations or suggestions from the expert interviews to improve the framework.

The interview transcripts were reviewed several times in analysis, searching for “common patterns and themes” emerging (Cho & Lee, 2014). The key quotes and phrases from the interviews were highlighted, and the constant comparative method was used to ensure that categories emerged that was consistent yet distinct. The categories and coding were then overlaid with the framework with relationships identified (Jackson & Mazzei, 2011).

Based on respondent feedback, common themes, priority ranking, and impacts per disruption mode will also be analysed. The limitations of the framework are being documented.

Figure 7 below outlines the comprehensive data collection and analysis framework to be pursued. This will inform the course and direction of the study with adjustments and modifications required of the framework.

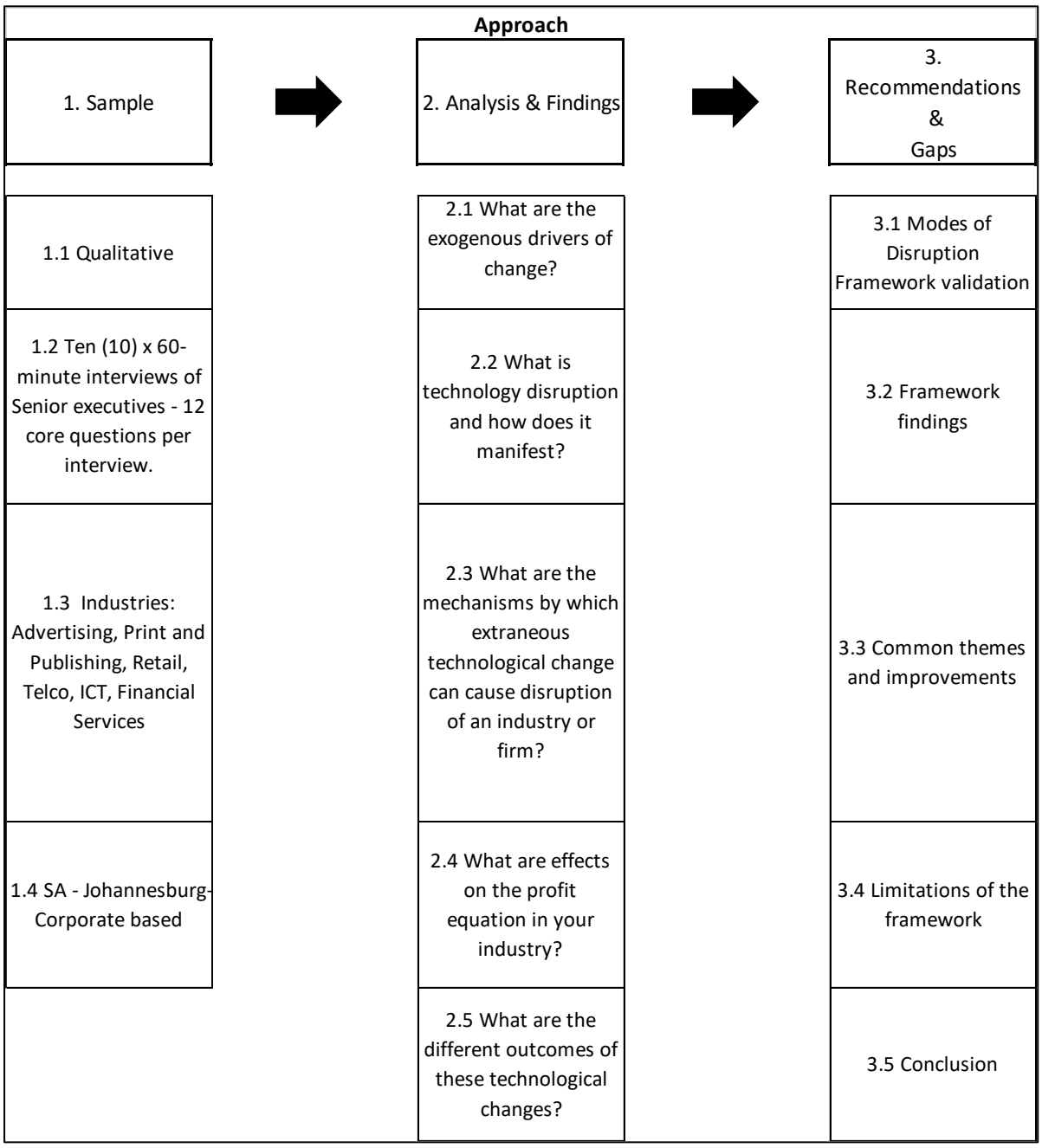

Figure 7: Conceptual Approach

During the interview process, it was clear that more clarity was required regarding the applications on the thirteen outcomes of disruption. This, in turn, necessitated the use of more open-ended questions and a conversational style to elicit reflections.

An interesting finding was that participants volunteered additional information for clarity and completeness when the interview notes were played back to participants.

The model's robustness and data were sufficiently tested and proven positive and established the framework's accuracy on the disruption outcomes. In addition, the false-positive test was also checked through random fact-checking (e.g., did volumes fall in a particular industry?).

3.8 Limitations of the study

There are some limitations to this research. These are the qualitative lens of the study, the limited number of seasoned business experts available, and additional factors such as the industry-level views of factors impacting disruption.

Firstly, due to this primarily being an experience and knowledge-proof case by experts, there may be scope in future studies to quantitatively evaluate the framework. This may help with the transferability rather than the framework's validity, which we seek to do in this paper.

Secondly, the participant numbers were relatively small due to the stature of the individuals required, and these, in turn, were limited to Corporate South Africa, primarily based in the Johannesburg metropolitan. A more comprehensive range of participants may lead to more expansive and emerging industries.

Additionally, it was previously highlighted how wealth distribution, skills (education), and geographical trade and production provide an excellent locus to test the model in the South African economy. However, other factors relating to the framework using quantitative data are the effect of politics, government, and the prevailing infrastructure on accelerating or decelerating the impact of disruption within industries.

Lastly, the results of this study will be aggregated at an industry level with firm implications. However, it has not studied the specific mechanics of firms within

industries. By way of example, data about items such as time-to-market where usage of customer co-creation or engineering and its subsequent effects have been excluded. So too has been resource and asset utilisations that may reveal optimisation data and predictive maintenance scheduling. Also excluded is the actual adoption and adaption of these technologies within specific firms.

3.9 Dependability and Reliability

The dependability and reliability in this study are essential as it seeks to have the generalisability of the model. In this respect, a tried and tested research strategy is being used, appealing to the concept of generalizability rather than relatability as generalization can only realistically take place over a period – which is why the requirement to select experts with over 20 years of experience

There is a complete audit trail of the interviews (on-demand cloud-based platforms that are secure), interview questions, rich descriptors, and how the questions related to the key components to be tested in the framework to increase dependability.

The critical question here becomes whether the expert views can be trusted, complete and what other sources could have been chosen. As highlighted, the interview listed is made of senior executives at leading businesses in South Africa and are acknowledged as such in their fields. Also, asking the same questions in the same order, probing, and validating each participant's response enables a higher degree of trustworthiness.

It also demonstrated the rationale and approach, acknowledging that gaps may arise requiring additional (unforeseen) data. Therefore, the limitations of this research have been addressed alongside the methods used to minimize potential criticisms.

3.9.1 *External validity:*

Relevant use of trusted experts and business sectors.

3.9.2 *Internal validity*

The validity and credibility test were met by proposing a framework based on fundamental theories such as Schumpeter's Creative Destruction, Rogers' Diffusion of Technology, and more recently, Christensen's Disruptive Innovation Theory. In addition, the definitions of disruption were researched and critiqued. This was then fused with contemporary examples in classical literature, anecdotal studies, or more trend-based thought leadership and point of view works arising from consultancies. This was then melded into a framework that is centred on the profit equation.

The only actual mechanism to test the profit equation is to apply the framework using the dimensions of profit, volume, price in a business context within corporate South Africa and using the expert interview to derive insights into the disruption phenomenon.

3.9.3 *Reliability*

Reliability in this context refers to whether the data represents the constructs assumed to be captured and, probably more importantly for the study - does the data consistently and accurately represents the constructs to be tested?

This data comprises the expert views on the exogenous drivers of disruption; technology as a primary exogenous driver of disruption; the modes of disruption relating to supply, demand, and the interface; the modes of disruption relevance to the profit equation and the thirteen mechanisms of disruption.

3.10 Demographic profile of respondents

The demographic data is an ~ 80%/20% mix of gender (9 male, 2 female) with > 80% transformational candidates (9 African / Indian / Coloured, 2 White). The primary selection criteria are age (> 40 years), seniority (executive committee), and experience (> 20 years). Further details can be obtained in the *Participant Interview guide in Appendix A.*

APPENDIX A: Participant List

3.11 Ethical considerations

This is a low-risk study as the interviews do not intend to cause harm or present radical views that could result in adverse outcomes. In addition, signed consent will be obtained before the actual interviews with the experts.

All data captured will remain anonymous and confidential. Identities will only be known to the researcher. Further details can be obtained in the *WBS Ethics Clearance Application in Appendix F.*

APPENDIX F: Ethics Clearance

CHAPTER 4. PRESENTATION OF RESULTS / FINDINGS

This chapter focuses on presenting the empirical findings of the interviews. These interviews focus on the linkages between technology and the “modes” of disruption. These modes of market engagement, demand, and production disruption are discussed in the context of the profit-equation model. The overall purpose is to assess the applicability of the model in a real-world setting.

4.1 Introduction

This section has been classified according to the interview structure guide to ensure all framework elements were covered. The structure of the interview covered five (5) areas, and these will be detailed below. The findings of each section are at an aggregate theme level and not per individual question. Where there are quotations, these are mainly based on the interview data or from published sources.

Recall that the focus is to assess the feasibility of the framework through an exploratory study on the modes of disruption, explores five (5) main areas:

- What are the extraneous drivers of technological change?
- What is technology disruption, and how does it manifest?
- What are the modes by which extraneous technological change can disrupt an industry or firm?
- What are the effects on the profit equation in your industry?
- What are the different outcomes of these technological changes?

The subsequent sections explore each of these five areas sequentially.

4.2 Results: Exogenous drivers of disruption

This section discusses the research results regarding the extraneous drivers of disruption and whether technology is predominant among these.

The earlier literature findings indicate that there are multiple drivers of disruption. Still, the interaction between the technology and its environment creates new market opportunities or challenges. Based on the interview data, the key driver of disruption

is the technology itself and how it affects societal trends – in this case, rapid consumer adoption – and the resultant lag of adaptation by organisations (Moneta & Sinclair, 2020).

The interviews and feedback synthesis reinforce this finding, especially in the Print and Publishing and Financial Services industries.

In the Print and Publishing Industry case, there are many societal and economic forces at play. The legacy of apartheid and a weak reading culture meant that most South African residents have low reading and writing abilities. South Africa ranks extremely poorly on literacy rankings (Research & Markets, 2019).

If this is the starting point, then any technological dynamic is sure to have a massive effect, specifically on the "digital divide," and exacerbated the gap between those with access to resources against those who lack them. This is further compounded by most of the Print and Publishing being digitised, resulting in the lower circulation of community newspapers, daily news outlets, and magazines

"The digital disruption in Print and Publishing is complex, multi-fold, and impacts the very nature of what is being done" (Woman, 40 years old).

Many traditional Print and Publishing businesses have attempted to move into a "platform" business model and diversify into non-media services such as event management. However, these have been inadequate to cover up for the shortfall in circulation and advertising revenue. Thus, despite attempts to reposition the traditional business, there has been an increase in production and distribution costs. This has made the legacy businesses in this industry uncompetitive with increasing cost-to-income ratios.

In addition, competition has emerged from social media players, search engines, and websites that have enabled self-publication. These digital-native companies can seamlessly offer media, advertising, and news with lower costs for publication and distribution and higher revenues from targeted advertising.

Unfortunately, even with the pursuant strategy of a “platform” business model and more digital media, these do not have the scale to compete with native digital companies.

There have been regulatory efforts to stave off the declining profit pools by curtailing the power of social media players. This is more prominent in developed nations, limiting information classified as “news” on the Facebook platform in Australia, a case in point (Meagher, 2021). Some publishing houses have opted out of Facebook entirely, pursuing WhatsApp as a channel for publication. Again, this is almost circular with Facebook acquiring the WhatsApp platform – resulting in traditional news and print agencies being pushed further to the fringes and eventually out of the market.

In support of these initial findings, economics plays a significant role in disruption initiated by technology. The shift to digital brings to the fore the intertwining part between technology and unit economics with the resultant impact on the practical benefits, such as speed and time savings, which drive cost savings. Sticking with the Print and Publishing industry, there is evidence that print and digital teams run differently with totally different team members and constructs. With the cost of connectivity and access constantly improving, more and more digital-only players enter the market. Therefore, there is a crowding out of existing traditional plates via unit economics favour them. Significantly, a mass of lower-income users is denied access to conventional print media in the South African context, while a smaller segment of a more affluent users is entering the digital world. These affluent users also tend toward more international news sites and eBooks. Thus, the key battleground for users’ attention has become fragmented on an economic level. Those traditional businesses who have adopted a dual analogue-digital play have found that this has not been favourable. As one participant observed:

“An economically disastrous approach” (Woman, 40 years old),

Technology-led disruption, in this sense, has made the print and publishing industry a scale game. One where the effects of digital globalisation have been truly profound. In this instance, any local print and publishing house must compete globally with an international consumer base demanding instant fulfilment and gratification. The

ultimate effect is the closure or consolidation of businesses such as Jacana Media, in which a consortium led by two publishers bought an 82% stake (SAbooksellers, 2019).

Because of this competition and immediacy, profit types and pools have changed. Premiums that could be charged due to apparent print quality (such as glossy magazines) have collapsed due to everyone playing off a similar quality base digitally. This creates a commoditisation effect with smaller margins and therefore, a scale game. Interestingly, population growth has increased, fuelling this scale effect, especially in emerging markets, thus driving consumption (BCG, 2018). As one participant noted :

“Frequency of use has increased, but for information, this has been on free social media platforms in countries like South Africa and Brazil” (Man, 47 years old)

A notable theme in the interviews has been the impact of COVID-19 as a source of disruption. Often referred to as a “black swan” event, it has dramatically altered the way the world works and, in some cases, accelerated the pace of change (McKinsey, 2020). In the Print & Publishing Business, one participant remarked:

“Though online news site traffic has increased by > 70%, the pandemic has led to advertising cuts and distribution challenges. One magazine publisher has already stopped trading while more are expected to withdraw” (Man, 47 years old)

In Financial Services, the economic cost structure has also been fundamentally affected, with one participant remarking on how it has affected the way people work and pay for goods and services:

“We have seen that with work-from-home, line items in the income statement relating to general, administration, and real estate costs have plummeted. Though there is some offset with regards to the provision of additional laptops, connectivity data, and video-conferencing subscriptions, the overall savings have been massive” (Man, 40 years old).

An unintended benefit was the productivity uptick in 10-20% of resources working remotely (Microsoft, 2020) due to COVID-19. The pandemic also created an upswing

in mobile wallet adoption, with a leading pan-African Financial Services company headquartered in Johannesburg, South Africa, reporting that:

"Mobile wallets on your bank accounts have quadrupled, which has enabled access to other products. There has also been greater collaboration with Telco's that have resulted in better credit scoring models meaning that the underserved and unbanked are coming into the market" (Man, 59 years old).

The unintended consequence of this has also been reducing branches and the need to develop new mobile-first solutions to better meet their customers' needs (PWC, 2019). This is important as the physical cost of brick-and-mortar infrastructure has risen with limited revenue growth. Branches played a more phycological and marketing role with minimal real returns. In contrast, digital mobile banking has driven accessibility and frequent daily use in a simple, cheap, and user-friendly manner.

Technology has also affected customer loyalty, with this being fiercely fought in all industries. Like digital wallets that have enabled digital banking transactions, technology has created a new mechanism for trading goods and services. Simply put, digital transactions are creating a disintermediation effect – one that is gaining momentum. Whereas in the past, customer loyalty was paid "lip-service" - the rise of eCommerce D2C models has presented a mechanism for brands to cut out the middleman and directly reach the end consumer (e.g., Farm to fork solutions). At the same time, consumer loyalty is moving towards platforms and alliances (e.g., Takealot and Discovery Miles) rather than stand-alone programmes (e.g., Click Clubcard's) that many consumers have eschewed in favour of more straightforward and integrated rewards ecosystems.

To conclude, the interviews have demonstrated that though are multiple forms of exogenous disruption, technology is at the centre of this disruption and the common element. Technology changes the unit economics of industries and reinforces the shift of consumer behaviour to channels that reduce customer "friction." The research findings relate specifically to the exogenous manifestation and not the process of disruption and identify critical aspects about it, thus extending the existing knowledge of disruption sources.

4.3 Results: Technology as a primary exogenous driver of disruption

This section explores the responses to the second area of investigation: what is technology disruption, and how does it manifest?

The second theme to emerge from the interviews is that technological change profoundly affects industries and business value chains. The participants have elicited a direct correlation of technology impacting revenue pools and churn within an industry. It is the second theme that confirms that technology is the primary driver of these changes. Notably, this is also correlated to the literature. Both the literature and interviews frequently reference technology affecting customers and operations, which becomes the frame for evaluation.

Customer and their awareness of products and services before a purchase have increased ten-fold. This has altered the approach in which marketers can now target and activate segments. Traditionally, marketers use the tried-and-tested “funnel approach,” which segmented customers by physical geographic reach. However, direct-to-consumer models have dynamically changed this by improving the supply chain, making them cheaper and faster. Similar to the first theme, it has driven the commoditisation of goods (Capgemini, 2017). As a Technology CEO remarked:

“Consumers have adopted technology at a much faster rate than a corporation. They also use it differently, whereas a corporation leverages technology to drive down cost, consumers use it to fulfil a need in daily life” (Male, 60 years old).

In this regard, technology has created divergent paths for customers and businesses. This, in turn, has created a chasm between how companies operate versus what customers desire, making the disruption even more profound.

Critically, customer behaviour has also become more fluid, with quality and availability features being taken for par, resulting in goods becoming commoditised. Rapid technology adoption by consumers has also meant that brands are fighting for consumers' attention (like the Print and Publishing examples referenced earlier).

This has resulted in the need for businesses to reinvent their business models. Many of these businesses are attempting to cross the “chasm” by creating a platform business model. Many have started with e-commerce, exemplified by the digital role transformation that traditional retailers have undertaken (BusinessInsider, 2020). This, in turn, has changed the purchasing frequency from primarily weekends to 24/7. As a retail guru highlighted, these business models vary the:

“Complexion of engagement with the customer as they move away from monthly consumption to daily, just-in-time needs” (Male,43 years old).

This engagement layer is the market engagement mode referenced in the framework, connecting demand and production from a business operations perspective.

Extending this finding has been the high prevalence of automation within these retailers, with less reliance on marketing and distribution expertise of seasoned marketers who leverage experience or observation. The new game is around data, and automation provides a level of customer insight and responsiveness not previously seen:

“Technology disruption has taken the subjectivity out of consumer behaviour with a higher appetite for A/B product testing to determine what customers like” (Male, 49 years old).

Another technology phenomenon has impacted the production and supply side in the form of e-Bidding. This has enabled smaller suppliers who, through digitally pooling their goods, to enter the supply chain. This, in turn, has had a knock-on effect of small, micro, and medium-sized businesses syndicating to a regional supplier level and creating a larger virtual supplier/bidding pool. An FMCG participant remarked:

“Technology disruption has created alternative markets, creating a cost-efficiency, transparency, and immediacy that large corporations have struggles to adapt to, while smaller businesses have grabbed” (Female, 43 years old)

This market creation is not necessarily positive at an industry level. There are some negative characteristics that digital technologies have introduced. For example, in the Telecommunications industry, the market size (by customer numbers) has not

dramatically shifted, with a ¬50 million population and 100 million subscribers remaining static for the last five years (Statista, 2021). Therefore, although there may be a new market for certain goods and services, these are more a feature of a shift in product revenue rather than an actual additional revenue stream:

"Three years ago, average revenue per user pools were approximately ZAR 300 million, but a shift from voice to data services has seen it drop to less than ZAR 100 million" (Male,43 years old),

There is also evidence that technology disruption is having a profound effect on labour rates. Automation of creative work in Advertising has seen a shift in how work is distributed and optimised, thus becoming more dynamic:

"With machine learning algorithms taking a more informed position in terms of what works or does not work with audiences. Experimental technologies have started within our firm to generate a volume of new ideas and campaigns" (Male, 46 years old)

This means that job pools in both the Telco and Advertising industries are falling. In the mining industry, resource planning automation and mechanisation have created a new category of jobs requiring less technical work. As the lead participant for industry noted:

"Blue-chip professional service firms are moving to contingent, and freelance work enabled through a globally connected, twenty-four by seven workforce who are on-demand. This has driven significant reduction in labour pools as well as employee benefit savings" (Male, 50 years old).

In a nutshell, technology is the most profound of all exogenous factors concerning digital disruption. Beyond technology disruption, there is now evidence of the evolution of technology and its associated impacts on industry and firms that operate within it. For example, 5G technology is predicted to be the next technology to reach maturity (and commercialisation). Still, these technologies come with significant capital outlay, with the incumbent not guaranteed to harvest the profits that may arise. As a Telecommunications ruefully mused:

“We have leapfrogged from automation to digital automation and then to Artificial Intelligence! But have we considered what is going on from a long-term commercial perspective?” (Male,43 years old).

Overall, the interview data of this study suggest that the direct impact of technology is on both the demand (customer) and production (provisioning and fulfilment of products and services) side. Echoing the earlier findings, technology disruption manifests across individuals (consumers), organisations (businesses), and multiple external and internal elements.

4.4 Results: Modes of disruption – supply, demand, and the interface

This section explores the mechanisms by which extraneous technological change is seen in industries or firms and whether this supports the modes of disruption framework proposed in Chapter 3.

The interview data analysis shows that the modes of disruption across demand and production are via a unique market engagement interface that creates value for existing or new customers.

This can be evidenced in the findings where there is significant intermediation above all other elements on the demand-side in the case of demand factors. Crucially, this is interlinked strongly with market engagement disruption, which is highly evidenced in Financial Services.

For example, traditional insurers' previous paper-based data-heavy collection process has been disrupted by new technology players. Discovery and Naked insurance (Mulligan, 2018) offer a direct-to-market offering and have also changed the nature of the underlying product through digital automation and analytics. Large chunks of the product and value chain have been automated and digitised. In addition, the relationship between parties has changed, with anything not having a material contractual nature (e.g., banking details, beneficiaries, benefits, fund values) being put into the consumer's hands, thus reducing the “back-office” burden/

Though customers have driven this product and service commoditisation to a degree, the technology itself has shifted the medium and channels of engagement. This has resulted in customers having easier accessibility, excellent financial advice, and increased productivity through advisor tools. One respondent highlighted:

"Though 30 million people are uninsured in South Africa, we are attempting to move with the technology and get more engagement with our customers. Gamification is a start, but building a community that is engaged daily is our goal" (Male, 40 years old).

Mobility through cellular phones has also created another digital dynamic. The shift from physical pieces of plastic (i.e., a debit or credit card) to mobile wallets or virtual cards has been accelerated through the COVID -19 pandemic (IOL, 2020). While the effect on other financial products set is unclear, there could be significant shareholder activism on individual stock trades of companies.

Technology has also created flexibility with ease of transactions. This is exhibited in digital verification of Know-your-Customer and eFICA, which are more seamless. The 2020 Experian data breach (DailyMaverick, 2020) has led to a downstream substitution of credit rating products with machine learning algorithms removing the need for integration into a central database. This is indicative of significant shifts in the value chain:

"In asset vehicle and finance, new entrants such as WeBuyCars.co.za along with electric cars and autonomous vehicles have created a different commercial model. We are seeing fewer asset purchases with rental or short-term usage contracts being favoured" (Male, 59 years old).

These technology-driven disruptions have also upended the traditional strategy and business planning process. Typically, an organisation researches the macro-environment factors, which then informs them of the strategic direction. Practically speaking, this informed the development of an idea and translated it into a product offering. The next step is to get the product delivered onto a channel and finally into a physical asset for the consumer.

However, demand is now coming from a digital medium – such as social media - which does not require massive downstream production costs (e.g., mailing brochures with

the associated time, printing, and delivery cost). In this sense, demand disruptions have again been evidenced on the production side.

This can be demonstrated by producing a high-end quality video that gets transferred from Television to YouTube. In some sense, there is the substitution of video production:

"Anyone with an iPhone can do a great commercial" (Man, 46 years old).

This degree of substitution may lead to an industry such as Advertising being redundant through an ecosystem run totally on artificial intelligence.

This phenomenon is not limited to just Financial Services or Advertising. Automation technology used to analyse statements and reporting has had a knock-on effect on the type of auditor that goes to a client. The provision of the service (globally vs. locally) has also changed:

"Virtual mobilisation is so much faster if a client in Canada requires work, I can source the best resources with the most relevant sector skills with the associated economic savings on travel, accommodation, not to mention mobilisation speed " (Male, 50 years old).

The Internet of things in fast-moving consumer goods (FMCG) has also provided richness in the end-to-end value chain of the shopper with reverse logistics fully integrated, resulting in less demand planning and more analysis and fulfilment per client. This automation and data on the supply side help create a demand-side environment where a consumer is always on:

"Margarine may be out of stock, but mayonnaise may be a natural substitute. The system's openness is unique and scary, and customers have a greater awareness of your value chain and are more open to experimentation (Male, 43 years old).

In FMCG, the digital tagging of transactions and analytics of machine learning algorithms have improved the understanding of habits with clear patterns emerging on what, where, and when consumers buy daily, weekly, or monthly. This results in a rich, interwoven consumer journey with multiple trigger points. These triggers can be

educational, consumption, or purchases of products and services in the physical and digital world.

Digital technology has impacted brands and their evolution. This can be seen in the proliferation of voice devices (i.e., Alexa, Siri) which has changed the engagement between brands and consumers. These virtual assistants curate who connects with the user, drive recommendations, and influence rating systems. Critically they filter how and who gets activated in a brand's customer journey.

An example of this in practice is that an individual may read an article online on toothbrushes; Google picks this up, analyses this as mouth care, and then prompts the individual with a mouthwash/floss offer. How, when, and where becomes crucial to complete the purchasing and fulfilment journey.

Intelligent automation in the form of machine learning has also had a significant effect on FMCG. It has not just altered the performance of customer insights but also the manufacturing line:

"Where in the past you would have needed five or six operators, now you have robotics. The impact goes beyond saving on human labour costs – the scanning of pallets and weights, anything defective can immediately tell you there is a supply chain issue" (Female, 43 years old).

This technological emergence coupled with the diffusion of Intellectual property and crowdsourcing of ideas has seen significant ramifications on the supply side. Notably, the convergence of industries and partners enables organisations, employees, and even customers (using 3-D printing) to create new solutions and services.

In Education and ICT, the delivery mechanism has also changed. Intellectual property has moved quickly and made access easier (through product substitution in the form of eBooks) and moving into audiobooks – a whole new genre! Thus, the impact of one demand element (substitution) has dramatically altered another (disintermediation) via an interlinking mechanism (market engagement).

In a similar vein, where a telecommunication firm would open a store or a franchise-dealer who resells the company's product on the firm's behalf, they now tend to have a virtual shopping experience:

"These stores are expensive, as every customer you acquire requires a 10% commission, so acquisition cost is high, but with e-commerce, the direct costs drop steeply" (Male, 42 years old).

One key finding that much of the existing literature is silent on relates to the systems-thinking approach to disruption (Ramezani & Camarinha-Matos, 2019). In this sense, organisations may identify the manifestation and potential disruption but not correctly allocate them. An example of this is Orange, a French Multinational Telecommunication firm headquartered in Africa. Orange started distributing its services via a set-top box, switched to an app, and returned to a box! The demand for streaming services has modified the game that Orange is playing. Where they initially strive to control the distribution, then have one partner. They now must have a mechanism to connect the consumer to Netflix, Amazon Prime Video, Apple TV, and Disney+, thus taking a referral or transaction fee versus charging a subscription themselves.

Mode	**Mechanism**	**Participant Examples**
Market Engagement Disruption	Access: Channel, sales, and ordering process	New multi-functional media services (i.e., event management) in Print & Publishing
	Ownership models and packaging	Reconstruct of Vehicle and Asset Finance in Financial Services due to autonomous vehicles and D2C models
	Price Differentiation & disruption	Virtual global workforce mobilisation in HR and Professional Services
	Brand and reputation	Voice-based apps that target unmet needs (i.e., the blind or simple payment convenience in Financial Services)

	Customer Insight: loyalty, Value Management & translation	Individualised credit scoring and algorithmic models based on transaction via digital mobile wallets in Financial Services
Demand Disruption	Disintermediation	Digital self-publication sites vs. Newspapers for content and distribution
	Substitution	Digital textbooks/law publications with embedded training in Education
	Downstream Substitution	Cheaper automatic washing machines and a higher degree of electrification, resulting
Production Disruption	Core Production Systems & resources	iPhone creation of YouTube video and ad production
	Automation	AI and Automation of Artwork creation and processes in Advertising
	Improved resource allocation/ utilization	IoT for warehouse management (i.e., pallet and logistics management) for Retail
	Supply	Orange set-top boxes for Entertainment content in Telecommunications
	Distribution	Naked insurance, Capitec Bank in Financial Services

Table 3: Selected Participant Examples of Industry Disruption

Table 3 provides selected examples by the interview participants of the modes and the underlying mechanisms of disruption. Overall, there is overwhelming consistency in the effect of technology on all industries and the intrinsic link of how it connects the demand-side and production-side via the market engagement layer.

4.5 Results: Modes of disruption – the profit equation

In this section, the research results are reviewed in terms of the effects of disruption on the profit equation in an industry.

In essence, it can be ascertained from the interview data that technology-led disruption strongly influences profits and the components of the profit equation. Though there is vigorous debate on which has the more significant impact (demand or production side), industry volumes, price, and ultimately profits are impacted by technology disruption and serve as crucial signposts for the different modes.

Profit pools have been decimated in the Print and Publishing industry, and news media firms continue to make losses. The Washington Post (often heralded as the case study on relevancy and being a commercially sustainable enterprise) had to sink huge investments into digital starting in late 2016 (Loonam, Eaves, Kumar, & Parry, 2018) and continues to do so, while searching for a sustainable business model.

Le Monde (a leading sports publication in France) is currently experimenting with AI. They use algorithms trained on massive data sets to write stories on soccer and other sports (Forbes, 2019). They have also explored other use cases, such as communicating the weather conditions and which clothing to wear or equipment to carry (i.e., an umbrella). In a somewhat dark view of the future, this is where the industry is headed. Well-trained algorithms may soon replace essential news articles (Hansen, Roca-Sales, Keegan, & King, 2017).

Other profit displacement examples concern Facebook, Google, WeChat. These companies have larger ambitions than just a social media network (New York Times, 2019). They can quickly shift large amounts of data into manufacturing content. Working with partners can bring (and charge for) insights to the data to enable enriched customer journeys. Data that was previously used as a means of social connection and advertising may now be be-configured to becoming a supply source of revenue-generating content by intelligent algorithms.

In this sense, it is mainly immaterial for traditional publishers of news outlets to debate the merits to print or broadcast their journalistic content – they will be caught in a vicious cycle of constantly feeding a machine that never stops. The only basis for the

competition being to scale their production. This, in turn, has had a significant consequence on their metrics and targets:

"*One needs to produce at least ten thousand (10 000) news items per hour to meet the demand for new information locally, regionally or globally! An impossible human asks"* (Female, 40 years old).

This places an unrealistic demand on journalists or news content producers, impacting the quality of news and dissuading resources to the industry. In a vicious spiral, newsrooms then embark on cost-cutting, further reducing the market and industry size.

The situation in Financial Services is equally haunting. Overall, the FS industry has seen significant growth in the last twenty (20) years, but the previous five (5) years of growth have been muted. In this respect, digital tools and technology have enabled greater access and education, and consumer advocacy. However, this has also been offset by negative press, poor investment advice, and poor returns, which have shifted the game to new entrants in the industry. These new entrants are not only bringing new technology platforms to the fore but also new offerings such as de-centralized finance and non-fungible tokens, which are aimed at removing the friction between transactions and reducing the cost of the transaction to zero (Chevet, 2018)

The South African FS industry has traditionally focused on reducing the distribution workforce (advisor, branches). Still, there is also the "hidden" cost of removing legacy systems for the incumbent:

"Though technology costs have fallen, they still represent 20-30% of the cost base which get passed onto existing customers" (Male,59 years old).

In Advertising, there has been a move towards automation, with fewer people doing more work. This has affected the traditional time and materials charge models, with:

"*What was usually seven days for artwork is now just fifteen minutes, not to mention the higher degree of accuracy" (Male, 49 years old),*

Expenses and the associated margin billed to large clients have also fallen due to remote working. This means clients expect more financial value alongside the performance of the actual communication. Crucially, margins on work are also

diminishing as analytic engines, and artificial intelligence becomes more mainstream and replaces humans.

This is exacerbated as margins continue to fall due to Advertising agencies moving their business models from retainers to a lease or rental model via an industry platform. This leads to the irrelevance of the retainer model. In addition, there is a greater emphasis on leveraging the “crowd” for free or near-zero cost for previously “scarce” assets.

Technology disruption has also led to mergers, closure of agencies or agency holding companies merging divisions. This is evidenced in VML joining Yellow & Red (Adweek, 2018). Media companies and agencies which used to be together now sit outside each other. There are fewer and larger groups dominating the industry, such as TBWA, Ogilvy, Omnicon (Adage, 2018)

Cost pressure has also emerged, with budgets shrinking due to the targeted nature of adverts or the reusability of commercials (same cast, different product or different cast, same effect):

“Anyone who has not digitally transformed/upskilled will be bankrupt in the immediate future” (Male, 46 years old).

In other industries, such as FMCG, the category of goods may go unchanged, but digital technologies affect the purchasing cycle. This is demonstrated in the Laundry category and washing powder. In the 1980s, one manufacturer had over 90% market share, though the volume was much lower (Chipp & Maphalala, 2019).

Today, there is more volume but less market share:

“Products such as MAQ and Arial have changed the game, especially in conjunction with consumption changes driven by a move from hand-washing to machine wash cycles” (Female, 43 years old).

In terms of volume, the average size of washing powder has also moved from 1kg units to 3kg units with the base price increasing, but not everything can be passed onto the customer. Volume portfolio mix has also changed, with previously 70% of sales being promotion-led and 30% on regular pricing. This has now moved to 60%

promotion and 40% regular pricing (Kanter.com, 2020) as consumers become more adept at price-comparison websites/apps and retailers' demand:

"A greater margin split" (Male, 43 years old).

Pricing has also been affected by currency volatility and supply chain logistics (during and post COVID-19), impacting business costs. The volume growth has offset this as supply chains become onshore and more frequent contracts to retailers. Interestingly, costs have fallen as recyclability has increased (Unilever, 2020)

Across all industries, people's costs have fallen. As permanent jobs decrease and labour force withdraws, more work is being funnelled to freelancers and gig-workers even though some skilled resources (e.g., data analysts) have increased (Glassdoor, 2019). The net effect is that of reduced overheads.

In ICT, for example, the barriers to obtaining solution and building an e-Commerce site are two weeks:

"*Core production systems have changed, and the ability to virtualise large volumes on a pay-as-you-grow basis has enabled more entrants. These entrants arise at a lower cost while traditional organisations are not quite able to capture all the benefits from technology disruption" (Male, 42 years old)*.

As another participant explained:

"In ICT, what has created the connectedness has been the platform, the networks, and the ecosystems. My business and IP are zero with absent capital and operating costs" (Man, 60 years old)

In support of the existing literature, technology-led disruption has marked effects on the profit equation. Though the quanta are out of scope, there is strong evidence of the displacement of prices and volume levers of the profit equation.

4.6 Results: Outcomes of disruption

A concluding theme relates to the impact of technology disruption on industry structure. This has had various effects in the study, ranging from an increase in

concentration, an increase in churn (both exhibited in Advertising), to lowering of the labour force (in Financial Services, Print, and Publishing) and a change in the profit pool mix (FMCG and ICT).

As referenced earlier, Advertising has gone through radical shifts in producing and disseminating its products and services. Where previously sifting through a stock photography book take days, one can instantly find and alter a photograph on Getty Images within seconds. The drawback of this is that creativity plummets. As fewer and fewer people enter this field, there will be a greater reliance on technology software to select, modify and produce the final copy for the client, which will be conveniently found in his/her inbox (if not by another algorithm itself).

The Advertising industry has seen a considerable “squeeze,” with company closures, mergers, and big brands existing. There is evidence that small start-ups operating in a digital context with a small team of data scientists can occupy a niche. However, even these are trending towards alliances or convergence with non-industry firms such as Accenture's acquiring King James digital agency (Financial Mail, 2017) being a case in point. This bridges the analytic and experience worlds and combining them in a unique value proposition. As one industry participant summarised:

“Those agencies that have not closed down have been running close to the wire, and if they have not evolved or learned how to take advantage of these new technologies, they are close to getting swallowed up” (Male, 49 years old)

In Financial Services, there have been significant changes as well. Though the industry has not grown, it has enabled new players to leapfrog other existing players. Discovery through its cross-divisional data sharing and Capitec through its operational excellence have altered the concentration ratios of the traditional Big 4 (Absa, FNB, Standard Bank, Nedbank). It is now a dynamic Top 6 with further digital-only players to launch, such as Bank Zero (MoneyWeb, 2018).

Besides Capitec, the rest of the Banks were already trading at heavy discounts, even pre-COVID (Bloomberg, 2021). Some sectors within Financial Services are still operating paper and using two-decade-old methods meaning that the labour force tends to be malleable and thus moves quickly amongst the legacy firms.

The specific challenge here is industry employment, which is on a decline. Though there are new entrants, these are lean teams led by a core group of venture capitalists. On the other hand, legacy companies struggle to attract the underwriting, actuarial, and general financial skills to maintain their existing architecture and cannot attract the engineers and creativity required for innovation.

As a seasoned industry participant eruditely put it:

"What you stand for and how you keep driving the brand promise is key. How you launch on digital platforms, yet branches get impacted - how can you be a force for good, especially in tough times, is important for younger generations, and if you are not becoming a platform business or pairing up with a Google, like Deutsche Bank, you may be already irrelevant to your future customer and workforce" (Man, 59 years old)

In other industries such a Professional Services, where adjacent opportunities are being sought (as exhibited by Accenture and King James), extreme mergers and acquisitions are unlikely. Still, there are moves such as DDI, with sixty (60) resources being sold to EY (PRNewswire, 2016), Deloitte purchasing Monitor with its small workforce of thirty-five (35) resources for strategy, and then the eleven (11) resources from KPMG's Risk Advisory team.

In echoes of Financial Services, professional services, management of resources, and talent is changing. Remote delivery centres operate in a "greenhouse" or "virtual centres" for collaboration in Pakistan or India. As a participant noted, *"We expect a 30-40% reduction in our full-time employees in the next 2-3 years*".

Though under margin pressure and operating harsh retail trading conditions, FMCG has seen the frequency of purchase increase and decreased firm consolidation. Cosmetics, which is more than Estee Lauder or Loreal globally, has multiple revenue streams (WWD, 2017). Similarly, Unilever now buys direct-to-consumer start-ups such as Dollar Shave to gain additional customer data and sales opportunities. They cross and up-sell consumers into other personal care products such as hair and skin. Share prices for FMCG remain stable, with high single-digit returns hence the investment attraction of asset management firms.

"*Foodservice may be disrupted either through Uber-eats, dark kitchens or click and collect, but you will still see consistent tea consumption, increase in hygiene, and an all-time high for home products. "* (Female, 43 years old).

In ICT, even with Vodacom and MTN, who can do things at scale and to a mass audience, profit margins have dropped significantly (DailyMaverick, 2019). The required resources mix is also shifting, with data scientists and AI programmers demanded instead of Industrial Phycologists.

"Potential investors may not be placing their bets on connectivity but rather on the over-the-top (OTT) service or an existing 'cash-cow division. The network is not an option. From a South African perspective, Investor will be more likely to invest in an OTT that has an alliance partner with the Telco cash-generating division," mused one ICT exec (Man, 43 years old).

Overall, and in alignment with some of the literature, disruption has some clear hallmarks such as:

- A shift in the employability of the sector (labour participation rate);
- Industry concentration ratios changing (and the inclusion of other players to make it more dynamic); and
- Falling profit pools.

4.7 Summary of the results/findings

To sum up, the profit-equation model in Figure 4 illustrates how the nature of technology-based disruption manifests itself and works its way through various modes and mechanisms (see Figure 5). Based on this study, it can be said that the framework crosses industries, value chains and creates value for the participants. Interestingly, the framework reinforces the linkage between the supply and demand side (and these are not mutually exclusive), thus making a dynamic link to the profit equation. In addition, the study reveals that the profit equation is a strong indicator of participants' previous and current experiences of disruption, their expectations of future use, and the fact that there is a continuous and interactive effect in the framework.

CHAPTER 5. DISCUSSION OF THE RESULTS OR FINDINGS

The main contribution of this paper is a simple yet expressive model for assessing industry and firm-level disruptions. More specifically, the proposed framework helps to understand how a disruptive innovation originates in one or more of the three different modes of disruption, based on how it impacts the profit equation as the key determinate.

5.1 Discussion of the model

This section discusses the emergence of technological disruption from the three perspectives: demand vs. production vs. market engagement.

Earlier research on the spreading of technology disruption has come in a burst of periods, classified loosely as the era of linear models, conceptual models, and innovation systems until the current digital age. These models had a sequential nature to their disruption, either emanating from the lower, underserved market or weeding out of inefficacies (Christensen, Raynor, & Verlinden, 2001).

Though the literature is dense and enriched with studies, it does not cover the exponential disruption witnessed in today's digital era. To understand this phenomenon more, a 3-d model is derived, based on two key principles:

1. The literature on innovation and disruption is generally located in one of three paradigms, namely that innovation originates in either a) innovation in or disruption of demand, with a locus external to the firm; or b) innovation or disruption of supply or production, with a locus internal to the firm; or c) more rarely, innovation or disruption of the way supply is connected to demand, in the customer engagement layer of the firm. The 3-d model contends that technological disruption can be better understood by explicitly exploring these three "modes" of disruption.

2. "Disruption" is defined as occurring when the aggregate profits in an industry (at an industry level) or available to a firm (at a firm-level) are materially affected by the set of innovations or disruptions across these three modes. The allows us to use the profit

equation to explore how disruption impacts the volumes a firm (or industry) achieves, the prices it can command, and the costs incurred. The factors of the profit equation then provide a robust tool for exploring the sources of potential disruption, both from the threat minimisation perspective and an opportunity identification perspective.

The first contribution is the development of the profit-equation model. This finds that disruption inherently affects the three levers of profit: (volume, price, and cost) minus cost. Therefore, it can be stated that these levers create different effects in different industries and result in other implications, thus driving incumbent players' (misdirected) responses.

This is exhibited in the research when participants were polled on the modes of disruption. The literature focused on a set of trends such as consumer shifts and marketing (McCaffee, Ferraris, Bonnet, Calméjane, & Westerman, 2011); mobility (Ross, et al., 2016); analytics capabilities, and the ability to gather data and improve the understanding of customer behaviour and needs (McCaffee, Ferraris, Bonnet, Calméjane, & Westerman, 2011); supporting technologies such as artificial intelligence and the linking of analytics and mobility to create new products and services (Thomke & Hippel, 2002) and lastly the availability of cloud computing and integration of big-data sets have led to improved and personalised sales and support processes within organizations (McCaffee, Ferraris, Bonnet, Calméjane, & Westerman, 2011). While these are all valid, they fail to articulate how the value can be disrupted from a leading indicator perspective, and this is where the framework gains relevance.

Highlighting the profit equation as the central tenant removes the inherent limitation of theoretical posturing (i.e., business model or product innovation, big bang vs. breakthrough). It also clears the “air” in understanding what parts of the profit equation are being attacked and how the shifts can either be exploited or defended against.

The second contribution was the unveiling of the disruption categorisation, and it commenced by looking at what types of disruption exist. What has been revealed is that there are many identifiable sources of change and disruption, with technology being one of several drivers.

The literature highlighted how technological shifts could be treacherous, as they involve different engineering skills, new product designs, and new production facilities for incumbent firms (Iansiti & Lakhani, 2020). Also, being able to scale rapidly and invade new and existing markets (McGrath, 2020) has meant that the path and impact it may have on a business and industry differ significantly (Piccinini, Gregory, Hanelt, & Kolbe, 2015).

The research question provided valuable prompts to the themes that were subsequently identified. The themes resulted from listening to the interview transcription and then gathering the common excerpts: this detailed comparison, re-examination, and grouping of codes to develop descriptive themes. Analytical themes were developed through an iterative process of reflection and interpretation of the descriptive themes within and across interviews.

The research has revealed that though participants could describe the mechanisms and outcomes of disruption, it was challenging to bed them down to a coherent and easy-to-digest model.

The author categorized technological change into thirteen unique mechanisms by proposing a conceptual framework of three layers, starting with technology and then moving into the three ‘modes’ of technological disruption. This is important as it links some of the earlier work of Schumpeter (Aghion, Akcigit, & Howitt, 2014). Thus, it allowed participants to systematically assess technology disruption and practically apply it in their business context.

The third contribution has been the linkages between the three modes of technology disruption. In this sense, the literature is that new start-ups can pivot away from disruption. Markides’ emphasised that cooperating could occur while enticing new customers with the improving technology. This means that even if entrepreneurs start on a disruptive path, disruption might be forestalled as incumbents see that cooperating is in their interests (Gans, 2020).

The interviewed participants reinforced this and highlighted another critical finding. While Unilever (Unilever, 2019) may purchase a start-up, the participants also confirmed that the supply and demand mechanisms' linkage was strongly intertwined. Ultimately, this means that the framework is dynamic in that it can propagate from one

mode into another. Simply put, it told that a) more than one mode can be present at a time; and b) that there can be a sequence of modes over time.

This means that the model is not linear but rather recursive, indicating that there may need to be a multi-modal understanding of the disruption when the profit equation gets attacked. This is important because an individual, organisation, or industry response will require factoring in one or more of the thirteen different outcomes.

In summary, it has demonstrated three key contributions to the literature with understanding the drivers, the accelerators, or disablers of technology-led disruption and its outcomes. What is clear is that there is a need for a framework that incumbents can use to prevent being paralysed by the swathe of application of exponential technologies that are coming to market.

5.2 Conclusion

It is clear that technology disruption in the digital era is powerful in that it can dramatically shift the dynamics of competitive advantage and how organisations seek to survive and thrive.

The proposed approach resolves a few apparent dichotomies with models of disruption referenced before by showing that by constantly scanning the profit equation, one can understand the type of technology disruption happening and which parts are attacking the value chain. Crucially it enables an appropriate categorisation and response by incumbents (or attackers themselves)

CHAPTER 6. CONCLUSIONS & RECOMMENDATIONS

6.1 Introduction

The rate of technology adoption is exploding (World Bank, 2016), and many organisations embrace exponential technologies to remain relevant and stave off competition. While this is a good start, existing strategy tools and techniques have proven limited as these technologies have fractured existing value chains and disrupted the profit pools of entire industries.

While some organisations are confident in identifying and responding (or take advantage) of these trends, many are unsure of the efficacy of their response. Classical disruption theory is limited in this era, requiring a new framework for scanning and evaluating technology-led disruption.

To this end, the proposed framework considers profit-equation as the vital determinate of disruption. This is then translated into a dynamic 3-d conceptual model on the modes of disruption. This leads to the thirteen mechanisms and how the market engagement interface links the supply and demand-led disruption.

This study aimed to answer the research question, “Can technology disruption be explained in terms of the modes or mechanism disruption, namely market engagement, demand, and production disruption?”. To do this, experts were interviewed in their respective fields, which yielded the following summary results:

- **What are the extraneous drivers of technological change?**
  There are multiple forms of exogenous disruption, with societal and economic factors being strongly linked with disruption. However, technology is at the centre of this disruption and the common element.

- **What is technology disruption, and how does it manifest?**
  Overall, the interview data of this study suggest that the direct impact of technology is on both the demand (customer) and production (provisioning and fulfilment of products and services) side. Still, in contrast to existing literature, these may not be independent or sequential.

- **What are the modes by which extraneous technological change can disrupt an industry or firm?**

  Overall, there is overwhelming consistency in the disruptive effect of technology on all industries. In this instance, technological change can disrupt the supply side, and/or the demand side, and/or the market engagement layer connecting supply with demand.

- **What are the different outcomes of these technological changes?**
  In support of the existing literature, technology-led disruption has marked effects on the profit equation. Though the quanta are out of scope, there is strong evidence of the profit equation's displacement of volume, price, and cost levers.

- **Why are there different outcomes of these technological changes?**
  Overall, and in alignment with some of the literature, disruption has three clear hallmarks. Firstly, there is a shift in the employability of the sector, with labour participation rates falling. Secondly, industry concentration ratios change with an additional dynamic of other players. Lastly, there are falling profit pools primarily in existing products and services.

It has been demonstrated that by using the profit equation as a framework to define and explore “disruption,” it can further expand technological disruption into three modes of disruption. These are disruption of demand, supply or production, and disruption of how supply is connected with demand. These three categories can be further decomposed into thirteen primary mechanisms of disruption. By connecting all these aspects, the study provides a lens for individuals, organisations, and industries to model their strategic decisions and actions, contributing to the existing literature.

6.2 Recommendations

So, what is the practical use of the model? Though the model has demonstrated its validity and usefulness, how can individuals, organisations, or industry bodies use it? In this section, two key recommendations are made.

Where to play?

This paper seeks to organize the existing theories to make them more useful and practically applicable to firms. The subject has been on introducing a framework that can assist companies in understanding where their disruption may originate or how that could become market disruptors, so that they choose the proper strategic response. The first recommendation is to assess the industry based on the profit equation and understand the dynamics. Can one of the profit levers of volume, price, or cost be disrupted, and, in turn, which of the root factors of that lever will be the source(s) of the disruption. This enables firms to focus their efforts on relevant factors, either defending against disruption or creating it.

Suppose a firm struggles to control one of these profit levers due to a technological disruption threat or opportunity. In that case, it may be best to tackle a niche or seek another market. Companies often estimate the market size and potential revenue pools rather than leveraging one of the levers – this then leads to the second step of how to play.

How to play?

As digitalisation drives intense competition, companies should seek to identify how their industry is being disrupted, through which mode of disruption, and focus their responses accordingly. This provides a practical framework to identify and shape strategic and tactical responses to digital disruption threats.

Firms could choose to pick one or a combination of modes of disruption to raise their performance proactively. Specifically, those with a combinatorial or even exponential effect would raise barriers to entry for disruptors. For example, a financial services firm opening up its data sets via APIs to acquire new customers and integrate themselves in a consumer buyer journey (affecting both the demand and production side) may expand into a new market leveraging its existing capabilities digital context. Managers may face the dual challenge of speed (to execute on this play). Alternatively, it can compete with one of the emerging technological players or create alliances with other companies.

An example of this could be Orange, the Telecommunications provider and potentially a terrestrial news and entertainment broadcaster. As mentioned in the interviews, Orange transitioned from a set-top box to an app and back to a set-top box in response to technological-based disruption. However, a more strategic response could be for Orange to partner up with legacy national or pan-Africa terrestrial broadcasters to produce African-themed content themselves being the distribution and packaging partner. Assessing the market across the profit equation provides an opportunity to look at one's industry from multiple dimensions and becomes increasingly powerful when overlaid with the 3-D model. Rather than seeing every organisation as a disrupter, organisations should pick the mode and corresponding disruption outcome they seek to play in, creating their own "blue ocean."

In summary, the proposed framework provides a tool to analyse the three profit levers carefully, and using the 3-d model; firms can generate insights based on the nature of competition and the sources of competitive advantage.

6.3 Limitations

As mentioned previously, this study was firstly limited to qualitative research and would benefit from a quantitative perspective. Using primary and secondary data sources such as Stats SA, the South African Reserve Bank, and the Companies and Intellectual Property Commission may enrich understanding disruption in the digital era. This is particularly important when understanding industry churn rates, labour participation, and patents lodged. Secondly, the study was delimited to the formal side of the South African economy and, in particular – Corporate South Africa – which leaves room for other geographies and sector analysis. Lastly, though vastly experienced across multiple industries, the interview participants were limited to a minimum of 20 years of work experience. New-age firms that have rapidly scaled with younger founders would provide an additional perspective.

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APPENDIX A: Participant List

P	Name & Contact	Industry	Role	Gender	Race	Age
1	Participant 1	Print & Publishing	Editor	Female	Indian	40
2	Participant 2	Print & Publishing	CEO	Male	Indian	47
3	Participant 3	Financial Services	COO	Male	Indian	40
4	Participant 4	Financial Services	CFO	Male	White	59
5	Participant 5	Advertising	Director	Male	Coloured	46
6	Participant 6	Advertising	Director	Male	White	49
7	Participant 7	Professional Services	Partner	Male	Black	49
8	Participant 8	FMCG	Director	Male	Coloured	43
9	Participant 9	ICT	CEO & Professor:	Male	Indian	60
10	Participant 10	FMCG	CMO	Female	Coloured	43
11	Participant 11	Telco	CEO	Male	Black	43

APPENDIX B: Consent Form

Consent Form

Research Title: An Investigation into Modes of Technological Disruption in South African Businesses

Researcher: Mr. Nahim Yusuf Bassa

I, ……., agree to participate in this research project. The research has been explained to me, and I understand what my participation will involve. I agree to the following:

(Please circle the appropriate options below).

I agree that my participation will remain anonymous	YES	NO
I agree that the researcher may use anonymous quotes in his / her research report	YES	NO
I agree that the interview may be audio recorded	YES	NO
I agree that the information I provide may be used anonymously after this project has ended, for academic purposes by other researchers, subject to their own ethics clearance being obtained.	YES	NO

…… (signature)

…… (name of participant)

…… (date)

…… (signature)

…… (name of the person seeking consent)

…… (date)

APPENDIX C: Interview Request

Dear Senior Executive

Organisations face a plethora of challenges due to rapidly changing technologies that impact business models in the new digital era. Increased competition in the form of digitally led, mobile-first start-ups and the technology convergence of industries has exacerbated the need amongst business managers to respond using new strategic frameworks and models built for the digital era. Seminal works have all played a critical role in explaining disruption across multi-disciplinary communities in a pre-digital age. However, today's managers must operate in a new digital context with increasing pressure to calculate the value to be ‘won’ in the digital market, how best to leverage existing capabilities, and how to work collaboratively (to achieve superior and sustainable results). However, a gap exists between the theoretical expositions of the seminal works and their application in the practical strategic processes of today.

I, Nahim Yusuf Bassa, am writing this email to request your participation in my research study for my Master of Management qualification in the field of Digital Business. My topic is An Investigation into Modes of Technological Disruption in South African Businesses. The aim is to postulate an intuitively deductive framework for the modes of technological disruption to help organisations and individuals understand how technological change creates disruptive opportunities or threats and how they can exploit technological change to disrupt markets in their favour. This will be achieved through leveraging academic literature, industry insights, and your valuable input.

As part of the research study, I would like to interview you in a session lasting no more than 60 minutes.

By completing and submitting the interview, it will be taken as consent has been given. Rest assured that your responses will be kept strictly confidential and anonymous.

Thank you in anticipation of your participation.

Nahim Y. Bassa

2298754@students.wits.ac.za

+ 27 79 568 9759

APPENDIX D: Interview Cover Page

An Investigation into Modes of Technological Disruption in South African Businesses

Organisations face a plethora of challenges due to rapidly changing technologies that impact business models in the new digital era. Increased competition in the form of digitally led, mobile-first start-ups and the technology convergence of industries has exacerbated the need amongst business managers to respond using new strategic frameworks and models built for the digital era. Seminal works have all played a critical role in explaining disruption across multi-disciplinary communities in a pre-digital age. However, today's managers must operate in a new digital context with increasing pressure to calculate the value to be 'won' in the digital market, how best to leverage existing capabilities, and how to work collaboratively (to achieve superior and sustainable results). However, a gap exists between the theoretical expositions of the seminal works and their application in the practical strategic processes of today.

The interview is required to obtain feedback from you as a SENIOR EXECUTIVE regarding your experience and perceptions of the Modes of Technological Disruption in South African Businesses.

These are open-ended questions that allow you to express your thoughts and opinion. The results of this interview will be used to gain a holistic view of technological disruption and seek to postulate a framework that businesses and individuals can use to aid them in the strategic decision-making process.

Participation and completion of this questionnaire are voluntary and anonymous. The interview should take no more than 60 minutes to complete. Your co-operation is appreciated.

Please answer the questions from your perspective and honestly. Select the most appropriate response accordingly.

Thank you for your participation.

Nahim Y. Bassa

2298754@students.wits.ac.za

+ 27 79 568 9759

APPENDIX E: Interview Guides and Coding

1-on-1 INTERVIEWS (10)			
Construct	**Code**	**Sub-Questions/Hypothesis**	**Interview Questions**
Drivers	ED	Exogenous drivers of disruption	ED1: In your industry, what have been the main exogenous sources of disruption in the last 20 years?
			ED2: How have these disrupted your industry (manifestations, not mechanisms, e.g., market size industry structure, industry profits, churn, etc.)
			ED3: In your firm, what have been the main exogenous sources of disruption in the last 20 years?
			ED4: How have these disrupted your firm (manifestations, not mechanisms, e.g., market share, revenue, costs, profits, customer loyalty, etc..)?
Technology	TD	Technology as a primary exogenous driver of disruption	TD1: Over the last 20 years, how has technology disrupted your industry
			TD2: How have these disrupted your industry? (Manifestations)
			TD3: Over the last 20 years, how has technology disrupted your firm
			TD4: How have these disrupted your firm? (Manifestations)
Modes	TM	Modes of disruption – supply, demand, and the interface	TM1: How has tech change affected demand factors in your industry in general and your firm in particular?
			TM2: How has tech change affected supply factors in your industry in general and your firm in particular? Supply factors include how you produce your product or service.
			TM3: How has tech change affected how supply and demand are connected in your industry in general and your firm in particular?
Profit Equation	PE	Modes of disruption – the profit equation	PE1: How has tech change affected volumes in your industry in general and your firm in particular?
			PE 1.1 Follow-up: why did volumes [rise/fall/not change]? Was it market size or market share, and why? [The intent here is to draw out substitution, downstream substitution, and disintermediation]
			PE2: How has tech change affected prices in your industry in general and your firm in particular?

			PE 2.1 Follow-up: why did prices [rise/fall/not change]? Was it related to industry structure, or was it cost-related, differentiation-related, or other customer factors? And what caused this? [The intent here is to draw out the driving factors of price change]
			PE3: How has tech change affected costs in your industry in general and your firm in particular?
			PE3.1 Follow-up: why did costs [rise/fall/not change]? Was it related to customer acquisition costs, production costs, distribution costs, overhead costs, or supply (input materials) costs? And what caused this?
Outcomes	TO	Outcomes of disruption	TO1: At an industry level, what evidence have you seen of the impact of technological disruption on industry structure, considering the following indicators: 5.1.1 Total market size/industry turnover 5.1.2 Industry concentration 5.1.3 Industry churn 5.1.4 Industry profitability 5.1.5 Industry employment 5.1.6 Industry investor attractiveness 5.1.7 Industry valuations 5.1.8 Any Others?
			TO2 Optional: You may wish to probe /validate the extent to which these observed manifestations result from tech change vs. other exogenous drivers.

APPENDIX F: Ethics Clearance

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

SCHOOL OF GRADUATE SCHOOL OF BUSINESS ADMINISTRATION ETHICS COMMITTEE
CONSTITUTED UNDER THE UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: WBS/BA2298754/252**
PROJECT TITLE	An Investigation into Modes of Technological Disruption in South African Businesses
INVESTIGATOR	Mr Nahim Yusuf Bassa
SCHOOL/DEPARTMENT OF INVESTIGATOR	MM (Digital Business)
DATE CONSIDERED	18 August 2020
DECISION OF THE COMMITTEE	Approved unconditionally
RISK LEVEL	MINIMAL RISK
EXPIRY DATE	30 JUNE 2021

ISSUE DATE OF CERTIFICATE 8 September 2020

CHAIRPERSON _____
(Dr MDJ Matshabaphala)

cc: Supervisor: Professor Armstrong

DECLARATION OF INVESTIGATOR

To be completed in duplicate and **ONE COPY** returned to the Chairperson of the School/Department ethics committee.

I fully understand the conditions under which I am are 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/we undertake to resubmit the protocol to the Committee.

Signature _____ **Date** 08/09/2020

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES