

# **Gordon Institute of Business Science**

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Enhancing competitive advantages and improving company performance  
through an exploration of innovation resistance behaviours  
within issues and/or challenges of the Internet of Things (IoT)

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# ABSTRACT

This research study explored the phenomenon of innovation resistance behaviours within the context of the Internet of Things (IoT). There have been calls from authors in the academic literature to re-engage with this underappreciated concept, and the IoT presented an environment wherein the presence and importance of these behaviours could be readdressed.

The IoT has the potential to impact organisational outcomes and produce substantial financial returns. However, despite this forecasted promise through the use of this available technology, organisations continue to grapple with the effective implementation of its applicability to create and capture value. Multiple issues and/or challenges are present wherein these described resistance behaviours emerge. If resistance cannot be overcome, adoption falters, and organisations will be unable to share in forecasted profits.

This research study aimed to assess if further academic and practical insights could be garnered through this perspective to effect better outcomes for organisations. Twelve semi-structured interviews with senior managers from organisations involved across the IoT value chain were performed to explore the concept of innovation resistance in this context of the IoT.

First, the research study found that innovation resistance behaviours are indeed relevant and transferable to the IoT. Second, mechanisms enabled through this available technology can be enhanced and used to improve value propositions to influence lower levels of resistance behaviours. Third, despite the advances in this technology-driven era, the fundamentals about the principle of trust featured as a theme deserving greater appreciation and attention.

This research study concludes with a framework to guide organisations and managers towards available competitive advantages and improvements in company performance within this developing environment.

## **KEYWORDS**

Keywords: Innovation resistance, the Internet of things (IoT), barriers to adoption, trust in technology

# DECLARATION

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

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Submission Date: 7 November 2018

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# **CHAPTER 1: INTRODUCTION TO THE RESEARCH PROBLEM**

## **1.1 Introduction**

The Internet of Things (IoT) is an envisioned paradigm that holds the promise of revolutionising how humans live, work, and exist, through the seamless interaction with a growing volume of heterogeneous objects and devices (Atzori, Iera & Morabito, 2010; Gubbi, Buyya, Marusic & Palaniswami, 2013; Lee & Lee, 2015; Metallo, Agrifoglio, Schiavone & Mueller, 2018; Miorandi, Sicari, De Pellegrini & Chlamtac, 2012; Whitmore, Agarwal & Da Xu, 2015; Wortmann & Flütcher, 2015). Basic things, objects, and devices, embedded with sophisticated sensors, can sense and perceive their context and via built-in networking capabilities access Internet services to communicate, connect, and interact with each other and people (Atzori et al., 2010; Gubbi et al., 2013; Miorandi et al., 2012; Whitmore et al., 2015).

These inherent capabilities have opened possibilities for the creation and development of a diverse and constantly growing range of innovative applications. For example, in the environmental monitoring of temperature, wind, and rainfall, IoT enabled enhancements have been proposed to monitor and detect even greater forces of nature – such as earthquakes and even volcanic eruptions (Moriandi et al., 2012). Unfortunate disasters – such as the tsunamis that affected Japan in 2011 (Parry, 2017) and more recently Indonesia in September of 2018 (Ellis-Petersen, 2018) – illustrate the impactful socio-economic and practical potential that IoT solutions possess.

The presence of this technology already exists throughout our everyday lives due in part to the continued evolution of technology over the course of time. For example, landlines have evolved to mobile phones and then to smartphones, vintage box or tube television (TV) sets to flat screens and now to smart TVs, and finally basic watches to wearable technologies. As the technological trajectory for these devices continues, so do their enhanced capabilities as well as their applicability. For example, newer versions of some wearable technologies – such as the upcoming Apple Watch Series 4 (Phelan, 2018) – have transformed the tracking and visualisation of heart rates from personal physical activity into real-time electrocardiography (ECG) monitoring that now

has the potential for preventative medical applicability – for example, the early detection of cardiac arrhythmias and associated anomalies.

Supply and delivery chains already incorporate inventory management and logistics systems to identify, record, and track assets (Gubbi et al., 2013; Whitmore et al., 2015). These processes can now be enhanced to detect and monitor entire product lifecycles and/or time periods. The combination of Google Maps with food delivery services – for example, UberEATS (Hui, 2014) – demonstrate how this interconnected and integrated environment can be used to innovate supply and delivery services as well as business value propositions (Whitmore et al., 2015).

The nature of these smart things has and will continue to change as the integration of machine learning, artificial intelligence (AI), and data analytics systems will allow for them to further alter their utility. Therefore, these developments will allow for more innovative applications to be created and leveraged by organisations to improve existing and/or facilitate new solutions and services.

The IoT is predicted to have an impact on every industry through these enabled and enhanced capabilities to improve internal productivity and efficiency (Metallo et al., 2018; Spiess, T'Joens, Dragnea, Spencer & Philippart, 2014) as well as external customer value propositions (Foroudi, Gupta, Sivarajah & Broderick, 2018; Nylén & Holmström, 2015). Therefore, the IoT represents a new technology with which organisations can channel mechanisms to create competitive advantages in the new digital industrial economy – more commonly referred to as Industry 4.0 (Chan, 2015; Hsu & Yeh, 2017; Metallo et al., 2018; Porter & Heppelmann, 2014; Westerlund, Leminen & Rajahonka, 2014).

The proliferation and permeation of these devices into every conceivable aspect of professional and personal lives will result in the number of these smart things, connected to the Internet, outnumbering the number of people on the planet. This is forecast by Gartner at 20 billion connected devices by 2020 (Hung, 2017) and around 100 billion connected devices by 2025 (Rose, Eldridge & Chapin, 2015). There is increasing acknowledgement that this unprecedented number of smart things presents opportunities for business with the potential value generated estimated by McKinsey to be at least \$3.9 trillion and up to \$11.1 trillion by 2025, with the higher estimate representing 11% of projected global GDP in that same year (Manyika, Chui, Bisson, Woetzel, Dobbs, Bughin & Aharon, 2015). This has resulted in many IoT-related acquisitions such as Google's \$3.2 billion takeover of Nest (Lee & Lee, 2015),

SmartThings by Samsung (Wortmann & Flütcher, 2015), and Solair by Microsoft (Metallo et al., 2018).

## **1.2 Background to the Research Problem**

For businesses to remain competitive in this developing digital economy, the IoT represents a new technology that can be leveraged to achieve general business objectives in value creation, delivery, and capture, as well as the critical goals of profitability, cost minimisation, differentiation, and revenue generation (Porter, 1985; Porter & Heppelmann, 2014). It can open new market opportunities, enable struggling organisations a chance at reinvention, success, and sustainability (Porter, 1985; Sun, Yan, Lu, Bie & Thomas, 2012). However, despite the potential and growing trend to take advantage of new technologies to realise projected and potential financial opportunities, as with many disruptive innovations, the mere presence of the technology and even its adoption and use, does not guarantee success (Porter, 1985; Sirdeshmukh, Singh & Sabol, 2002; Zysman & Kenney, 2018).

This environment presents with multiple issues and/or challenges that need to be identified, considered, and then addressed before these goals and objectives can be entertained (Atzori et al., 2010; Gubbi et al., 2013; Lee & Lee, 2015; Mani & Chouk, 2017; Miorandi et al., 2012; Whitmore et al., 2015). These issues and/or challenges are associated with varying degrees of reluctance to acceptance, engagement, and subsequent adoption. Authors in the academic literature have described this behavioural response as resistance to innovations (Bradley & Stewart, 2002; Gatignon & Robertson, 1985, 1989; Heidenreich & Kraemer, 2016; Kleijnen, Lee & Wetzels, 2009; Kuisma, Laukkanen & Hiltunen, 2007; Lapointe & Rivard, 2005; Laukkanen, 2016; Mani & Chouk, 2017; Martin, Gustafsson & Choi, 2016; Molesworth & Suortti, 2002; Patsiotis, Hughes & Webber, 2013; Ram, 1987; Ram & Sheth, 1989; Rogers, 2003; Talke & Heidenreich, 2014). Innovation resistance behaviours present a significant hurdle for organisations attempting to utilise new technologies to drive value creation (Kleijnen et al., 2009; Reaidy, Gunasekaran & Spalanzani, 2015; Thiesse, Staake, Schmitt & Fleisch, 2011).

Multiple authors have alluded to interrelated issues and/or challenges within the IoT environment in which these behaviours manifest. Connectivity, interoperability, and data security challenges, have all been discussed as current concerns. These issues have been described as examples of barriers encountered with regard to the

functionality of the environment as well as towards more favourable reciprocal stakeholder engagement (Atzori et al., 2010; Chan, 2015; Lee & Lee, 2015; Mani & Chouk, 2017; Westerlund et al., 2014; Whitmore et al., 2015).

IoT enabled and enhanced efficiency solutions can provide demonstrable internal cost savings through improved efficiencies and increased productivity. However, the cost-benefit analysis still requires proof of sustained return from the substantial capital investments involved to offset inevitable diminishing returns from this generic strategy (Chan, 2015; Dijkman, Sprenkels, Peeters & Janssen, 2015; Lee & Lee, 2015; Porter, 1985; Westerlund et al., 2014).

Highly competitive environments routinely steer organisations to investigate other methods and mechanisms to improve both their competitive advantages and company performance. The IoT presents organisations with potential opportunities that can enable greater external revenue generation through the interconnected nature of the digital era and the growing ease of accessibility to the consumer market (Atzori et al., 2010; Dijkman et al., 2015; Gubbi et al., 2013; Lee & Lee, 2015; Martin et al., 2016; Miorandi et al., 2012). However, responses from individuals and society can be volatile and fair-weathered at best. Therefore, firms are faced with much uncertainty in attempts to improve their presence in these consumer-facing scenarios.

Therefore, the presence of these identified concerns bring into question the lack of emphasis placed on resistance behaviours in prior innovation research as well as in the IoT context (Bradley & Stewart, 2002; Gatignon & Robertson, 1985, 1989; Heidenreich & Kraemer, 2016; Kleijnen et al., 2009; Kuisma et al., 2007; Lapointe & Rivard, 2005; Laukkanen, 2016; Mani & Chouk, 2017; Martin et al., 2016; Molesworth & Suortti, 2002; Patsiotis et al., 2013; Ram, 1987, 1989; Ram & Sheth, 1989; Rogers, 2003; Talke & Heidenreich, 2014). The researcher has found that this is possibly due to a pro-change bias in the academic literature where it is assumed that the majority of stakeholders are open to new products and/or services and that all innovations are assumed to be good, and therefore that acceptance and adoption should occur (Heidenreich & Kraemer, 2016; Heidenreich & Spieth, 2013; Kleijnen et al., 2009; Laukkanen, Sinkkonen & Laukkanen, 2008; Laukkanen, 2016; McKnight, Choudhury & Kacmar, 2002; Ram, 1987; Rogers, 2003; Speier & Venkatesh, 2002; Talke & Heidenreich, 2014). However, the researcher questions the validity of this assumption as high innovation failure rates continue to be reported (Castellion & Markham, 2013; Heidenreich & Kraemer, 2016).

In increasingly rapidly-changing environments, a more balanced and informed understanding is required to incorporate new technologies effectively to attain competitive advantages and achieve improved company performance in this developing landscape (Porter, 1985; Sun et al., 2012). Extant studies on new technology adoption and organisational usage have not yet matured and business strategies in this context are at present vague and there is a notable absence of prevalent models to help guide organisations – this is possibly due to the novelty of this subject (Chan, 2015; Hsu & Yeh, 2017; Hui, 2014; Lee & Lee, 2015).

### **1.3 The Research Problem**

First, even though the importance and presence of innovation resistance behaviours has been acknowledged, the academic literature has largely ignored this concept (Bradley & Stewart, 2002; Gatignon & Robertson, 1985, 1989; Heidenreich & Kraemer, 2016; Kleijnen et al., 2009; Kuisma et al., 2007; Lapointe & Rivard, 2005; Laukkanen, 2016; Mani & Chouk, 2017; Martin et al., 2016; Molesworth & Suortti, 2002; Ram, 1987; Ram & Sheth, 1989; Rogers, 2003; Talke & Heidenreich, 2014). This pro-change bias towards acceptance and adoption has been acknowledged to account for this neglect (Heidenreich & Kraemer, 2016; Heidenreich & Spieth, 2013; Kleijnen et al., 2009; Laukkanen et al., 2008; Laukkanen, 2016; McKnight et al., 2002; Ram, 1987; Rogers, 2003; Speier & Venkatesh, 2002; Talke & Heidenreich, 2014).

Second, there are still very few studies about the managerial, economic, behavioural, and social challenges involved with new technologies to assist with informed decisions regarding their applicability and more effective implementation (Lee & Lee, 2015; Patsiotis et al., 2013; Porter & Heppelmann, 2014; Schneider & Spieth, 2013). The managerial literature has recommended that a more informed and comprehensive understanding is critical to effect better value creation and capture through new technologies such as the IoT (Chan, 2015; Metallo et al., 2018).

### **1.4 Research Aims**

First, the researcher aimed to develop further insights through this research study by establishing whether prior and perceived conceptualisations of innovation resistance behaviours are actually transferable to the context of the IoT, and if calls for re-

engagement with this concept are warranted (Kleijnen et al., 2009; Lapointe & Rivard, 2005; Laukkanen, 2016).

Second, to attain competitive advantages and improve company performance through innovative mechanisms that incorporate this technology, new conceptual and practical frameworks are required to assist business logic and strategies to be more aligned to current circumstances as traditional models may be inadequate in this environment (Casadesus-Masanell & Ricart, 2010; Dijkman et al., 2015; Whitmore et al., 2015). In potentially gaining a greater understanding of the dynamics of innovation resistance behaviours within the context of the IoT and how they have been addressed, it was hoped that organisations would be able to identify, prioritise, and address, presenting issues and/or challenges within the IoT and concomitant resistance behaviours more effectively.

Despite the IoT being in its infancy, when coupled with its rapid development and forecasted growth in the near term, it was determined that this research was urgently required for organisations to take effective advantage of its significant presence and applicability.

## **1.5 Scope of the Research**

The presence and emergence of innovation resistance behaviours has the potential to hinder the effectiveness of an organisation's use of technology to enact mechanisms towards success and sustainability. Through this qualitative and exploratory research study, the researcher investigated if organisations can, through detailed discussion with key industry stakeholders, garner deep insights, which can be distilled and incorporated into more sustainable business models and in-turn influence greater participation and engagement with stakeholders to deliver improved company performance in this context.

## **1.6 Significance of the Research**

First, most studies lacked an empirical basis from which to suggest strategies to overcome resistance behaviours to innovations (Heidenreich & Kraemer, 2015). A better understanding of possible reasons for underlying resistance behaviours towards smart and connected products and/or services could be used in their development and implementation (Mani & Chouk, 2017).

Second, this research study aimed to answer calls from the academic literature for research into approaches to effect better use of the IoT (Casadesus-Masanell & Ricart, 2010; Chan, 2015; Dijkman et al., 2015; Hsu & Yeh, 2017; Metallo et al., 2018; Whitmore et al., 2015).

It was hoped that this research study would further knowledge in the academic literature as there have been few studies regarding resistance behaviours encountered with these always on, always watching, and always connected devices.

## **1.7 Conclusion**

Chapter 1 presented an introduction to this research study. It highlighted the concept and presence of innovation resistance behaviours that compound identified issues and/or challenges within the growing environment and context of the IoT. This concurrent presence is a concern for organisations looking to create competitive advantages and improve their company performance through this available technology.

This research study proceeds as follows: Chapter 2 presents a comprehensive overview of the academic literature as it relates to the issues and/or challenges within the current IoT landscape and the concept of resistance behaviours towards innovations. Chapter 3 presents the research questions posed that form the basis of this research study. Chapter 4 outlines a description of the qualitative research methodology used to collect and analyse the data in this research study. Chapter 5 presents the results of the research study and Chapter 6 presents the discussion of these results. Chapter 7 closes with academic and business insights derived from the results, followed by suggestions for further research.

## **CHAPTER 2: LITERATURE REVIEW**

### **2.1 Introduction**

Chapter 2 provides a review of the constructs of the described concept of resistance behaviours towards innovations within the context of notable issues and/or challenges that are encountered with regard to the IoT. Chapter 2 begins with a descriptive overview of the components and applications of the IoT. Thereafter, Chapter 2 discusses issues and/or challenges wherein resistance behaviours may emerge within technology-related concerns about connectivity, interoperability, and data security and privacy.

Chapter 2 continues with a focus on difficulties involving business-related concerns about the pursuit of low cost strategies and revenue generation through this technology. Resistance behaviours towards innovations and the key elements of this phenomenon are then described. Chapter 2 concludes with a discussion on the role about the principle of trust within this environment.

This review of the academic literature highlights not only the importance of a comprehensive understanding of the inherent capabilities and possible applicability of the technology but also of the presence of resistance behaviours within identified areas that may hinder effective use of the IoT and desired outcomes for these organisations. Chapter 2 provides insights into these characteristics that are to be explored in this research study.

### **2.2 The Internet of Things (IoT)**

#### **2.2.1 Description of the IoT**

The “Internet of Things” (IoT), as a term, was first used in 1999 by Kevin Ashton in the context of supply chain management (Ashton, 2009; Hsu & Yeh, 2017; Westerlund et al., 2014). The IoT has since been used broadly to describe a futuristic concept involving interconnected physical and digital entities (Atzori et al., 2010; Gubbi et al., 2013; Miorandi et al., 2012; Whitmore et al., 2015). Even though this research study is not a technical paper, a basic understanding of the components is required. The following layers have been separated simply for descriptive purposes (Atzori et al.,

2010; Gubbi et al., 2013; Hsu & Yeh, 2017; Lee & Lee, 2015; Sun et al., 2012; Thiesse et al., 2011)

### **2.2.2 “Things-Orientated” or Sensing Layer**

A ‘things-orientated vision’ or sensing layer is concerned with object visibility, traceability, and data capture. Things embedded or retrofitted with sensors such as active or passive radio frequency identification (RFID) tags, allow for individual object identification and data acquisition from the surrounding environment (Thiesse et al., 2011).

### **2.2.3 “Internet-Orientated” or Networking Layer**

An ‘Internet-orientated vision’ or networking layer is concerned with interconnectivity and communicability. This consists of Near Field Communication (NFC) technology that allows for inter-device transfer of information when near to each other, as well as Wireless Sensor Networks (WSN) that connect multiple devices from the sensing layer to the Internet (Gubbi et al., 2013). This has enabled the creation of an extended and interconnected network that is able to disseminate and facilitate data exchange.

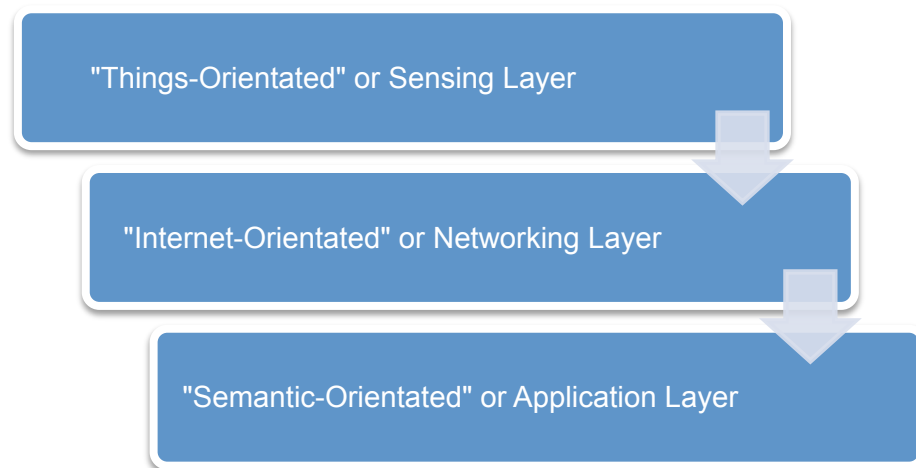
### **2.2.4 “Semantic-Orientated” or Application Layer**

A ‘semantic-orientated vision’ or application layer is concerned with reasoning and execution. The volumes of data from a growing multitude of heterogeneous devices distributed over various locations can be gathered through RFID or NFC or WSN mechanisms (Gubbi et al., 2013). Middleware software platforms or Cloud-based computing services are incorporated at this stage to assist with aggregation, analysis, and subsequent actions (Lee & Lee, 2015).

Device-to-device applications are therefore able to resolve problems rapidly and autonomously, and where the data informs human decisions, it can be presented in intuitive and visualised forms – such as with displayed icons (Hsu & Yeh, 2017; Lee & Lee, 2015).

The exponential increase in data collected from a growing number of IoT devices and the real-time reaction and response that is required has shifted the focus to enabling these functions on the edge – to be available on the actual device. This embedded intelligence that enables reasoned decisions and actuation, differentiates these smart

things from existing entities in networked systems, thereby introducing a disruptive level of innovation into the world (Atzori et al., 2010; Lee & Lee, 2015; Patsiotis et al., 2013).



**Figure 1. Description of the IoT**

### **2.2.5 IoT Applications**

These layers have allowed for the development of a myriad of industry-oriented and/or user-specific IoT applications (Lee & Lee, 2015; Porter, 1985). The following IoT capabilities have also been separated for descriptive purposes only.

### **2.2.6 Monitoring and Control**

Equipment performance, energy usage, and even previously mentioned environmental conditions, can be monitored and controlled from anywhere and at any time. Applications have been described in logistics, and in production facilities, as well as in smart home automation for security, electricity and water metering, and even carbon emissions management (Atzori et al., 2010; Gubbi et al., 2013).

### **2.2.7 Big Data and Analytics**

Data analytics and interpretation on the data collected from IoT devices can uncover areas of inefficiency within process and operational flows. Aggregated IoT data can also be utilised to improve end-user experiences and/or the effectiveness of advertising

and marketing campaigns through the enabled and enhanced understanding of individual behaviours, preferences, and societal trends – pattern recognition. Other applications, for example, within the health industry are numerous and include both individual and practitioner collection and analysis of information to inform adjustments to behaviours and effects on various health parameters (Atzori et al., 2010).

### **2.2.8 Information Sharing and Collaboration**

This paradigm of device-to-device and/or device-to-individual interconnectivity allows for information to be shared for mutually beneficial outcomes. This is prominent in supply chain management and logistics where delivery delays can be updated for both supplier and customer. This application has been extended to current mobile applications (Apps) such as Waze, Google Maps, and Uber, and these have improved customer journey experiences through real-time visualisation, engagement and participation (Miorandi et al., 2012).



**Figure 2: IoT Applications**

The complete value of the IoT can be seen when all the technical layers and capabilities converge, and where they can be applied to solutions, products and/or services to accomplish a useful objective anywhere and at any time (Atzori et al., 2010; Gubbi et al., 2013; Miorandi et al., 2012; Whitmore et al., 2015). The socio-economic potential of smart cities, smart homes, and smart devices, has been extensively described in the literature (Atzori et al., 2010; Gubbi et al., 2013; Hengstler, Enkel &

Duelli, 2016; Miorandi et al., 2012; Porter & Heppelmann, 2014; Whitmore et al., 2015; Wortmann & Flütcher, 2015).

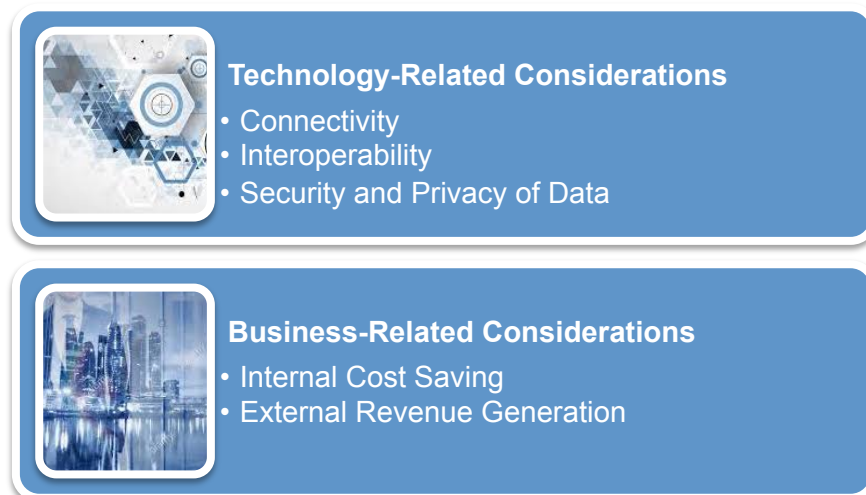
For example, smart grids would collect data on energy usage from homes and buildings, and utility operators could incorporate this information into supply-and-demand load balance schedules (Gubbi et al., 2013). These enhancements would result in a higher quality of service provision – for example, no load shedding (Caboz, 2018) – as well as an improved cost versus profit management system for the utility operators (Gubbi et al., 2013). Business scenarios for operational efficiency and increased productivity have also been expressed for a wide range of industries that include retail, logistics, transportation, manufacturing, aviation, and mining (Atzori et al., 2010; Dijkman et al., 2015; Gubbi et al., 2013; Hengstler et al., 2016; Miorandi et al., 2012; Porter & Heppelmann, 2014; Whitmore et al., 2015; Wortmann & Flütcher, 2015; Zysman & Kenney, 2018).

The IoT also features extensively in consumer smart products and enhanced services. Miorandi et al. (2012) provided a smart fridge scenario to better illustrate this possibility, where items stored in a smart refrigerator, identified by means of RFID or equivalent sensors, could be accounted for, and through embedded computing and networking capabilities, the smart fridge would be able to inform or even negotiate for best quality items, at a better rate, and for delivery from various suppliers (Metallo et al., 2018; Whitmore et al., 2015).

While some current devices are equipped at their design stage to handle some of these limited functions in specific situations, the increase in enabled things connected to the Internet will allow for these described and integrated scenarios to be realised without them necessarily been considered at time of design (Miorandi et al., 2012). This push for all things to be equipped or retrofitted with connectivity capabilities presents multiple plug-and-play scenarios, whereby any device can act as a consumer and/or provider of data, and through information transfer and analytics, these enabled devices can channel autonomic and/or interactive value-added services for businesses or individual end-users (Gubbi et al., 2013; Guinard, Trifa, Karnouskos, Spiess & Savio, 2010; Miorandi et al., 2012; Whitmore et al., 2015).

## 2.3 Issues and/or Challenges

However, despite the endless list of grand possibilities, and the solutions and opportunities that this interconnected environment presents, several practical and conceptual issues and/or challenges exist that organisations need to consider before investment and use. Despite the pull of financial and/or socio-economic benefits through the multitude of innovative applications that can be created through the versatility of the technology, the realisation of investments made by organisations to gain a competitive advantage or secure a financial return is not a certainty (Chan, 2015; Hsu & Yeh, 2017; Lee & Lee, 2015; Porter, 1985; Westerlund et al., 2014; Whitmore et al., 2015).



**Figure 3: Issues and/or Challenges with the Internet of Things**

### 2.3.1 Technology-Related Considerations

The technical focus in some of the academic literature is not surprising as the IoT environment is still in its formative stages (Atzori et al., 2010; Gubbi et al., 2013; Koshizuka & Sakamura, 2010; Miorandi et al., 2012; Whitmore et al., 2015; Wortmann & Flütcher, 2015). An isolated error in a non-connected system will have less of a knock-on effect compared to the interconnected environment of the IoT. Ramifications within a fully interconnected and integrated environment have the potential to cause disorder. Specific technical details are beyond the scope of this research study,

however, a discussion about the recurring themes of connectivity, interoperability, and security and privacy of data is required. Issues with these fundamental functional aspects need to be addressed for a well-engineered and commercially viable environment and system to manifest from which products and/or services can be enhanced and launched (Lee & Lee, 2015).

### **2.3.2 Connectivity**

The IoT would simply not exist or be able to function if Internet connectivity – required for things to become connected things – was compromised. Reliable and stable connectivity infrastructure is required for the growing volumes and countless streams of continuous data collection and transfer. Infrastructure that is unable to accommodate for the growing number of connected objects, devices, and things can result in saturation of Internet bandwidth and system-wide performance problems as well as concerns with its continued use (Botta, De Donato, Persico & Pescapé, 2016; Lee & Lee, 2015).

### **2.3.3 Interoperability**

The different types of connected objects and devices from toothbrushes to clothing, and from refrigerators to cars, without commonly accepted and/or still emerging standards and protocols, has made their integration into platform interfaces and operating systems very challenging (Chan, 2015; Westerlund et al., 2014). This fragmented state has affected the realisation of the complete value of a fully integrated system (Al-Fuqaha, Guizani, Mohammadi, Aledhari & Ayyash, 2015; Chan, 2015).

Custom-designed vertical solutions – consisting of a complete package of hardware and software that provides an isolated service and/or solution – have either resulted in and/or caused this observed inability for horizontal integration (Chan, 2015). This seems counter-intuitive to the desired purpose of an interconnected system whereby connected things, objects, and devices are separated from one another and where better engagement and participation is compromised in such scenarios.

### **2.3.4 Security and Privacy of Data**

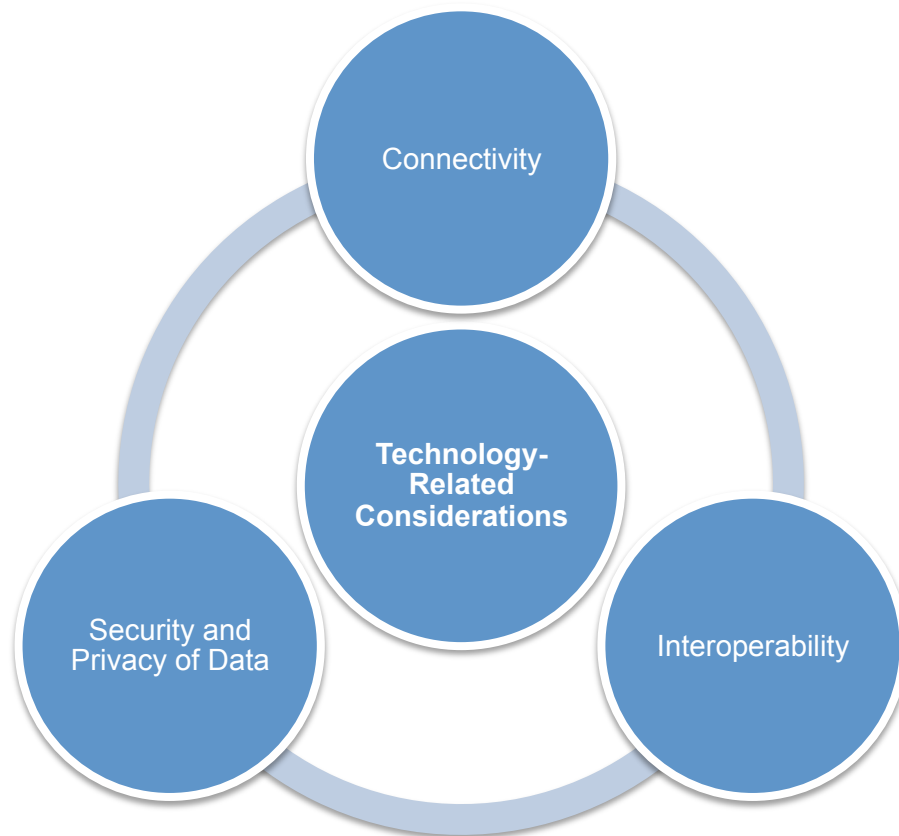
The main barrier to the acceptance, adoption, and use, has been found to surround concerns of secure data collection, transfer, and storage (Atzori et al., 2010; Juels, 2006; Mani & Chouk, 2017; Whitmore et al., 2015). The recent admission from

Facebook that over 50 million users accounts had been compromised through a cybersecurity breach highlights not only the incident but also the extent of some cybersecurity attacks in an interconnected world (Isaac & Frenkel, 2018).

The escalating number of cybersecurity breaches and hacks illustrate the vulnerability of an interconnected system that offers inadequate protection and/or resilience to these cybersecurity threats (Hsu & Yeh, 2017; Weber, 2010; Whitmore et al., 2015). The literature has offered several explanations, one of which is that earlier versions of connected and enabled devices have been very simple in design and form, and typically do not house data encryption techniques, and thus present multiple points of access to a system if connected (Lee & Lee, 2015).

The release of sensitive and private data is the main concern resulting from these breaches. Unauthorised access is extremely concerning as collected data represents an asset in terms of trade secrets and/or competitiveness in a business context, and where, in a personal context, extraction of identification and financial information can result in fraud and theft (Lee & Lee, 2015; Miorandi et al., 2012).

Genuine professional and personal engagement can only occur if issues of secured access and approved sharing of information are addressed to ensure that end-users feel comfortable participating in such an interconnected environment (Atzori et al., 2010; Gubbi et al., 2013; Miorandi et al., 2012; Whitmore et al., 2015). The complexity and sophistication of encrypted algorithms can provide assurances that collected data is and can be protected. However, any incident that results in low end-user confidence in the safety precautions of such a system represents a real threat to an IoT deployment of any scale in either a business and/or private capacity (Atzori et al., 2010; Gubbi et al., 2013; Lee & Lee, 2015; Miorandi et al., 2012).



**Figure 4: Technology-Related Considerations**

### **2.3.5 Business-Related Considerations**

It has been forecast that the IoT can generate \$14.4 trillion in value through the combination of lowered costs and increased revenues among companies and industries from 2013 to 2022 (Dijkman et al., 2015). This is higher than estimates previously mentioned by McKinsey but still comparable in terms of projected impact (Manyika et al., 2015). Therefore, there is a massive financial incentive for organisations to pursue these strategies through this available technology. Use of mechanisms to attain competitive advantages and improve company performance will vary depending on the generic strategy that is emphasised (Porter, 1985). In addition, an organisation's technology strategy needs to be consistent and congruent with its overall business strategy and business model (Chan, 2015; Porter, 1985).

For some industries these basic strategies directed towards lowered costs and/or differentiation remain valid. In other industries, these strategies are mutually reinforcing with this technology, such as where greater operational efficiency through tracking and logistics translates to improved service and end-user experiences – UberEATS has

previously been mentioned as an example (Hui, 2014). However, despite the allure of these projected financial returns there are many factors that require consideration either in isolation or in combination, which have been found to create apprehension and reluctance to pursue these generic strategies through this available technology. Hesitant first mover advances, engagement, and participation may be more prevalent in such instances. These responses are relevant for this research study in terms of resistance behaviours that may emerge under conditions of risk and uncertainty.

### **2.3.6 Capital Expenditure (CAPEX) and Return on Investment (ROI)**

Studies have elaborated on the operational challenges faced with financial considerations and returns from investments in new technologies (Frankenberger, Weiblen, Csik & Gassmann 2013; Lee & Lee, 2015). However, irreversible high CAPEX costs, uncertainty surrounding ROI, and long payback periods from investments, have not been adequately investigated in the literature in this context (Lee & Lee, 2015). The CAPEX requirements include a number of sensing and actuating IoT devices, additional security measures both on site and through security providers, as well as for the software platforms that can integrate, analyse, and display the relevant information (Hsu & Yeh, 2017; Sun et al., 2012).

There is also inherent uncertainty with market fluctuations and investment in rapidly changing technologies that may be irrelevant and obsolete in the future (Fichman, Keil & Tiwana, 2005). IoT products and services have not yet matured and proof of concept (POC) phases for some IoT solutions may be quite long as there is no set precedent with most of the applications (Chan, 2015; Dijkman et al., 2015; Lee & Lee, 2015; Westerlund et al., 2014). Therefore, the cost-benefit analysis that organisations have to consider is not as simple in practical terms even if the conceptual solution is deemed worthy.

### **2.3.7 Internal Cost Saving**

Organisations looking to redesign and optimise internal workflows, improve utilisation and tracking of assets, prevent interruptions through predictive maintenance, control distribution costs, and improve supply efficiency with real-time visibility, have more of an incentive to invest. The financial benefits from such solutions to improve productivity and efficiency and lower costs are concrete and measurable through quantitative net present value (NPV) calculations or real option valuations used to justify the CAPEX investment and ROI in these instances (Fichman et al., 2005; Lee & Lee, 2015).

Operating margins can be maximised to the extent that organisations can leverage their core capabilities in bringing products and/or services to market through greater control of key areas (Hui, 2014).

However, competitive advantages and improved company performance cannot simply revolve about cost improvement measures. Easier accessibility to this technology has lowered the barriers for its use by any organisation, even if the actual implementation of the technology may vary between companies. The competitive advantage for any organisation pursuing a low-cost strategy is transient as competitors may also and most likely will pursue this same logic. There is a level of diminishing returns with these strategies where further improvements in efficiency are simply no longer possible (Dijkman et al., 2015; Porter, 1985).

### **2.3.8 Employment**

The growth and decline of organisations and industries discussed in combination with the effects of technology on employment is not new. This has been debated in the literature with arguments for technologies holding the stance of positive productivity gains through the transformation of work processes, the augmentation of employee skills and the development of new capabilities, versus arguments against technologies that encompass labour-market dynamics with regard to displacement of employees and increasing unemployment (Lee & Lee, 2015; Zysman & Kenney, 2018). The susceptibility and security of current professions and workforces with the exponential growth and advancement of technology, and the potential negative and broader economic impacts on employment, has further raised concerns (Frey & Osborne, 2017; Zwick, 2002).

A greater willingness to accept a technology has been found if technology is positioned to assist rather than exert or shift control over to technology and away from the individual involved (Hengstler et al., 2016). Decisions can be made to either substitute labour or to leverage human cognition with technology. Notably, outcomes are not inherent to the technology itself, which is analogous to the premise that success or failure is not guaranteed through the simple presence of a technology (Porter, 1985; Zysman & Kenney, 2018).

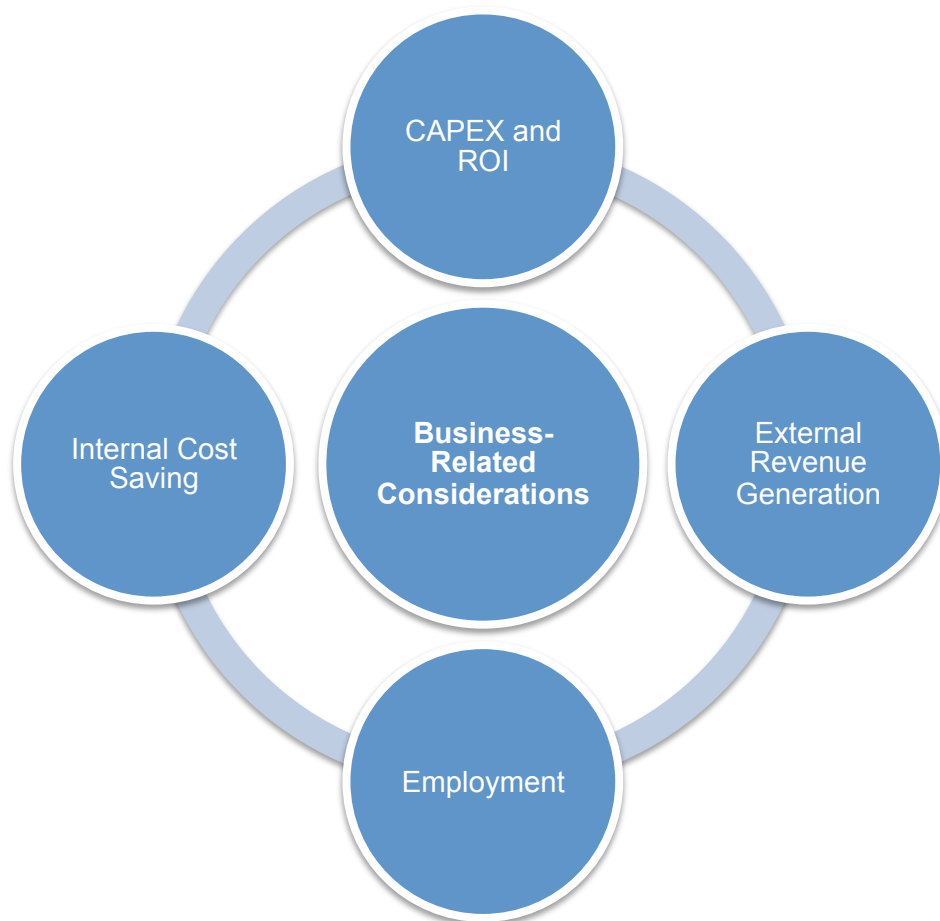
Questions remain within each production phase, organisation, sector and industry. Each organisation and each leader needs to decide how to proceed under presenting circumstances. The pursuit of low-cost technology-driven strategies places standard

routine tasks in a vulnerable position to displacement. This is pertinent to this research study as this creates an environment wherein resistance behaviours to innovation are more likely to emerge (Lee & See, 2004).

### **2.3.9 External Revenue Generation**

Diversification through the development of new products and/or services are necessary for an organisation to continue with a sustainable presence (Heidenreich & Kraemer, 2016; Martin et al., 2016; Miorandi et al., 2012; Prins & Verhoef, 2007). Businesses are realising the potential applicability with the inherent capabilities of the IoT and are exploring avenues to expand their revenue generating models (Atzori et al., 2010; Dijkman et al., 2015; Gubbi et al., 2013; Lee & Lee, 2015; Martin et al., 2016; Miorandi et al., 2012).

Various value-added services and subscription-based models have been described as examples of possible recurring revenue streams for organisations after initial product and/or service sales in this interconnected environment (Bucherer, Eisert & Gassmann 2012; Chan, 2015; Hui, 2014). However, the mechanisms required to leverage these approaches appropriately for profitability remain unclear (Hui, 2014). Traditional business logic, models, and strategies may not be suited for this integrated and interactive environment, and this is challenging organisations to adapt existing and conventional approaches in order to remain competitive (Chan, 2015; Hui, 2014; Lee & Lee, 2015).



**Figure 5: Business-Related Considerations**

For example, in traditional approaches, value creation and capture is centred about firm-centric outcomes (Chan, 2015; Hui, 2014; Metallo et al., 2018; Möller, Rajala & Svahn, 2005; Westerlund et al., 2014; Whitmore et al., 2015). However, in an interconnected environment, organisations can no longer exist or function in such isolation. The IoT serves as a platform that connects organisations to a comprehensive and distributed ecosystem that allows and requires collaboration and for relationships across previously perceived boundaries between businesses, and businesses and individuals (Chan, 2015; Hui, 2014; Metallo et al., 2018; Möller et al., 2005; Westerlund et al., 2014; Whitmore et al., 2015). This shift in mindset and focus on partnerships requires consideration of how all of the other participants and the network can create value for the mutual benefit of all involved stakeholders (Chan, 2015; Möller et al., 2005; Vargo & Lusch, 2004; Westerlund et al., 2014).

However, immature technologies and evolving ecosystems have no set structure. The complexity of multiple integrated and mobile components found in IoT scenarios

presents a significant challenge for organisations that wish to capitalise on potential commercial opportunities. These developing ecosystems may be inadequately positioned at this point in time for effective utilisation (Hui, 2014; Metallo et al., 2018; Möller et al., 2005; Whitmore et al., 2015). The presence of resistance behaviours is also observed to be an underlying and underappreciated factor that requires consideration for this possible lack of greater engagement and greater participation of multiple stakeholders.

### **2.3.10 Innovation Resistance**

Organisations have traditionally held the belief that the quality, the performance, and the lack of complexity of their products and/or services, is enough to convince individuals in their adoption and use (Heidenreich & Kraemer, 2016; Slater & Mohr, 2006). This is supported by the extensive amount of research in the innovation diffusion literature, especially with regard to technology acceptance and adoption (Davis, Bagozzi & Warshaw, 1989; Heidenreich & Kraemer, 2016; Kuisma et al., 2007; Laukkanen, 2016; Venkatesh, Morris, Davis & Davis, 2003). Studies have consistently published and exhaustively cited describing integrated frameworks and models – such as the Technology Acceptance Model (TAM) (Davis et al., 1989), TAM 2 (Venkatesh & Davis, 2000) and TAM 3 (Venkatesh & Bala, 2008) – to help explain and assist with technology acceptance and adoption across different contexts (Hsu & Yeh, 2017; Patsiotis et al., 2013). This emphasis has biased the academic literature towards pro-change where it has been framed that the majority of stakeholders are accepting of new products and/or services based on these principles, and therefore that adoption and use should occur (Lee, Kozar & Larsen, 2003).

Although these elements may assist with greater preference towards certain technological innovations, history has demonstrated the failure of many minimally viable products and/or services that are geared with these intentions (Martin et al., 2016). Castellion and Markham (2013) reported innovation failure rates between 40 and 55% (Heidenreich & Kraemer, 2016). The resulting negative ROI poses a significant threat to a firm's future competitiveness and survival (Bayus, Erickson & Jacobson, 2003; Heidenreich & Kraemer, 2016). Continued high failure rates suggest that underlying reasons do not solely reside in a failure to reach the minimum threshold of these characteristics extolled in the adoption and diffusion literature (Chiesa & Frattini, 2011; Heidenreich & Kraemer, 2016; Heidenreich & Spieth, 2013; Kleijnen et al., 2009; Ram, 1989; Ram & Sheth, 1989).

Failure may occur despite an emphasis on these adoption-related characteristics in attempted approaches to “tip-the-scales” towards acceptance and adoption (Chiesa & Frattini, 2011; Fortin & Renton, 2003; Heidenreich & Kraemer, 2016; Heidenreich & Spieth, 2013; Kleijnen et al., 2009; Ram, 1989; Ram & Sheth, 1989). For example, screw-top wine bottles replacing traditional corks were envisioned to provide greater convenience for consumers, however, this did not appeal to traditional wine drinkers and received a poor response (Garcia & Atkin, 2006).

Therefore, the identification of the presence as well as reasons for innovation resistance behaviours is important, as these may negatively affect the acceptance and engagement from potential individuals, which in-turn influences their actual behavior, despite the ease-of-use and perceived usefulness of the product and/or service (Gatignon & Robertson, 1985; Heidenreich & Handrich, 2015; Heidenreich & Spieth, 2013; Laukkanen, Sinkkonen & Laukkanen, 2009; Ram, 1989; Ram & Sheth, 1989).

Therefore, despite the overwhelming positive scenarios and financial predictions that exist for organisations to engage with these new technologies, and even though rapid introduction into the market holds the potential for first mover advantages and reputational gains (Debruyne, Rudy, Griffin, Hart, Hultink & Robben, 2002), resistance behaviours towards innovations requires more consideration. Innovation means change and resistance to change is a normal human response (Heidenreich & Handrich, 2015; Heidenreich & Kraemer, 2016; Heidenreich & Spieth, 2013; Laukkanen, 2016; Mani & Chouk, 2017; Martin et al., 2016; Ram, 1987). Even though human responses and reactions can be less predictable, innovation success is dependent on both the level of adoption versus the level of resistance, and therefore a greater understanding of this concept may improve the acceptance and adoption of new and innovative products and/or services (Gatignon & Robertson, 1989).

However, the concept of innovation resistance behaviours, its associated variables, and its importance, has been largely neglected in the academic literature (Bradley & Stewart, 2002; Gatignon & Robertson, 1985, 1989; Heidenreich & Kraemer, 2016; Kleijnen et al., 2009; Kuisma et al., 2007; Lapointe & Rivard, 2005; Laukkanen, 2016; Mani & Chouk, 2017; Martin et al., 2016; Molesworth & Suortti, 2002; Patsiotis et al., 2013; Ram, 1987; Ram & Sheth, 1989; Rogers, 2003; Talke & Heidenreich, 2014). The literature assumes a linear relationship between the positive and negative factors influencing adoption (Patsiotis et al., 2013). However, it is not appropriate to simply conclude that resistance is the opposite of adoption (Gatignon & Robertson, 1989; Herbig & Day, 1992; Kleijnen et al., 2009; Ram & Sheth, 1989). The characteristics of

adoption and resistance are somewhat different and should therefore be considered as separate concepts rather than opposing concepts (Chiesa & Frattini, 2011; Claudy, Garcia & O'Driscoll, 2015; Gatignon & Robertson, 1989; Heidenreich & Kraemer, 2016; Heidenreich & Spieth, 2013; Kleijnen et al., 2009; Ram, 1987, 1989; Ram & Sheth, 1989).

Ram (1987, p. 208) stated that “resistance and adoption can coexist during the life-cycle of an innovation”. The presence of simultaneous favourable and unfavourable views suggest that a comprehensive understanding of why some do not adopt is just as important as knowing why others do adopt, and this may assist organisations in decreasing the probability of innovation failure within the context of the IoT (Ferreira, da Rocha & da Silva, 2014; Mani & Chouk, 2017; Ram, 1989; Szmigin & Foxall, 1998).

### **2.3.11 Continuum of Resistance**

Innovation resistance behaviours are described as active and/or passive in nature. Authors have presented these behaviours in a continuum from avoidance to active rebellion (Fournier, 1998) or in a hierarchal fashion moving from postponement to rejection to opposition (Kleijnen et al., 2009).

Postponement occurs when individuals are reluctant to adopt an innovation due to circumstances that are not suitable for them at that point in time or until the innovation improves over time (Kleijnen et al., 2009; Laukkanen, 2016; Mani & Chouk, 2017; Ram & Sheth, 1989; Szmigin & Foxall, 1998). The latter can be seen in instances when early investment is tapered with technology-related innovations as improved versions in the foreseeable future would render previous purchases obsolete (Fichman et al., 2005).

Rejection occurs when individuals actively decide to not take up an innovation that has been introduced into the market as it is perceived to carry too many risks (Kleijnen et al., 2009; Laukkanen, 2016; Mani & Chouk, 2017; Patsiotis et al., 2013; Ram, 1989; Szmigin & Foxall, 1998). Various data cybersecurity concerns can be observed to present with this described response.

Finally, opposition occurs if individuals consider an innovation as a threat and actively engage in actions against its adoption (Fournier, 1998; Kleijnen et al., 2009; Laukkanen, 2016; Mani & Chouk, 2017; Szmigin & Foxall, 1998). The effects of technology on employment and the negative displacement of labour – as discussed in

Section 2.3.8 – has alluded to the possibility of this extreme end-of-the-spectrum reaction presenting under these described circumstances.



**Figure 6: Continuum of Innovation Resistance**

### **2.3.12 Active Innovation Resistance**

Ram and Sheth (1989) consolidated observed influences of active innovation resistance behaviours into functional and psychological barriers (Claudy et al., 2015; Heidenreich & Handrich, 2015; Heidenreich & Kraemer, 2015; Heidenreich & Spieth, 2013; Kleijnen et al., 2009; Kuisma et al., 2007; Laukkanen, 2016; Laukkanen et al., 2009; Mani & Chouk, 2017; Ram & Sheth, 1989).

Functional barriers are expressed as usage, value, and risk barriers (Gatignon & Robertson, 1985; Herbig & Day, 1992; Kleijnen et al., 2009; Laukkanen, 2016; Mani & Chouk, 2017; Patsiotis et al., 2013; Ram & Sheth, 1989; Szmigin & Foxall, 1998; Woodside & Biemans, 2005). A usage barrier occurs when an innovation is perceived to be incongruent or incompatible with an individual's established behaviour patterns. Uncertain or unproven performance, difficulty with use or a degree of potential change, are also viewed as influences invoking usage barriers. Functional barriers also include an identified value barrier that occurs if an innovation does not offer superior price-to-performance value compared to alternatives. A risk barrier arises if an innovation is perceived to potentially cause harm to an individual. CAPEX and ROI concerns can be seen to invoke the value barrier, whereas the risk barrier can be seen to emerge with aforementioned cybersecurity and data privacy concerns.

The principles of perceived ease-of-use and perceived usefulness advocated in the adoption and diffusion literature would seem to counter suggested complexity and incompatibility issues (Davis et al., 1989; Forsythe & Shi, 2003; Kuisma et al., 2007;

Laukkanen, 2016; Mani & Chouk, 2017; Oreg, 2006; Venkatesh & Davis, 2000; Venkatesh et al., 2003). However, the continued adoption and use of innovative products and/or services cannot be demonstrated and therefore illustrates the need to consider the existence of other influences – such as these functional and psychological barriers – that may impede acceptance, adoption, and use.

Psychological barriers are expressed as tradition or image barriers (Fortin & Renton, 2003; Gatignon & Robertson, 1985; Herbig & Day, 1992; Kleijnen et al., 2009; Laukkanen, 2016; Mani & Chouk, 2017; Molesworth & Suortti, 2002; Patsiotis et al., 2013; Ram & Sheth, 1989). A tradition barrier occurs when an innovation deviates or runs contrary to wider societal traditions, customs or norms, or when it conflicts with an individual's existing values and/or prior belief structures. Finally, an image barrier emerges if an innovation is viewed unfavourably or is negatively perceived within social circles.

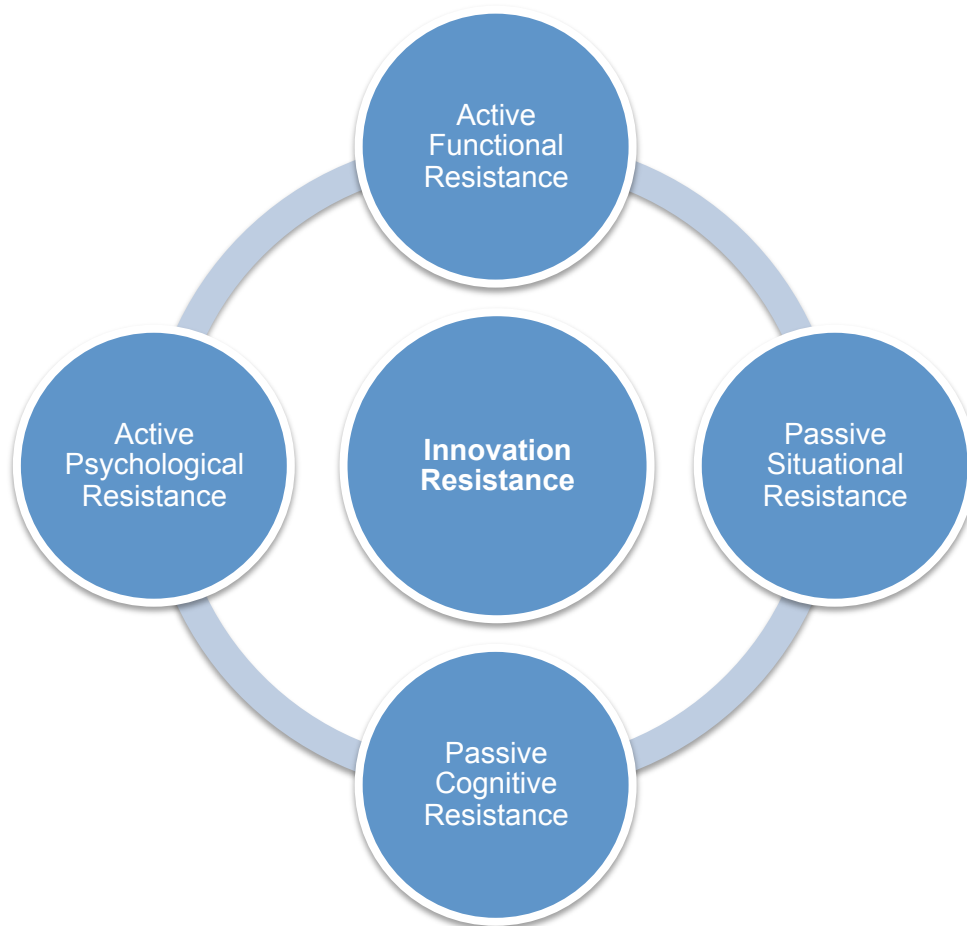
Movement between the different levels on the continuum has been found to be dependent on the amount and nature of the preceding factor as well as the context in which the barriers present (Kleijnen et al., 2009; Laukkanen, 2016). The complexity of human reactions and responses compounds the difficulties encountered in engagements and interactions. Therefore, business strategies may benefit from a more informed understanding of these conceptual constructs of active resistance behaviours towards innovations.

### **2.3.13 Passive Innovation Resistance**

Passive innovation resistance has received even less attention in the academic literature than active innovation resistance (Heidenreich & Handrich, 2015; Heidenreich & Kraemer, 2015; Heidenreich & Spieth, 2013; Talke & Heidenreich, 2014). Passive resistance is not dependent on an innovation's attributes but is formed from either a situational tendency to preserve the status quo or a cognitive inclination to resist any discontinuity that may follow (Heidenreich, & Handrich, 2015; Heidenreich & Kraemer, 2015, 2016; Laukkanen et al., 2009; Talke & Heidenreich, 2014).

Radical innovations have been found to enhance these responses as these individuals either moderate or avoid the innovation in question to maintain consistency and congruity in their environment unless a trigger or compelling argument motivates a shift from this state of non-adoption (Ghazizadeh, Lee & Boyle, 2012; Heidenreich & Handrich, 2015; Heidenreich & Kraemer, 2015; Heidenreich & Spieth, 2013; Kleijnen et

al., 2009; Laukkanen, 2016; Ram, 1987; Talke & Heidenreich, 2014). Therefore, enhanced features built to drive acceptance and adoption of innovations may not be effective in this reluctant group (Fortin & Renton, 2003; Heidenreich & Handrich, 2015; Heidenreich & Kraemer, 2015; Heidenreich & Spieth, 2013; Oreg, 2003).



**Figure 7: Innovation Resistance**

The enabled interconnected and interactive nature of the IoT provides an environment in which scenarios may arise and conflict with societal ethics (Thiesse, 2007). For example, digital surveillance – “Big Brother is watching you” – is viewed as an infringement on personal privacy (Hsu & Lin, 2016; Lee & Lee, 2015) and can have a negative effect on adoption behaviour and trust in the actual technology and/or its use (Mani & Chouk, 2017). This was recently highlighted by the Cambridge Analytica scandal and their admitted use of social media data and information from Facebook to influence voter opinions in the 2016 American presidential elections as well as the

Brexit vote (Meredith, 2018). This resulted in Facebook losing more than \$119 billion in market value from the fallout of this scandal (Neate, 2018) as well as the subsequent collapse of Cambridge Analytica (Cadwalladr, 2018).

Finally, the influence of age has also been discussed with regard to both active and passive innovation resistance behaviours. This is relevant in this context as older generations – Baby Boomers and Generations X's – have been exposed to a greater spectrum of technological transitions compared to younger individuals – Millennials – that have entered a world based purely around these new technologies. Older individuals have also been suggested to be more sensitive to preceding influences and tend to be more risk averse (Ram, 1987; Laukkanen, 2016; Laukkanen, Sinkkonen, Kivijärvi & Laukkanen, 2007; Moschis, 2003).

## **2.4 Trust**

The academic literature has suggested methods such as incremental introductions, trials and demonstrations of value with which to reduce perceived concerns and influences that may invoke innovation resistance behaviours (Debruyne et al., 2002; Heidenreich & Handrich, 2015; Heidenreich & Kraemer, 2015; Heidenreich & Spieth, 2013; MacVaugh & Schiavone, 2010; Ram & Sheth, 1989). However, a key consideration that is central and possibly even supersedes the mechanics involved with these approaches is the development and required existence of trust (Ghazizadeh et al., 2012; Lee & See, 2004; Rousseau, Sitkin, Burt & Camerer, 1998; Sirdeshmukh et al., 2002).

The dynamic nature of an interconnected and interactive environment allows for management about the phenomenon of trust to be extremely challenging, as without trust on many levels, successful innovation introduction and use is unlikely (Atzori et al., 2010; Ghazizadeh et al., 2012; Hengstler et al., 2016; Lee & See, 2004; McKnight et al., 2002; Miorandi et al., 2012; Slovic, 1993). Trust evolves over time and is initially driven by the degree to which future behaviour can be predicted (McKnight et al., 2002). Dependability follows whereby the consistency or reliability of performance needs to be proven before ultimately shifting to faith where user reliance is secured (Hengstler et al., 2016; Lee & See, 2004). However, trust is a fragile construct and can be destroyed more quickly than it is created (Slovic, 1993). Therefore, resistance behaviours can be found to emerge even after adoption has occurred if trust has been tested and/or compromised.

### **2.4.1 Trust in Technology**

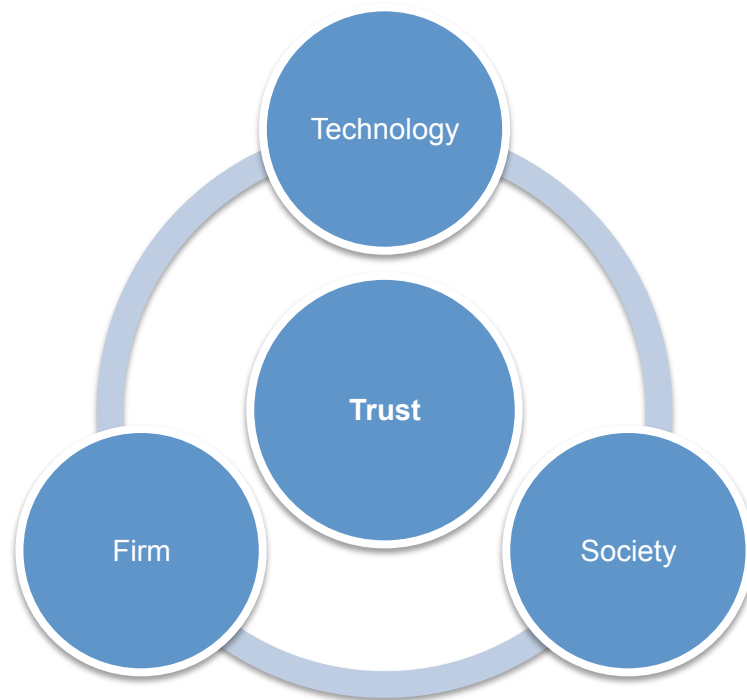
Trust in technology entails trust in the purpose that it was designed for. Greater human-to-technology engagement is possible if the technology is compatible with established values and patterns and this may help mediate the desire and/or need for control as well as the amount of autonomous decision-making an individual is willing to delegate to the technology (Castelfranchi & Falcone, 2000; Ghazizadeh et al., 2012; Hengstler et al., 2016; Karahanna, Agarwal & Angst 2006; Lee & Moray, 1992; Lee & See, 2004; Slovic, 1993). Any event contradicting this precedent may garner attention and provoke the emergence of resistance behaviours (Kasperson, Renn, Slovic, Brown, Emel, Goble, Kasperson & Ratick, 1988).

### **2.4.2 Trust in the Firm**

Importantly, firms that conduct themselves in accordance with institutions of respected governance, regulations, and accountability measures – such as with the Protection of Personal Information Act or POPI Act in South Africa and the General Data Protection Regulation or GDPR in Europe (Edwards, 2013) – are deemed more trustworthy and are generally more accepted (Karjaluoto, Mattila & Pento, 2002; Laukkanen, 2016; Weber, 2009, 2011). In addition, credibility from expertise, goodwill, reliability and continued engagement with stakeholders, has been found to positively effect attitudes and behaviours towards organisations and the products and/or services with which they are associated (Hengstler et al., 2016). These are crucial elements in developing trust in a firm's authenticity and intentions (Ghazizadeh et al., 2012; Hengstler et al., 2016; Lee & See, 2004).

### **2.4.3 Societal Trust**

Finally, in an increasingly interconnected, interactive, and digitally integrated world, social opinion and judgment is becoming more influential. As this technology is woven into the fabric of society, social discourse about the trustworthiness of these developments occurs, and both adoption and resistance are both influenced by these perceptions (MacVaugh & Schiavone, 2010; Wejnert, 2002).



**Figure 8: Trust**

Mechanisms for developing trust in these various instances need to be systemically fostered in counter-measures against innovation resistance behaviours (Hengstler et al., 2016). For example, communication has been advocated to promote iterative feedback loops to sway impressions and to reciprocate trust and confidence (Ram, 1989; Slovic, 1993). Communication in various forms can negate fears, contextualise benefits, and promote compatibility with existing conditions and circumstances (Hengstler et al., 2016; Herbig & Day, 1992; Kleijnen et al., 2009; Oreg, 2006; Patsiotis et al., 2013). However, sincere communication has been found to be more effective in promoting engagement compared with blatant public relations efforts or marketing initiatives (Nienaber & Schewe, 2014).

Therefore, the principle of trust should be prioritised for organisations attempting to gain competitive advantages, improve their company performance and market outcomes (Hengstler et al., 2016; Kleijnen et al., 2009; Laukkanen, 2016; Patsiotis et al., 2013; Ram & Sheth, 1989; Talke & Heidenreich, 2014; Wortmann & Flütcher, 2015).

## **2.5 Conclusion**

Chapter 2 presented a review of the academic literature that forms the basis for this research study. Despite the value that can be created and delivered through new technologies such as the IoT, acceptance and adoption is not a certainty. The complexities of this interconnected era presents a challenge for organisations attempting to create and capture value enabled through this available technology within this environment. In order for organisations to gain a share of the substantial financial forecasts, the researcher argues that a more holistic perspective is required from which business logic and models can be informed. The researcher believes that insights gained through the concept of innovation resistance behaviours within the context of issues and/or challenges described in the context of the IoT can be utilised to assist in this regard.

In conclusion, when considering the growing importance of the IoT industry and the competitiveness in the global economy, organisations should be striving to maximise their gains as well as minimise their losses. “If you are unable to break down resistance, adoption slows and innovation likely fails” (Laukkanen, 2016, p. 2437).

Chapter 3 follows and presents the research questions informed from this literature review for this research study.

# CHAPTER 3: RESEARCH QUESTIONS

## 3.1 Introduction

Chapter 3 presents the research questions informed from the academic literature review in Chapter 2 that form the basis of this research study. These questions have been created based on the insights gained about innovation resistance behaviours and the issues and/or challenges that present with the IoT. These questions were structured to explore how these interrelated elements can be identified and then addressed to create competitive advantages and improve company performance for organisations within this environment. Finally, the impacts and implications of implementation and use were explored to inform further insights. The sequence of the research questions is displayed below.



Figure 9: Sequence of Research Questions

## 3.2 Research Question 1

**Have innovation resistance behaviours been identified by organisations within issues and/or challenges of the IoT?**

To realise the potential that the IoT holds for organisations that want to incorporate this available technology into mechanisms and strategies to achieve their organisational

goals and objectives, identification of issues and/or challenges in which resistance behaviours may negatively affect acceptance and adoption should be of primary importance before implementation and use are even considered. In this regard, the initial aim of this research study was to establish if the concept and constructs about innovation resistance behaviours was transferable and relevant to the context of the IoT (Kleijnen et al., 2009; Lapointe & Rivard, 2005; Laukkanen, 2016).

Multiple authors in the academic literature have acknowledged or alluded to the possible presence of resistance behaviours (Bradley & Stewart, 2002; Gatignon & Robertson, 1985, 1989; Heidenreich & Kraemer, 2016; Kleijnen et al., 2009; Kuisma et al., 2007; Lapointe & Rivard, 2005; Laukkanen, 2016; Mani & Chouk, 2017; Martin et al., 2016; Molesworth & Suortti, 2002; Ram, 1987; Ram & Sheth, 1989; Rogers, 2003; Talke & Heidenreich, 2014) within issues and/or challenges in the context of the IoT (Atzori et al., 2010; Gubbi et al., 2013; Koshizuka & Sakamura, 2010; Lee & Lee, 2015; & Chouk, 2017; Miorandi et al., 2012; Westerlund et al., 2014; Whitmore et al., 2015; Wortmann & Flütcher, 2015).

Connectivity – identified as fundamental to the functioning of the IoT – and interoperability – observed to enhance it's underlying potential – both present with issues and/or challenges that can generate reluctance to engage and participate within this environment (Al-Fuqaha et al., 2015; Botta et al., 2016; Chan, 2015; Lee & Lee, 2015; Westerlund et al., 2014). In addition, the heightened emphasis surrounding cybersecurity and data privacy concerns in this interconnected environment, highlight the increasing importance of this identified risk barrier that may invoke innovation resistance behaviours (Atzori et al., 2010; Gubbi et al., 2013; Hsu & Yeh, 2017; Juels, 2006; Lee & Lee, 2015; Mani & Chouk, 2017; Miorandi et al., 2012; Weber, 2010; Whitmore et al., 2015).

The pursuit of cost savings through technology-driven internal efficiencies is clouded by the presence of high CAPEX costs without much established long-term and proven outcomes from this new technology (Dijkman et al., 2015; Fichman et al., 2005; Frankenberger et al., 2013; Hsu & Yeh, 2017; Lee & Lee, 2015; Porter, 1985; Sun et al., 2012). Uncertainty about the “staying power” of some technologies in rapidly-changing times, as well as the recognised diminishing returns with low-cost strategies, add to this state of reluctance in adoption and utilisation of new and innovative technologies such as the IoT (Chan, 2015; Dijkman et al., 2015; Lee & Lee, 2015; Porter, 1985; Westerlund et al., 2014).

Even though the IoT presents a mechanism with which to pursue external revenue generation, consumer markets are complicated by even less predictable responses and reactions from individuals as well as society, especially within this interconnected and interactive environment (Bradley & Stewart, 2002; Gatignon & Robertson, 1985, 1989; Heidenreich & Kraemer, 2016; Kleijnen et al., 2009; Kuisma et al., 2007; Lapointe & Rivard, 2005; Laukkanen, 2016; Mani & Chouk, 2017; Martin et al., 2016; Molesworth & Suortti, 2002; Patsiotis et al., 2013; Ram, 1987, 1989; Ram & Sheth, 1989; Rogers, 2003; Talke & Heidenreich, 2014).

Adoption and use is not guaranteed despite the pro-change bias in the academic literature as described resistance behaviours are present and can emerge (Chiesa & Frattini, 2011; Fortin & Renton, 2003; Gatignon & Robertson, 1989; Heidenreich & Handrich, 2015; Heidenreich & Kraemer, 2016; Heidenreich & Spieth, 2013; Kleijnen et al., 2009; Laukkanen, 2016; Mani & Chouk, 2017; Martin et al., 2016; Ram, 1987, 1989; Ram & Sheth, 1989). Therefore, Research Question 1 aimed to investigate if observations with regard to the presence and emergence of resistance behaviours in the context of described issues and/challenges with the IoT are of merit and warrant consideration by organisations as well as the academic literature.

### **3.3 Research Question 2**

**How have innovation resistance behaviours within issues and/or challenges of the IoT been addressed by organisations in creating competitive advantages and improvements in company performance?**

Multiple authors in the academic literature have called for empirical studies from which to base approaches to address the presence and emergence of resistance behaviours within this environment (Heidenreich & Kraemer, 2015; Mani & Chouk, 2017) to effect better use of new technologies such as the IoT to achieve desired goals, objectives and outcomes (Casadesus-Masanell & Ricart, 2010; Chan, 2015; Dijkman et al., 2015; Hsu & Yeh, 2017; Lee & Lee, 2015; Martin et al., 2016; Metallo et al., 2018; Patsiotis et al., 2013; Porter & Heppelmann, 2014; Schneider & Spieth, 2013; Whitmore et al., 2015). Knowledge generated from the psychology behind innovation resistance behaviours has been acknowledged to promote greater acceptance, diffusion and adoption (Sheth, 1981).

Various mechanisms have been proposed to counter the presence and emergence of resistance behaviours. For example, trials and POCs with quantifiable financial calculations and projections are mentioned in the academic and managerial literature as methods to justify the cost-benefit analysis in cost savings proposals (Fichman et al., 2005; Hui, 2014; Lee & Lee, 2015). Creative communication and framing techniques used in advertising and marketing campaigns as well as the use of partner networks and leveraged ecosystems have also been mentioned as mechanisms that organisations can potentially use to influence consumers in organisational pursuits of external revenue generation (Chan, 2015; Hui, 2014; Lee & Lee, 2015; Metallo et al., 2018; Möller et al., 2005; Westerlund et al., 2014; Whitmore et al., 2015).

The IoT presents a modality to enable and enhance these approaches through its inherent capabilities and applicability in these instances (Atzori et al., 2010; Gubbi et al., 2013; Hsu & Yeh, 2017; Lee & Lee, 2015; Miorandi et al., 2012; Patsiotis et al., 2013; Sun et al., 2012; Thiesse et al., 2011; Whitmore et al., 2015). Therefore, Research Question 2 aimed to explore the approaches used by organisations in these scenarios to address innovation resistance behaviours within issues and/or challenges that they may encounter to better inform decisions with regard to implementation and use of this available technology to create and capture value.

### **3.4 Research Question 3**

#### **What impacts and implications require consideration by organisations that have progressed to implementation and use of the IoT?**

Acceptance and adoption does not ensure success or continued sustainability (Porter, 1985; Zysman & Kenney, 2018). Even though concomitant resistance behaviours and issues and/or challenges can be identified and addressed, they do not disappear and they are not erased. Innovation resistance evolves along a described continuum in the academic literature and presents in response to the manner in which implementation and use occurs (Fournier, 1998; Kleijnen et al., 2009; Laukkanen, 2016; Mani & Chouk, 2017; Patsiotis et al., 2013; Ram, 1989; Ram & Sheth, 1989; Szmigin & Foxall, 1998).

The implementation and use of enabled technology to achieve desired organisational goals can still have negative outcomes. Internally, the pursuit of increased productivity with technology-driven low-cost strategies has been observed to displace employees. Therefore creating an atmosphere wherein subsequent resistance behaviours can

emerge (Lee & See, 2004). Externally, mechanisms that misuse collected data can have far-reaching and negative consequences in such an interconnected environment especially with the influence from greater levels of social engagement and interactive participation (Atzori et al., 2010; Gubbi et al., 2013; Lee & Lee, 2015; MacVaugh & Schiavone, 2010; Miorandi et al., 2012; Wejnert, 2002; Whitmore et al., 2015).

The overall efficacy of strategic implementation and use of new technologies by organisations to achieve desired outcomes in these instances has been proposed to be dependent on the concurrent development and incorporation of trust into these mechanisms (Ghazizadeh et al., 2012; Lee & See, 2004; Rousseau et al., 1998; Sirdeshmukh et al., 2002; Slovic, 1993). Trust is central to the continued participation of all stakeholders involved (Hengstler et al., 2016). If trust is compromised, the value proposition falters, and resistance behaviours emerge.

Therefore, Research Question 3 aimed to uncover which impacts and implications were considered by organisations in their implementation and use of this available technology, and if the principles with regard to trust were found to be important and incorporated into their management of these resistance behaviours.

### **3.5 Conclusion**

Chapter 3 has presented the three research questions that formed the basis of this research study. Through a logical progression, it was hoped that the answers to these questions would assist with a broader understanding and awareness of how and where this conceptual knowledge can be leveraged practically to assist business logic, models and strategies within the context of the IoT. Chapter 4 follows and presents the methodology used in this research study.

# **CHAPTER 4: RESEARCH METHODOLOGY**

## **4.1 Introduction**

Chapter 4 presents the outline and justifications for the design of this research study. The purpose of this research study was informed through a critique of the literature from peer-reviewed studies in academic journals with regard to innovation resistance as well as the IoT. The assessment that followed informed an exploration of the concept and constructs of innovation resistance behaviours within the context of the IoT. This research study utilised a qualitative approach to answer the three research questions posed in Chapter 3.

The researcher believed that by conducting the research study in this manner that insights gained would be able to assist organisations within this environment with both conceptual and practical knowledge. Semi-structured interviews were conducted with senior managers of identified organisations involved across the IoT value chain both in South Africa and abroad. Open coding was followed by categorisation of code names into code groups. These code groups were then aligned to themes that had emerged from the literature review in Chapter 2.

Chapter 4 includes considerations taken with regard to researcher bias and reliability, ethical concerns, issues of trustworthiness, and finally limitations of the research study's design. Chapter 4 concludes with a summary before proceeding to the results and analysis of the findings in Chapter 5.

## **4.2 Research Design**

This research study adopted a qualitative approach. This methodology is appropriate when exploring an identified area for research to allow for a greater understanding of the complexity of an identified situation (Bloomberg & Volpe, 2012; Creswell, 2014; Kothari, 2004). The intent of qualitative research is to explore and discover a phenomenon through the interaction of the researcher with others and to gain insights from the meaning of their world (Williams, 2007; Yin, 2015).

The decision to conduct this research study in this manner was made in response to the calls from authors in the academic literature for re-engagement with the concept of

innovation resistance (Kleijnen et al., 2009; Lapointe & Rivard, 2005; Laukkanen, 2016). There is also a recognised dearth of knowledge on the managerial, economic, behavioural, and social challenges involved with the IoT to assist with informed decisions regarding more appropriate business logic and approaches to capitalise on its presence (Lee & Lee, 2015; Patsiotis et al., 2013; Porter & Heppelmann, 2014; Schneider & Spieth, 2013). Therefore, based on an observed overlap of resistance behaviours within issues and/or challenges identified in the context of the IoT, the researcher believed that an integration of this concept and context from a review of the academic literature would add to the academic knowledge and inform practical insights.

Due to the need for further academic theory in the developing area of the IoT, this research study took an initial deductive approach. The presence of described innovation resistance behaviours as well as issues and/or challenges within the context of the IoT did not negate the exploratory nature of this research study, as the research study aimed to understand the phenomenon of innovation resistance in the context of the IoT. The apparent lack of academic integration and the possible transferability of this phenomenon to the IoT landscape, provided an opportunity through which both could be investigated simultaneously.

The initial deductive approach was then followed by an inductive approach because of the codes and themes that arose from the qualitative analysis of the collected data. This combination of both deductive and inductive methods is advocated in the literature for a study of this nature (Saunders & Lewis, 2012; Bloomberg & Volpe, 2012).

Semi-structured interviews were chosen as the primary method for data collection as they provide the richness and flexibility required to answer exploratory research questions in this manner (Bloomberg & Volpe, 2012; Kothari, 2004; Saunders & Lewis, 2012). These interviews provided a scenario wherein participants were freely able to express and elaborate on their answers (Kothari, 2004; Saunders, Lewis & Thornhill, 2009) and for the researcher to reciprocally capture events and/or experiences from their perspective (Creswell, 2014).

Semi-structured interviews also have the potential to elicit thick and rich descriptions (Denzin, 2001) that provide the researcher the opportunity to probe for and clarify statements, which is valuable in a complicated and complex area under study such as the IoT (Bloomberg & Volpe, 2012). This amount of detailed and in-depth description gives the discussion an element of shared or vicarious experience, and provides a

vehicle with which to communicate an illustration of the topic, grounded in the reality of the participants' world (Bloomberg & Volpe, 2012).

The goal was to capture and represent the opinions of the participants holistically, and to allow for concepts to emerge, and be interpreted and represented in a meaningful manner (Merriam & Tisdell, 2016; Williams, 2007; Yin, 2015). Therefore, the fundamental assumptions and features that allow for a research study to proceed in a qualitative direction were found to be appropriate for this research study.

### **4.3 Population**

The population for this research study consisted of senior managers from a heterogeneous group of organisations involved across the IoT value chain. The interviews were directed towards the organisations' senior digital and technology managers. It was believed that these strategic managers would have a comprehensive understanding of the IoT and would be able to knowledgeably answer the semi-structured interview questions. The wide ranging applicability of the IoT allows for this available technology to have a presence across a wide-range of industries globally. Therefore, the researcher gathered a combination of local South African as well as foreign insights in hopes of a comprehensive and extended understanding of the concepts and context under study. The researcher attempted to gain a balance between local and global participants, however, only two foreign European organisations responded to requests compared to responses from ten local organisations. The two global participants were included in the research study as this allowed the researcher to compare a spectrum of opinions not confined by geographical boundaries. The review of the academic literature revealed areas across the IoT value chain that would be of relevance for this study. Therefore, senior managers in organisations that fulfilled the following criteria were approached for this research study:

- (1) Senior managers that had at least five years of experience within organisations actively involved in the IoT landscape.
- (2) Organisations positioned across the IoT value chain that included hardware and software developers, connectivity and cybersecurity as well as consultancy and solution providers, and finally product and/or service providers in both business-to-business (B2B) and/or business-to-consumer (B2C) capacities.

## 4.4 Sampling

Due to the ubiquitous and growing nature of the IoT, and its varied applicability in multiple industries, an exact list of the entire population was not available and was impossible to establish. Therefore, probability sampling was not used in this research study (Saunders & Lewis, 2012).

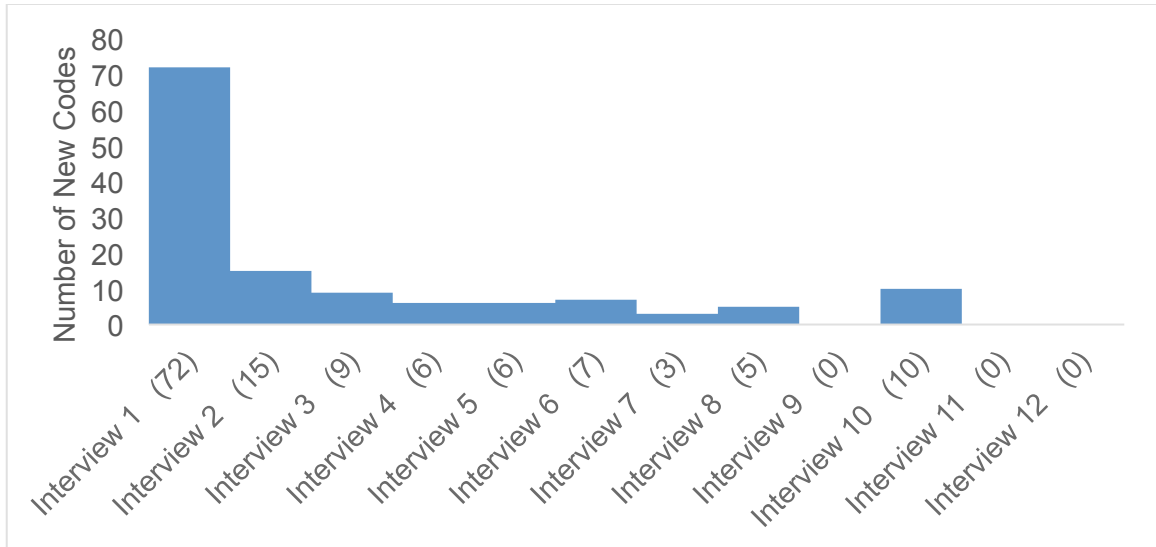
As there was a need to select information-rich participants, a two-layered subjective approach using purposeful and snowball non-probability sampling techniques was preferred (Bloomberg & Volpe, 2012; Merriam & Tisdell, 2016; Patton, 2001). These methods are deemed appropriate for exploratory qualitative studies to question relevant individuals for a broad range of information that can yield insights and understanding to the phenomena under investigation (Bloomberg & Volpe, 2012; Yin, 2015).

The researcher engaged his informal business network for possible interviewees and used secondary research methods through online Google searches to establish a list of businesses matching the population criteria before approaching the required senior managers. Additional background information on potential organisations and candidates was collected to ensure that those who were approached fitted the sample descriptions. The researcher was also able to understand their business context and area of expertise within the IoT environment before the interview. Snowball sampling was then utilised to gain access to additional members of the population, as initial participants were most able to identify further potential respondents that fit the required characteristics (Patton, 2001).

For non-probability sampling techniques, the issue of sample size is ambiguous (Saunders et al., 2009). In addressing this issue, the sample size was not fixed at the outset and collection of qualitative data continued with additional interviews until data saturation was reached – the point when no new insights from further data analysis was found (Bloomberg & Volpe, 2012; Saunders & Lewis, 2012).

The formation of new codes was noted by the researcher from each interview during analysis with Atlas.ti qualitative data analysis software (Bloomberg & Volpe, 2012; Saunders et al., 2009; Wildemuth, 2017). This has been visually plotted below and illustrate that saturation was reached after interview ten. Two additional interviews were performed to confirm that saturation had been reached. Further interviews were

limited by time constraints and the researcher deemed the sample size robust enough in content to answer the three research questions effectively (Merriam & Tisdell, 2016).



**Figure 10: Number of New Codes by Interview**

## 4.5 Unit of Analysis

The organisations identified to fit the specified population criteria in Section 4.3 were utilised as the unit of analysis for this research study. All the organisations are currently positioned across the IoT value chain in aforementioned capacities.

## 4.6 Interview Schedule

The research questions, informed by the academic literature review, were used as a framework from which to develop an interview schedule to guide the discussions – Annexure C (Bloomberg & Volpe, 2012). The interview schedule has the advantage in exploratory studies to both freely move between questions and to probe further where necessary, and to better focus the direction of the interview (Saunders & Lewis, 2012). This was particularly important as the participants varied in their opinions across their different levels of expertise within the IoT environment.

## **4.7 Pre-test**

A pilot study was performed with a senior manager from an organisation that represented the population characteristics of the set criteria in Section 4.3. This assisted the researcher in refining aspects of the method, accompanying procedures, data collection and/or analysis that may have been overlooked before the real data was collected (Yin, 2015). This also helped determine the usefulness of the instrument developed and provided the researcher the opportunity to test his interviewing skills.

The pilot study also allowed an opportunity for the participant to interpret, understand, and answer questions without suggestion or ambiguity (Bloomberg & Volpe, 2012). The areas of technology-related and business-related areas of concerns where specific themes had been identified, were confirmed in the pilot study. This assisted in the alignment and flow of questions asked in subsequent interviews.

## **4.8 Data Collection**

Interest from appropriate managers and organisations who met the outlined criteria for this study was initiated by emails. Face-to-face direct interviews were arranged and conducted within a three-month period between June and September 2018. A mutually agreed upon date, time and venue was coordinated with those that agreed to partake in the study, and these details were confirmed via a confirmation email and a Google calendar notification. The interviews were proposed to be between 45 and 90 minutes in duration. This would afford time for the participant to reconstruct experiences from their own personal perspective (Yin, 2015). This was significant as the study essentially gathered insights from industry specialists and key industry stakeholders that were personally involved with the subject matter.

Background information on the prospective participants and their organisations was collected through secondary research – as explained in Section 4.4 – through online Google searches as well as through LinkedIn profiles, direct company websites, and social media pages. This triangulation of this additional data assisted the researcher with a greater understanding of the businesses and the managers' area of expertise within the IoT landscape. This also assisted with triangulating the validity and reliability of the collected data from appropriately identified individuals and organisations when analysed (Bloomberg & Volpe, 2012).

Three online video interviews were conducted and recorded over Skype or Google Hangout with senior managers that were located outside of Johannesburg, South Africa, where the researcher was based. One interview was conducted with the owner/manager of an organisation based in Cape Town, one interview was with a manager of an organisation based in the United Kingdom, and the other online interview was with an owner/manager of an organisation based in Ireland.

All interviews were conducted in an environment that was conducive to an open and honest dialogue. Face-to-face interviews were conducted either on the respective organisation's property or on Skype or Google Hangout interviews that were conducted with the researcher and manager based at their respective offices. All interviews were conducted in environments that minimised disturbance (Saunders & Lewis, 2012). Data was audio-recorded in its entirety on two devices simultaneously. The audio-data was backed up on the researcher's portable USB hard drive as well as an iCloud platform. Hand-written notes were taken during the interviews to supplement the audio-recordings.

A clear list of themes, noted in the interview schedule, directed the open-ended discussion to the research questions and research objectives and aims (Bloomberg & Volpe, 2012). This allowed for a narrative response from the participants to convey the nature of interactions, consequences of actions taken, and how it related to the study. This narrative naturally organised the data within the context of the participant (Saunders et al., 2009). The researcher explored these identified themes through a purposeful discussion with the participant. The shortest interview conducted was 11min, 14s and the longest interview conducted was 1hr, 28min, 44s. The average duration of the twelve interviews was 57min, 59s.

## **4.9 Data Analysis**

Atlas.ti qualitative data analysis software was used to analyse the collected data (Bloomberg & Volpe, 2012; Saunders et al., 2009; Wildemuth, 2017). The audio-recordings were transcribed verbatim by the researcher and analysed soon after each interview had been recorded. The data analysis process involved taking large volumes of collected raw data and reducing it into meaningful codes and then allocating those codes into groups (Bloomberg & Volpe, 2012; Merriam & Tisdell, 2016; Yin, 2015). Data collection and analysis occurred concurrently and required arrangement of time in-between interviews to allow for a single process to be completed before the next

scheduled interview. This allowed for patterns or themes to emerge that informed adjustments to refine the interview schedule for subsequent interviews (Bloomberg & Volpe, 2012).

Code names were inductively created through the process of open coding as there was no pre-existing coding frame or model available for this integrated study (Bloomberg & Volpe, 2012; Hsieh & Shannon, 2005; Merriam & Tisdell, 2016). This allowed the researcher to be open to the emergence of new themes and to not force the evolving coding scheme into any predefined categories (Bloomberg & Volpe, 2012).

Relevant quotes were assigned to code names. Descriptions were assigned to each code for interpretation and to communicate the essence of the data, given the purpose of this research study (Merriam & Tisdell, 2016). Emphasis was placed on the assertion of themes instead of a simple word count of specific words that frequently appeared. A thorough abstraction of the data assisted in avoiding an impressionistic and superficial view. This allowed for the researcher to become immersed in the data and strengthened the validity of the conclusions drawn (Bloomberg & Volpe, 2012). Creating and adhering to this analytic procedure or coding scheme was viewed as a consistent manner with which to increase the trustworthiness of this research study (Hsieh & Shannon, 2005).

Code names were grouped into code groups. Subsequent code groups were then aggregated into interrelated themes and allocated to a research question based on their relevance. These were placed into sub-categories under each research question so that data suitable for answering each research question could be presented in a structured manner. The literature review guided the structure of the research questions and the themes that emerged, and as such allowed for the study to be linked and transferable to the body of existing knowledge across contexts (Bloomberg & Volpe, 2012; Hsieh & Shannon, 2005).

The coded data and quotations were then examined and interpreted. Subsequent convergent and/or divergent patterns within and across code groups, and between interviews, were identified and noted (Bloomberg & Volpe, 2012; Saunders & Lewis, 2012). Analysis through examination and comparison of these relationships then occurred with the data being synthesised to reconstruct an integrated explanation. This allowed the researcher to advance with broader concepts and implications, formulate conclusions, and extend both the academic literature and provide practical

recommendations (Williams, 2007). These are discussed in the remaining chapters. A full list of codes and code groups have been provided in Annexure D.

#### **4.10 Researcher Bias and Reliability**

The threat of researcher bias to the credibility and reliability of this research study was acknowledged, as data collection and ultimately the analysis rested with the subjective framing, assumptions, and choices of the researcher (Bloomberg & Volpe, 2012; Saunders & Lewis, 2012). To minimise this potential negative impact on the reliability of this research study, the researcher followed the recommendation from Bloomberg and Volpe (2012) with the use of “member-checks”. A factual account and summary of the interview was provided to some participants for feedback and evaluation to avoid biased or inaccurate interpretation by the researcher before the data was captured and analysed (Bloomberg & Volpe, 2012; Saunders et al., 2009). This methodological rigor mitigated the bias that questions the reliability of qualitative studies, and improved the dependability, confirmability, and consistency of interpretations of the data, and justified the use of selected quotations to support the arguments presented in Chapter 5 (Bloomberg & Volpe, 2012; Saunders & Lewis, 2012).

#### **4.11 Limitations**

There are study specific and inherent limitations that apply to all research studies. Research studies that are qualitative by design are not generalisable, as with quantitative studies, due to the restricted sample size, the purposeful sample method, and the context specific data that is collected (Bloomberg & Volpe, 2012). This research study was found to be concentrated on organisations in large urban cities that may limit the findings to be applicable beyond these areas. It is acknowledged that findings in smaller cities and rural areas as well as other geographical locations could possibly be different.

Definitive conclusions cannot be drawn from the findings as interpretations are subjectively judgmental and perspectives from both authors and participants contain an element of bias (Saunders & Lewis, 2012). The limitations on researcher subjectivity have been discussed in Section 4.10.

Interviews are not neutral tools for data collection and are the result of an interaction between the researcher and the participant in the context of a research study

(Bloomberg & Volpe, 2012). Not all people are equally cooperative, nor do they equally articulate and/or perceive situations in the same manner, and some participants may be guarded and less candid with their answers in an interview setting. This participant reactivity was considered as this research study was dependent on the information provided by the participants (Maxwell, 2005). The variation in duration of each interview testify to these observations and was notably present in an interview that was discrepantly shorter in length than all of the eleven other interviews.

However, generalisability is not the goal of qualitative research. Rather, the focus of qualitative research is on transferability (Bloomberg & Volpe, 2012; Saunders et al., 2009). The in-depth descriptive nature of the study allows the reader to assess whether the findings are applicable in other similar contexts or settings (Bloomberg & Volpe, 2012; Schram, 2003; Yin, 2015). The ubiquitous and interconnected nature of the IoT and the sample of organisations across the IoT value chain were involved in a wide range of industries, thus improving the transferability of this research study and its results. The findings are hoped to be useful at a conceptual level, instead of merely drawing mandatory conclusions from the research study's findings (Yin, 2015).

Other limitations included the time constraints for the completion of this research study and the fact that the researcher was not formally trained in the interview process or in the techniques that were applied. This was also a cross-sectional study that served as a "snap-shot" of this phenomenon within this context at a particular point in time (Saunders et al., 2009; Saunders & Lewis, 2012). The study did not account for any longitudinal changes that can occur especially in such a rapidly-changing technological context and environment as that of the IoT. The findings and conclusions derived from this research study were intended to reflect the reality of that particular time, with the realistic assumption that the circumstances explored are complex, and the current situation is dynamic and subject to change (Saunders et al., 2009).

#### **4.12 Validity and Reliability**

In qualitative research, validity and reliability are used as the standards of trustworthiness of the research study (Bloomberg & Volpe, 2012). Secondary data collected through online searches – as suggested in Section 4.4 – were confirmed during the interviews to ensure the criteria for participation were met to increase both the reliability and validity of the data collected.

A high level of validity is possible with qualitative semi-structured interviews if conducted and interpreted carefully so that the findings accurately represent the reality of the situations being described (Bloomberg & Volpe, 2012; Merriam & Tisdell, 2016; Yin, 2015) – the interviews allow for the research study to measure what it intends to measure (Saunders & Lewis, 2012). The themes surrounding this research study were emailed before the interview and reiterated before the start of the interview to facilitate a common understanding between the researcher and the participant. Continuous reference to the themes concentrated the focus of the discussions to the concepts being investigated. “Member-checks” – as mentioned in Section 4.10 – were used to enhance the reliability and validity of the interpretation of the information gathered (Bloomberg & Volpe, 2012).

The heterogeneous sample of IoT businesses assisted in triangulation and validation of the range of opinions gathered, and the use of these multiple sources lead to a fuller and richer picture of the phenomena under investigation. Opposing and/or varied views were noted and purposefully further discussed and included in the results as this limited the appearance of bias in this research study, and challenged expectations and/or other emergent findings. This was found to better represent the reality that life is composed of different perspectives that do not always coalesce (Bloomberg & Volpe, 2012; Yin, 2015).

Reliability refers to the extent to which the data collection techniques or analysis procedures yield comparable observations on different occasions by different researchers (Bloomberg & Volpe, 2012; Merriam & Tisdell, 2016; Saunders & Lewis, 2012). The researcher has provided a detailed rationale and a thorough “audit trail” of the choices and decisions made for data collection and analysis (Bloomberg & Volpe, 2012; Lincoln & Guba, 1985). A full list of code names and groups have also been included to enhance reliability – Annexure D. Inter-rater reliability was also used by asking two colleagues to code a sample of interviews to assess if the researcher’s coding was consistent. This reduced the potential bias of a single researcher collecting and analysing the data. Inferences that were not supported by the data or lacked consistency were reviewed and the differences reconciled for interpretation (Bloomberg & Volpe, 2012).

By addressing these issues of validity and reliability, as well as concerns surrounding bias and limitations, the researcher hoped to establish believability and plausibility of this research study.

## **4.13 Ethical Considerations**

The researcher was concerned with producing an ethical research design, as much as an intellectually coherent and compelling argument (Bloomberg & Volpe, 2012). Researchers are morally bound to conduct research in a manner that minimises potential harm and protects the interests and rights of participants involved (Bloomberg & Volpe, 2012; Merriam & Tisdell, 2016; Saunders & Lewis, 2012). With these considerations in mind, the researcher first obtained ethical clearance from the university's Ethics Committee to ensure that the research was approved – Annexure A.

Informed consent is central to research ethics and ensures that participants retain their autonomy in this voluntary exercise to withdraw at any stage as well as the ability to consider for themselves what risks are worth taking in furthering academic knowledge (Bloomberg & Volpe, 2012). A combined informed consent form and confidentiality agreement was presented for the participant and the researcher to sign before the interviews began. Electronic copies were either electronically signed or signed and scanned and then emailed back to the researcher by those participants who were interviewed via Skype or Google Hangout. Two of the participants gave verbal agreements before their interviews commenced.

Anonymity was ensured as any references to names of the participating participants and organisations in the study were changed to pseudonyms, and where necessary names of the organisations' major business partners, products and/or services were also changed to support this anonymity – for example, [Company X] (Bloomberg & Volpe, 2012). Further precautionary measures were taken to ensure that the storage of interviews, records, and data could only be accessed by the researcher.

## **4.14 Conclusion**

Chapter 4 described the research design and methodology that was intended for use in this research study to attain the objectives and aims established from the outset of this research proposal in Chapter 1, and to assist in providing answers to the research questions in Chapter 3.

The qualitative exploratory study utilised semi-structured interviews from a purposeful sample of a heterogeneous cohort of businesses, currently positioned and involved across the IoT value chain. The phenomenon of innovation resistance behaviours

within the context of the IoT was explored through the data collection and analysis procedures described.

Chapter 5 follows and presents the results from this exploratory qualitative study. These results are then compared with the current academic literature, and interpretations and conclusions are formed in Chapter 6. Finally, recommendations are offered in Chapter 7, with the intention of contributing value to the academic literature as well as for practical knowledge and application.

## **CHAPTER 5: RESULTS**

### **5.1 Introduction**

Chapter 5 presents the key findings from the semi-structured interviews with the twelve senior managers who were participants for this research study. These managers were from a heterogeneous group of organisations across the IoT value chain. These organisations currently either incorporate IoT devices, systems, solutions, products and/or services into their own firms, or advise or provide these elements for businesses across a wide range of industries. The key findings are presented as they relate to the three research questions as posed in Chapter 3.

The results are presented in relation to the research questions that were informed from the academic literature review in Chapter 2. Code groups were aggregated into interrelated themes and allocated to a research question based on their relevance. These were placed into sub-categories under each research question, so each research question could be answered and presented in a structured manner.

The themes that emerged were identified from the qualitative analysis of the interviews. These concepts provided insights on the presence of innovation resistance behaviours within issues and/or challenges in the IoT, the manner in which these issues and/or challenges have been addressed, and finally on the impacts and implications that require consideration with implementation and use. Quotations from the participants have been included to assist with a description of the findings. Some have been edited for brevity. Chapter 5 begins by presenting a description of the participants in this research study, followed by the presentation of the results from the qualitative analysis.

### **5.2 Description of Participants and Context**

All names of organisations involved were changed from their original names to ensure anonymity and confidentiality for the respondents – as was affirmed in the ethical considerations in Section 4.13. The participating senior managers were selected based on the criteria specified in Section 4.3 from organisations across the IoT value chain. This selection of a heterogeneous group of organisations involved in the IoT environment was chosen to create a varied sample and to increase the richness of the data collected.

**Table 1: Description of Participants and Context**

<b>Company Pseudonym</b>	<b>Description</b>	<b>City and Country</b>
1. Secure Pay	Chief Digital Officer (15yr experience) Data security B2B	Johannesburg, South Africa
2. MNO 1	Chief Digital Officer (7yr experience) Connectivity – Mobile Network Operator (MNO) B2B and B2C	Pretoria, South Africa
3. MNO 2	Chief Digital Officer (5yr experience) Connectivity – Mobile Network Operator (MNO) B2B and B2C	London, Europe
4. Digital Solutions 1	Chief Digital Officer (11yr experience) Digital solutions consulting B2B	Johannesburg, South Africa
5. Insure	Chief Digital Officer (20yr experience) Insurance B2B and B2C	Johannesburg, South Africa
6. Digital Tech	Chief Design Engineer (9yr experience) Hardware B2B	Johannesburg, South Africa
7. IoT Connect	Chief Executive Officer (11yr experience) Interoperability – digital solutions and hardware B2B and B2C	Cape Town, South Africa
8. IoT Solutions	Chief Digital Officer (6yr experience) Interoperability – digital solutions and hardware B2B	Pretoria, South Africa
9. Telecoms Solutions	Chief Digital Officer (11yr experience) Connectivity aggregator B2B	Johannesburg, South Africa
10. Digital Solutions 2	Chief Digital Officer (22yr experience) Digital solutions consulting B2B	Johannesburg, South Africa

11. IoT Devices	Chief Executive Officer (9yr experience) Hardware B2B	Ireland, Europe
12. Retail	Chief Operations Officer (6yr experience) Retail B2B and B2C	Johannesburg, South Africa

A total of twelve semi-structured interviews were conducted with these senior managers following a pilot interview. Five of the twelve organisations included in this research study were involved in both B2B and B2C capacities – MNO 1, MNO 2, Insure, IoT Connect, and Retail. The remaining six organisations were involved in a B2B capacity only – Secure Pay, Digital Solutions 1, Digital Tech, IoT Solutions, Telecoms Solutions, Digital Solutions 2, and IoT Devices.

Four organisations were specifically involved with either the design and/or the provision of IoT hardware devices – Digital Tech, IoT Connect, IoT Solutions, and IoT Devices. Two organisations were Mobile Network Operators (MNOs) that provided Internet connectivity services – MNO 1 and MNO 2. One organisation focused on the consolidation and aggregation of devices and vertical solutions onto horizontal platforms – IoT Solutions. One organisation was directly involved in cybersecurity – Secure Pay.

Two of the twelve managers and their respective organisations were based in Europe – MNO 2 and IoT Devices. These international opinions were expected to add to the diversity of perspectives garnered for this research study. Of the remaining ten managers and organisations, Retail and Digital Tech were based and focused within South African borders, IoT Connect had an extensive African footprint, and the remaining seven had both South African and global offices, as well as experience both locally and abroad – Secure Pay, MNO 1, Digital Solutions 1, Insure, IoT Solutions, Telecoms Solutions, and Digital Solutions 2.

As mentioned, the researcher was based in Johannesburg, South Africa. Of the twelve interviews, two were with overseas organisations and were conducted via Skype as discussed in Section 4.8. The South African company based in Cape Town was conducted via Google Hangout as mentioned in Section 4.8. The remaining ten

interviews were conducted face-to-face in Johannesburg or Pretoria depending on the location of the organisation.

The participants from IoT Connect and IoT Devices were owner/managers. The participant from Digital Tech was the organisation's Chief Design Engineer. The participant from Retail was the organisation's Chief Operating Officer. Eight of the twelve participants interviewed were the organisations' Chief Digital Officer – Secure Pay, MNO 1, MNO 2, Digital Solutions 1, Insure, IoT Solutions, Telecoms Solutions, and Digital Solutions 2.

Each face-to-face interview was conducted either on the premises of the organisation or at a central and convenient location for the interviewee. Each participant was emailed a summary of the research problem, aims and objectives beforehand. This gave participants deeper insight about the research study before interviews commenced, and mitigated any concerns participants may have had about the intrusiveness of the research study. The summary and research questions were given with the consent form at the beginning of the interview and kept on the table or shared via email with the consent form. This allowed both parties opportunity to refer to these during the interview and was an attempt to keep the interview content focused.

### **5.3 Results: Research Question 1**

**Have innovation resistance behaviours been identified by organisations within issues and/or challenges of the IoT?**



**Figure 11: Overview of Themes for Research Question 1**

### **5.3.1 Relevance**

a) In every discussion, both South African and European participants expressed that resistance behaviours within issues and/or challenges of the IoT were present and that the concept and constructs were relevant.

Digital Solutions 2: “We certainly do not have a 100% buy-in into this world of disruption and change that we in at the moment. There are still elements of resistance.”

Telecoms Solutions: “It’s a relevant discussion because it’s very prevalent in the engagements that we have. Does it exist? It does.”

IoT Devices: “But not everyone has adopted ... And that’s a very interesting question to why?”

## 5.3.2 Technology-Related Issues and/or Challenges

### 5.3.2.1 Connectivity

a) An understanding of the issues and/or challenges within the IoT environment began with the actual technology. Connectivity issues were acknowledged by all the participants. It was noted that connectivity is mandatory for the fundamental functioning of an IoT solution, product and/or service. Issues that do not allow for a connection to the Internet, negatively impacts the opening of any value proposition. Poor connectivity coverage, small or low bandwidths that cannot accommodate the volumes of collected and shared data, and/or infrastructure issues, had all been encountered by participants and were expressed as areas wherein resistance behaviours had been observed.

Digital Tech: “It’s no good if I have this Wi-Fi enabled air conditioner, but I don’t have a decent Wi-Fi network in my house. How is that going to help?”

Retail: “A lot has to do with bandwidth and the infrastructure.”

b) One of the participants voiced that limited functions of the actual hardware was also an issue with some IoT deployments.

IoT Connect: “It [the IoT device] has a range of only 20metres instead of 50metres.”

c) Multiple Internet connectivity service providers also present a challenge as there are many operators from which to choose. However, each service provider has limited area of network coverage. Therefore, complete coverage is not guaranteed through a single service provider.

Telecoms Solutions: “Regardless rural or urban, you get either connectivity overlaps or connectivity dead spots.”

d) A scenario was also expressed by one of the European participants where cross-over of network frequencies may also have potentially inadvertent but disastrous effects – IoT Devices:

IoT Devices: “Within medical environments that you have, you obviously have certain bandwidths that you can or can’t use, so you don’t end up with any conflicts with any other systems ... Hospitals have got all sorts of devices that

are used for all sorts of reasons and eventualities ... If they're all talking to each other and something goes wrong. Who's responsible?"

#### 5.3.2.2 *Interoperability*

a) Various devices and/or solutions are present in this environment that do not communicate with one another. This lack of standardised and/or common protocols does not allow for integration of the variety of data streams from the growing multitude of connected devices. Isolated vertical solutions compound this present and disparate state of many systems. Therefore, true patterns and interactions cannot be uncovered for the complete value of a fully integrated system to be realised.

IoT Solutions: "Interoperability first is key ... [X] is saying no to the [Y] thing and to the [Z] thing ... The vertical IoT platform is someone has gone and solved a particular problem ... Bundle into this maybe three sensors, a connectivity gateway, a little Azure package, a few pre-packed populated analytics things and maybe a complex machine learning algorithm at the top. It's packaged, and this solves fridge tracking, or this solves agriculture in a box ... that becomes the requirement and you build that vertical IoT stack. There's a lot of guys that have done these things but the problem in industry is you end up buying all these point-to-point solutions but now you can't generate the value of the horizontal value arm."

Digital Tech: "Ten different systems all retrieving little bits and pieces of information from the site ... None of them holistic ... They don't speak to each other ... They can't correlate this information."

Secure Pay: "One of the biggest problems ... is that everything is segregated ... It is trying to get the integration of all of these different sensors ... one monitoring the geyser, one monitoring the temperature, the fridge, one monitoring the ambient temperature, monitoring the foot counter in a store."

b) One of the main reasons found for this lack of interoperability was that companies had dedicated investments for their own R&D that forced the buyer to commit to a vertical solution that was only usable with that original equipment manufacturers' (OEM) device.

Digital Tech: "Most of the dedicated IoT companies are producing their own custom hardware ... The R&D that goes into the hardware is exceptionally high

... Own the platforms and we should also invest in the devices so we tie the customer directly to us.”

Digital Solutions 2: “So it had to be the sensor, the reader, the data lakes etc. All had to be from the same service provider.”

IoT Solutions: “The OEM vendor’s models are very old school ... I’m [Company X] and the only way you’re going to get the Industry 4.0 is you rip up all your other equipment and put in [X] ... [Company Y] and [Company Z], they all have been pushing this same game ... Such a linear way of viewing Industry 4.0.”

c) This OEM business model was illustrated by one of the participants with the use of Apple and their iOS platform as a relatable example – Digital Solutions 1.

Digital Solutions 1: “You are entrenched as with Apple. You get part of that ecosystem and that will make it hard for you to leave the ecosystem because when all the other puzzle pieces sit within the ecosystem, you have this and not that in the ecosystem.”

d) With these identified issues surrounding connectivity and interoperability, action latency was noted to be an issue that delayed real-time requirements in some instances.

IoT Solutions: “Latency is becoming a big issue ... I need something to happen immediately ... I request information back but sometimes it comes up to 48 hours later. So, you spent all this money for an IoT enabled piece of equipment and you are getting reports a day to two days later, and your mining cycle is six to seven hours ... How am I supposed to pick up something or have shift optimisation to fix the problem before the value is lost? All this helps me do is retrospective stuff.”

### 5.3.2.3 *Security and Privacy of Data*

a) The cybersecurity and privacy of collected data was found to be one of the more prominent themes of discussion during the interviews. The incidence and prevalence of cybersecurity threats – attacks, hacks, and breaches – pose a significant risk within this environment.

Digital Solutions 1: “My data has been breached, my data has been hacked. I think that’s going to happen actually more and more ... The headlines are going

to be far worse in the coming future ... Because remember as the drive to more enhanced security moves, so does the ability to break that security ... It's an equal drive ... I would always worry about the security and the data privacy side."

Retail: "We are obsessed with [security] to be honest. Both internally and externally."

Digital Solutions 2: "Everything where we have had progress from a technology perspective comes with an element of risk, and without a doubt, at the moment, the biggest element of risk is cyber. The cyber threats, the data that gets surfaced, the ability to hack a machine, and so on. So, as we build up our digital capabilities in these business solutions, we've got to back it up with proper cyber capabilities. It's the one and the other. It's the paint and the paintbrush."

Insure: "They're [security breaches] just becoming more and more regular ... I think that's the scariest part that someone may have a data breach ... No-one is better because not that they negligent, it's just this stuff happens. This is the world we live in."

MNO 2: "The risk of cyber attacks is high ... Companies need to be prepared ... Nothing is unhackable ... [The] main concern or negative views or writing about the IoT is about the security and the data privacy."

b) Unauthorised access to sensitive information, manipulation, and misuse of that data, and damage to the credibility and reputation of the organisation involved, were all expressed as notable ramifications from these cybersecurity attacks.

IoT Solutions: "There is too much risk for us to have a feed into our smelter. If someone hacks that feed ... they can blow up our smelter."

Secure Pay: "Data is very sensitive to a customer no matter what data it is ... You don't want a person to understand where all of their fridges for [Company X] are for a competitor of [Company X]. If somebody hacks the system to see where your footprint is, it's confidential and sensitive data."

Telecoms Solutions: "The individual consumer is concerned about what information is being shared from my personal life out into the world ... [The] concern is not what is happening with my information in this transaction, the concern is how easy is it for an unscrupulous or unethical hacker to get into

your systems to take my information and devoid me of some of the things that I personally own and have.”

Retail: “Reputation wise, especially if you use data as a differentiator then all of a sudden it’s not safe. People will pull out. Its extremely risky ... People won’t forget.”

c) This was found to bring into question the various security mechanisms, protective measures, and associated guarantees that are given to ensure risks to the security and protection of collected data have been considered.

Telecoms Solutions: “How are you, as an entity, mitigating somebody else from the outside coming in and getting access to my bank accounts, stealing my money and getting access into my business environment, and defrauding me and holding me ransom with malware and, and, and ... Top of mind is security. How do you mitigate the security aspects ... and that you've taken every single precaution available?”

d) It was found that security had been focused at the transfer stage and at the storage site – either in servers or in the Cloud. However, the actual devices were found to be the areas most vulnerable to cybersecurity attacks, as they had not been built with necessary cybersecurity measures in mind.

IoT Solutions: “Last year a casino was hacked through the temperature sensor in the fish tank because that was connected to the main enterprise system ... They hacked the sensor that had no protection whatsoever and they got into the main finance system of the casino.”

Secure Pay: “The biggest, biggest concern and loopholes in security sit at the device site ... This little sensor that’s sitting there, that gateway that’s sitting on your site, that is where a lot of the breaches happen ... Businesses and people that are building these solutions need to make sure that that device is as secure as possible.”

e) Finally, the question of liability was raised when and/or if a cybersecurity breach occurs and on whom the responsibility for the failed protection resides.

Secure Pay: “One of the biggest concerns that we always find in industry is where does the liability sit? So, at the end of the day, if something had to happen. Who takes the blame?”

### 5.3.3 Business-Related Issues and/or Challenges

#### 5.3.3.1 *Apprehension and General Uncertainty*

a) There was expressed uncertainty about how organisations could leverage the IoT and the data it provides to create and capture value. It was observed that uncertainty and apprehension was present for both internal cost saving strategies and external revenue generation mechanisms. There was a notable push for adoption due to the presence of the available technology despite a lack of understanding and/or ability to utilise it appropriately.

IoT Connect: “Getting the data is one thing ... [Company X] didn't know how to or what to do with this data ... Real-time data coming in ... Suddenly, [Company X] is managing risks on an hour-by-hour basis or minute-by-minute basis.”

Digital Solutions 2: “Many executives at the moment don't really understand how to unlock value from the technology ... How do I uplift customer experience? How do I reduce operating costs? And how do I drive additional revenues inside my business? ... Most executives, CEOs, don't know what the right or the best decision is moving forward with regard to these digital technologies.”

Retail: “Industry is so ready. The technology is there. The ability to share is there but the differentiator is really about analytics. Can you use analytics? Can you make sense out of it? ... People actually aren't good at using data right now to make more meaningful information out of it.”

IoT Solutions: “People are battling with how to unlock the value from it. Even people that are doing IoT, they're doing it and they're saying, OK well now where is the value?”

Secure Pay: “One of the biggest things is that I don't think the guys fully understand yet ... How do you show the value of that IoT solution?”

b) The IoT was also recognised as being in the early development stages of a new technological environment that involves a steep learning curve. This possibly provides part of a broader explanation to some of the present uncertainties with the technology.

Digital Solutions 1: “We are on a learning curve ... People are concerned that it's a very young technology.”

MNO 1: “Steep learning curve that everyone is on at the moment.”

c) Many organisations identified that there was a definite pressure and push from industry and the competitive environment to adopt new technologies regardless of the uncertainties currently involved.

Secure Pay: “I think the IoT and any part of technology, the large majority of people say that if you don't get on to the bandwagon, you'll get left behind ... That's the way that the market was going and it was important for the organisation to follow suit ... All the competitors in our space went into the IoT.”

Digital Solutions 1: “They're forced to by the industry ... Business actually forces them into the technology ... It's not will this technology work, its more on how can I use this technology ... because all the other competitors are doing it ... They simply can't afford not to do it ... They can't be seen to be lagging ... Competition is quite fierce.”

d) Practically, it was noted that decisions involving technology adoption by organisations places managers at personal risk, and this was observed to add to the reluctance and uncertainty surrounding the technology.

IoT Connect: “Nobody's ever been fired for not being first but people have been fired for being first and it not working ... It puts you at risk in terms of your personal position in the company ... You don't want to add more risk in terms of your individual role.”

MNO 2: “CEOs or middle level management, they're afraid of their positions or of the impact of their decision ... reluctant to take these big decisions.”

Digital Solutions 2: “Not all organisations are comfortable making a big decision ... Most executives can't draw on past experience, education, or industry paradigms to make the right decisions as to what's the next best step should be.”

e) Finally, one of the participants noted that the IoT entails change for the organisation and that there is apprehension to alter the course from a previously successful position and formula – Digital Solutions 2:

Digital Solutions 2: “There is a competency curse that organisations face ... [It's] very difficult to stop using the recipe with which they've been successful.”

### 5.3.3.2 *Internal Cost Saving*

a) Practical concerns about the capital required for technology-driven efficiency and improved productivity were voiced as an important practical consideration. Significant cost savings were expected from these sometimes extremely costly investments.

Secure Pay: “Capital ... Technology comes out but it's very expensive ... The only concern is, for adopters of the solutions, is the cost factor ... So, when you look at the failure points, it's number one.”

IoT Devices:” So IoT isn't the hurdle. It's the cost of developing the product that's the hurdle. So, developing this product, we put figures together which was about 240k in Euros.”

One of the participants was able to illustrate the potential costs involved in vivid terms and figures – Digital Tech. It was found that the high costs involved from R&D and vertical solutions accounted for a large proportion of the costs involved. This was seen to be a significant barrier to adoption.

Digital Tech: “The problem of anything new is that it comes with cost ... The cost of this equipment is still a grey area ... Purpose built IoT boxes are extremely expensive ... \$10 000 to \$20 000 per box ... If you look at a network that has 100 000 sites and \$10 000 per site just for the controller and you haven't even touched the deployment of the sensors or the software cost or the spend of licensing etc. ... [You] cannot justify the cost of a deploying that on every single site because it is just too high ... We can build the best system in the world but if the price is too high, we won't even get it to site.”

b) These high capital investments were found to require the appropriate context and relevance to justify and motivate for their implementation and use – the cost-benefit analysis needed to make logical sense.

Digital Tech: “In Pick 'n Pay, will you spend a few million dollars for a scanner to tell you if someone has taken a can of bake beans under their shirt? Probably not.”

Secure Pay: “Hypothetically, if you're only losing R30 000 a month but your solution that you're going to implement is R60 000 a month, that's double the cost of what you're losing ... At the end of the day it's a top-line and bottom-line.”

c) Organisations are also faced with the difficulties of legacy equipment, hidden costs such as with required cybersecurity measures, and the risk that the devices installed may soon be obsolete due to the rapidly changing nature and evolution of technology.

IoT Solutions: “[IoT] requires large investments ... The fact that you need to rip out all the equipment to put in new digitised equipment ... So if you are building a new factory, it's easy to digitise the factory. But if your factory is ten years old, I guarantee you going to need to retrofit into that equipment.”

Secure Pay: “In your own environment, [cybersecurity] pushes up your costs as a business ... Ongoing maintenance ... A Chief Information Security Officer ... Processes ... Disaster recovery plans, business continuity plans and all of that ... [So] depending on how you structure your solution for an end-point client, as a business, now if I'm selling to an end-point client, I would then need to understand where are the challenges and the costs sitting.”

MNO 2: “It's a risk to invest in a technology that very soon will be obsolete ... So I think there's this uncertainty about what is the best approach.”

d) Finally, one of the participants noted that economic and political concerns in the macro-economic environment also played a role in the investment decisions of larger organisations – IoT Solutions. This illustrated the need to consider other factors that could potentially hinder the investment and the adoption of new technologies.

IoT Solutions: “We are not investing in any new equipment. There is no FDI entering the country.”

### 5.3.3.3 *External Revenue Generation*

a) The IoT presents a mechanism through which organisations can engage and interact with individuals. However, this was notably expressed as challenging for organisations in terms of revenue generation. The participants were also noted to be consumers of IoT products and/or services in their personal capacities, and were able to give opinions from both a business and consumer perspective. Of the five organisations that were directly involved in B2C IoT products and/or services, two of the organisations – one South African and one European organisation – had experienced recent failures.

IoT Connect: “Three years ago we started building custom IoT solutions ... Lots of failures and learnings out of that ... Consumer IoT is a completely different ballgame ... We not going to carry on past this year.”

MNO 2: “Last year or the last two years, there was also the [Company X] Smarthome and it was a pilot project that was deployed in six [Company X] retail stores. But the beginning of the year [Company X] stopped those business units ... Not as good as the KPIs or as the expectations of the business.”

These failures were examples of the difficulties that all the participants expressed with regard to revenue generation through consumer-driven IoT products and/or services.

IoT Solutions: “Consumer IoT ... it’s a different thing.”

Secure Pay: “[Consumer IoT] There’s a multitude of complexity.”

b) One of the participants that had experienced failure in the South African consumer IoT market expressed that general difficulties with consumer markets accounted for some of the challenges to successful introduction – IoT Connect. These included marketing and advertising, partners, as well as necessary distribution channels.

IoT Connect: “There are restrictions around reaching a market ... To take any consumer product to market, you need exceptional marketing budget or a very strong partner ... Consumers are all about how you access the market ... To get there, to activate, you need distribution networks, you need fulfilment.”

c) A notable barrier voiced was that of the high costs and low affordability of some products and/or services that hindered consumer market penetration.

MNO 1: “So if I go to you and I and we use the buzzword ... Convert your home to a smart home ... There's a massive layout for you.”

Digital Solutions 2: “[Consumer IoT] it's mostly to those that have the economic means to do it ... We need to find out where is that economic lever that is going to drive people to adopt it or to be forced to adopt it ... That economic imperative will drive the adoption of consumer IoT.”

Secure Pay: “The problem is the cost factor at the end of the day and bridging that gap ... Eventually the adoption rate will increase ... Eventually it will get to that stage of adoption and mainstream ... The full value of IoT that will start

materialising in the next few years of more and more people adopting it ... So, where it's at a good price, it solves problems etc. ... Where people can afford it and it's solving their problem, then they start adopting it quicker.”

d) The participants were of the opinion that the consumer IoT environment was presently composed of novelty and entertainment products and/or services. This was viewed to supersede the practical value and socio-economic applicability that the technology can provide.

Digital Tech: “In the consumer [IoT] segment, it's a novelty. I don't think it has a lot of practical use at the moment ... Showing their friends that can turn the lights on or I can Google pin some music and then, Oh look at that.”

IoT Solutions: “I'm wearing a Fitbit. It's just sensing my run and presenting it in a format later, and then connecting it to a social network ... Own the home stuff on the DV box to control not just the geyser but the gate control, and the pool motor, and house temperature and stuff. I'm not yet convinced of that market. If I was going to bet the farm on the market, it wouldn't be that one.”

Insure: “The clever fridge that could order in and the fridge is talking to your oven ... That kind of stuff ... I mean there's just nothing practically I guess really useful in that space that kind of became mainstream ... It just doesn't feel like there's been something that's come along and been a game changer.”

MNO 1: “When it's a consumer, it's like a gimmick thing ... And what is the immediate benefit apart from like a party on Saturday when your friends are over? ... Apart from all the party tricks, there's not a lot of benefit for me now as a consumer ... There's no value in it for me at this point in time ... Like a smart watch ... That's the fancy and sexy stuff ... That's not the real IoT. I'm not changing a process. I'm not really doing something smart for you.”

Digital Solutions 2: “[The] world of consumer IoT, in other words wearables, insidables, shockables etc. I think that's an untouched market ... Wearing or having a wearable is just like a cool thing. There's very little reason for it. Even if you wear it a lot there is no benefit. At the moment, it's mostly for my information. I want to see my heart rate and how many steps I took etc.”

IoT Devices: "I reckon probably a lot of people don't know that they are using an IoT device. You know if you are using a Fitbit or an Apple watch or whatever. There is a novelty to it that surpasses the fact that it's an IoT device."

e) The existence and prevalence of consumer IoT products and/or services in this novel format was partially explained by the lack of trust in technology beyond these entertainment purposes. The following opinions illustrated that distrust surrounds some enhanced technological capabilities. Digital intrusiveness, loss of privacy, and a distortion of traditional norms were found in these explanations for the possible lack of current and greater acceptance of some enabled technological abilities.

Digital Tech: "I don't think anybody's got to the point where they arrive home ... facial recognition ... unlock my door. I don't think they have that level of trust in these devices yet ... I don't think that comfort level is there yet. Would you let an IoT device run a bath for a child? Probably not at this point."

IoT Devices: "But yes I do view some things as just because you can have it doesn't mean you should have it ... There is no need for my fridge to talk to my toaster or my kettle. I'm still human enough to know when I've run out of milk. ... Me personally, I think that in terms of resistance from a personal perspective, myself and [my wife], we're dead set against having something like Alexa in the house or whatever Google devices in the house. To me that's just like having a stranger in your house that you can't see and it's just weird ... A lot of smart TVs come with an onboard camera. To me that's just that's unnecessary. You know you hear all the reports that those TVs are hacked, and you know, I don't need it. So, it's certainly something that I'm not going to specifically go shop for. I probably would avoid purchasing something that has that's sort of built-in intelligence. I don't believe it doesn't need to have that."

Insure: "The voice enabled stuff ... On my scale of useful versus creepy, it's still living in the creepy space ... I've got one of these things at home, super useful to have a Google device sitting there ... Then you keep reading articles about the fact that it's listening all the time and we even actually forget it's in the lounge and the next thing, something wakes it up and it answers the wrong question. You kind of go, \*@£%! This thing is sitting there, listening to what you watch on TV, listening to our family discussion. It is creepy ... Google's live earth view with these super high definition cameras ... Low orbital and every four minutes ... Low kind of flying satellites ... Recording live feature ... On the

iPhone you go to Google maps it's not a static [picture] taken six months ago, it's a live image ... Privacy is not the same, it will never be the same.”

MNO 1: “The kids play with it. They will ask that thing lots and lots of questions but what is the value in that? You know, so my value at home is I want them still to read books and they read books. So how do I get that little piece right? If they're going to keep asking Alexa all these questions, then there's no need for books.”

f) Finally, two of the participants noted that the lack of a sustainable market or developed ecosystem was a contributing factor to this current state in the consumer IoT environment – Digital Tech and Digital Solutions 2:

Digital Tech: “You need that scale to tip to the point that there is a sustainable market for [IoT] and then there will be an explosion ... [You] need a critical mass to the typical supply and demand.”

Digital Solutions 2: “We haven't created those ecosystems that unlocks that economic imperative ... We haven't really unlocked the economic equation.”

#### **5.3.4 Results Summary: Research Question 1**

Technological-related issues and/or challenges are central to the fundamental functioning of an IoT environment. Connectivity was recognised to be paramount to the IoT as Internet connectivity is the pre-requirement for a thing to become a connected thing. Connectivity problems were focused about infrastructure, actual hardware device issues as well as small or low bandwidths. Incomplete network coverage despite the multitude of connectivity providers was also given as a current issue experienced by the participants. One of the participants from Europe expressed the dangers involved where cross-over frequencies could have unintended but disastrous consequences, for example, in medical situations where connected devices are deployed – IoT Devices.

Interoperability issues within the environment did not allow for the complete value of a completely interconnected and integrated system to be realised. Problems included the lack of standardisation for device protocols and the presence of various OEM vertical solutions. One participant was able to provide the example of Apple devices and the iOS platform to illustrate these issues in a relatable manner – Digital Solutions 1. This disconnected presence was found to be in stark contrast to a proposed interconnected environment

Both connectivity and interoperability issues, either in isolation or in combination, have added to latency issues that are not suitable for required real-time decisions and/or actions. Connectivity is a necessary requirement whereas interoperability would be of additional value. However, the lack of interoperability was found not to prevent acceptance.

The security and protection of collected data was consistently emphasised by all of the participants. Cybersecurity threats and the unauthorised access to sensitive professional and/or private information was of primary concern. Tarnished reputations and credibility for those organisations involved were expressed ramifications. Multiple points of vulnerability were highlighted at the transfer stage and at storage sites either on servers on in the Cloud. However, the most concerning location was found to be at the actual device site where in-built cybersecurity measures were commonly lacking. The participants raised the question of liability and responsibility in these instances in which protection and privacy of collected data was compromised.

There was much uncertainty surrounding the understanding and ability to utilise the IoT appropriately. The push by industry and the competitive environment to engage with implementation of available technology – despite these reservations and the learning curve involved – was seen as possibly driving use without an adequate comprehension of how to best leverage its presence and applicability. Personal employment risk with regard to decisions involving new technology adoption and poor ROI as well as competency courses of established organisations were also expressed as contributors to apprehension experienced by the organisations under these circumstances.

Strategic cost savings are possible through this available technology. However, the high capital investment required for some solutions are seen to outweigh the potential benefits. R&D and vertical OEM solutions accounted for some of the high CAPEX costs involved. The need to convert legacy equipment, and hidden and associated costs, add to these expenses. The justification in the cost-benefit analysis was context specific, and also required consideration of the continued existence and viability of certain technologies into the near future. One participant expressed that other factors such as macro-economic conditions may also play a role in poor engagement and adoption of technology for certain organisations – IoT Solutions.

Finally, the consumer IoT market was found to present a complicated mix of issues from which to generate revenues. Notably, unsuccessful B2C IoT projects had been experienced by managers of one South African and one European organisation – IoT

Connect and MNO 2. The need for distribution channels, partners, marketing and advertising, were expressed as general difficulties with the introduction of any product and/or service to the consumer market. However, the main barrier for consumer IoT products and/or services was found to be centred around cost. At present it was observed by participants that there was limited affordability for these products and/or services that restricted greater penetration.

Consumer IoT was seen to be driven by novelty and entertainment purposes instead of the practical applicability and socio-economic applications that are possible with the IoT. The lack of use beyond various entertainment purposes was seen to convey the lack of trust in enhanced and enabled technology. Examples were given by the participants to illustrate how digital intrusiveness, decreased levels of privacy, and changes to some traditions and norms had been impacted. Resistance behaviours to technology were clearly expressed by the participants with these examples. Finally, the lack of a sustainable market and/or ecosystems were also noted to play a role in the lower than predicted success for organisations within the IoT consumer market.

## **5.4 Results: Research Question 2**

**How have innovation resistance behaviours within issues and/or challenges of the IoT been addressed by organisations in creating competitive advantages and improvements in company performance?**



**Figure 12: Overview of Themes for Research Question 2**

## **5.4.1 Addressing Technology-Related Issues and/or Challenges**

### *5.4.1.1 Addressing Issues and/or Challenges: Connectivity*

a) Connectivity issues were identified as fundamental to the basic functioning of the IoT. Without connectivity, the initial value proposition fails. The results showed that identified reliability and consistency issues were being addressed through a combination of technological advances and by organisations capitalising on abilities to solve these issues. For example, MNOs provide connectivity products and/or services and have commoditised the requirement for connectivity.

Digital Tech: “Mobile [Network] Operators are actually one of the biggest enablers of IoT tech, as without them there is no backbone on which to deploy services.”

b) Other organisations have been able to solve for the issue of disrupted and/or poor network coverage in some geographic areas. These organisations – such as Telecoms Solutions – act as horizontal aggregators of various connectivity service providers to ensure greater network coverage. Some connectivity providers were noted to not have the same network coverage as others. Therefore, these aggregators have the ability to

consolidate the various networks in an area to provide reliable and consistent connectivity for the end-user.

Telecoms Solutions: “Our core value proposition sits at the connectivity layer. We are a connectivity provider for multiple verticals and multiple solutions. Which means that all of our key solutions sit in the SIM connectivity ... Our SIM card essentially acts as multiple SIM cards for a single device. So, our real value sits in multi-network, any continent or country deployments ... The technology that we provide is autonomous as it is actively scanning for the best network and will always attach to what's available to transact.”

c) The issues with connectivity infrastructure varied and were found to be situation dependent. One of the participants expressed how advances in Wi-Fi technology have allowed for some geographic areas to bypass previous landline requirements for connectivity – MNO 1. One of the European participants was able to express a contrasting view with the lack of connectivity issues experienced in his environment – IoT Devices. These developments have improved the environment for solutions, products and/or services to be proposed.

MNO 1: “In some of the African countries that we offer or operate in, there are no fixed lines ... and so what happened there was they immediately went from no communication to Wi-Fi communication.”

IoT Devices: “I can leave my house listening to streaming audio and I can arrive at college, which is just 12 kilometres into the city, and not drop a beat. And I just run it all off cellular. You obviously get different kinds of packages but we're unlimited data and you could pick up Wi-Fi all over the city. It's on buses, on trains. It's being rolled out massively ... There is a European Union mandate with regards to mobile roaming, and believe it or not, I think access to the Internet is now regarded as a human right or something ridiculous.”

d) The amount of data transferred has also been minimised to small data bundles or packets of data that allow for improved ease of data collection and transfer, as well as speed of delivery. This development has also improved the environment for IoT solutions, even in connectivity scenarios reliant on lower bandwidth connections. This has enabled organisations' to tailor solutions to what is available – in terms of connectivity – and still provide a product and/or service that maximises the value under previously difficult instances. The issue of action latency has also been partially assisted by these developments.

Digital Tech: “The IoT now consists of tiny packets. Hundreds and thousands of them from a myriad of different places all the time.”

Telecoms Solutions: “Because the nature of IoT and end-to-end transactions ... it’s really low data packages that are coming out ... Packets of information ... Really low volumes of data.”

IoT Devices: “Packets and small bundles ... I mean its highly compressible.”

IoT Solutions: “Two hundred tonne coal dump trucks push five terabytes of data a day ... And now you want to put five trucks in Rustenburg on a 2G network and say IoT what? ... So even on that machine, we saying ... from an IoT perspective ... show me when there is a vibration or something when someone walks in front of you ... Show me when you need to be rescheduled to a different tip ... Pinging a message once every three hours can tell me the temperature or if it goes over certain thresholds ... [This] works for distributed things.”

#### 5.4.1.2 *Addressing Issues and/or Challenges: Interoperability*

a) Similar to the aggregation of multiple connectivity providers, horizontal solutions have been developed that can consolidate various vertical OEM devices and/or systems. These organisations – such as IoT Solutions – have identified the issue and need for the aggregation of multiple disparate vertical solutions, and have been able to consolidate them onto a single horizontal platform. These horizontal aggregators provide platforms through which the full value of the IoT can be realised.

IoT Solutions: “With the horizontal IoT platform, I’m not trying to be a banking platform or an agricultural platform or a mining platform ... I’m a multisided platform that allows any device to plug-in and any enterprise analytics application to live on top of that and link these two together ... Whatever makes sense to link together, we can link together.”

Digital Solutions 2: “I think that’s where the magic and where we started seeing a rapid growth and appetite for adoption in IoT and it was specifically when you didn’t have to own the entire ecosystem of one tech in order to get the solution.”

Secure Pay: “If you had one individual or one entity that could supply one platform and integrate all of those temperature sensors, electricity sensors,

water flow sensors, all of that in, then it's better from a proposal to an endpoint client.”

b) The development, ability and availability of these horizontal solutions no longer restricts solutions to OEM business models. Advancements with the actual devices have also complemented the development of these horizontal platforms. The dependence on OEM devices for that organisation’s specific solution has diminished as data collection can now occur from simpler and cheaper agnostic devices. These agnostic IoT devices merely act as a conduit for data collection and transfer. Devices can now be retrofitted into legacy equipment and therefore solutions can be developed for established organisations attempting to digitise their entrenched operations. It was observed that these developments in both connectivity and interoperability have improved the environment for solutions, products and/or services and lowered some of these barriers to entry and participation.

Digital Solutions 1: “It's purely input and it is interchangeable. What product? It doesn't matter. What sensor? It doesn't matter. As long as you get the data, where the data comes from is irrelevant.”

Digital Solutions 2: “We're doing the right job when we are not aware of which device we are using. It's about can you surface the data required from the various different sources in a way that allows us to interrogate, manipulate and react to the data. That's what matters. That's is to me the goal of IoT. I will be indifferent as to which sensor. I think sensors will be sensors and there will be no differentiation.”

IoT Solutions: “So I can go into a 20year old [Company X] ... Retrofit into old equipment ... Digitise it and pull all that information up ... I can make it available into an analytic system, a truck scheduling system, a conveyer preventative predictive maintenance system ... And it happens with all the equipment that was already there.”

c) Finally, the issue of action latency has been further assisted by other technological advances on the edge – on the actual device. The increased processing and autonomous decision-making capabilities at the edge have decreased reliance on high-speed connectivity and large bandwidths. Decisions and actions can be achieved in real-time with these developments in device capabilities.

Digital Solutions 1: “The most effective way is going to be intelligence on the edge. Where they do the computation actually on the IoT device ... Put on the firmware and the analytics tools ... They don't need to send that massive amount of data to the Cloud to have it analysed and then send it back to the IoT device. The decisions are being made immediately.”

Digital Solutions 2: “Previously you would have to push everything up ... Then all of its configuration and then you'd have to come back down again ... Now you can put some basic instructions on the edge. So, when there's an emergency, typically you get an explosion of data and that would typically slow the devices down because they push all the data up into the data lakes and into the Cloud and back down again ... The edge devices now can do some processing on the edge without that latency.”

IoT Solutions: “Because the connectivity was often intermittent on a 2G edge network on a mine, I need to figure out a way to say that if the network drops, store this information and then when it comes back, then send it all again and store it in a way that you did not lose any data. This was never a consideration for a Western company with infinite connectivity. So, they were saying, just put sensors that send information to the Cloud. Where we said, how do we manage more at the edge. Then they realised ... sending it into the Cloud was wrong. Think about how expensive connectivity is and now they just want to pump all that to the Cloud. We are managing it all and running algorithms on the edge ... beautiful case of reverse innovation.”

#### 5.4.1.3 *Addressing Issues and/or Challenges: Security and Privacy of Data*

a) Security and privacy of data were identified as prioritised concerns in this environment. However, the advances in cybersecurity threats to infiltrate a system has also resulted in improvements of counter measures. One of the participants was able to provide an analogy to illustrate this scenario in visual terms – Digital Solutions 2:

Digital Solutions 2: “It goes back to the most primitive weapons or tools. As a weapon or tool gets better, more efficient and sharper, you need a better shield and ways and means to protect ... I was watching a documentary around as Formula One cars have become quicker, the number of deaths has declined because of safety increasing. So, they were able to go quicker because they got safer ... And so, every time there was an event or an incident in Formula

One, there was a big investigation to figure out what caused that. So that brought about a change in materials and in chassis', in regulations, and what tracks would look like etc.

So every time there is a hack, I think you up the quality of the sector ... One organisation in an industry or in a sector that gets hacked, what it does, it forces everyone else to tighten their game. And perhaps within adjacent industries everyone will take the security thing a lot more serious. So, it's almost like an industry that whose efficiencies will be written in blood every time there's a hack where the level of efficiency or the quality increases ... Understanding what benchmark you need to be at from a safety perspective and every time there is a hack ... The benchmark raises and raises."

b) The participants recognised how the increased incidence, prevalence, and gravity of the ramifications, have resulted in formal regulatory requirements such as the South African POPI Act and the European GDPR. These regulatory developments were observed to also legitimise the presence of this environment.

Digital Solutions 2: "The regulators and civil society groups have been driving the data agenda ... We are reliant on the regulators. And I think South Africa as an economy is probably even more reliant on foreign regulators in terms of trends and direction ... But the watchdogs are I think that the ones that are looking after it at the moment. That could be regulators or civil groups."

Secure Pay: "With POPI Act coming into play and all of that, you have to segregate that data and you have to secure that data ... Industry standards of securing data and eventually there will be laws put in place. There will be standards put in place on what companies need to do and operate the network in accordance with IoT."

Insure: "This whole GDPR introduction, General Data Protection stuff from Europe, that's become mandatory ... There's so much sensitivity from a regulatory perspective ... There's a lot of regulation driving the fact that these things need to be in place."

IoT Devices: "The European Union's gone and implemented what they call GDPR ... Data protection and it's super stringent and they slap you with heavy fines if you don't play by the rules."

c) Similar to the issues with connectivity and interoperability, cybersecurity problems have allowed for the development of organisations to provide solutions, products and/or services for these issues. Cybersecurity providers have developed a myriad of hybrid security solutions and measures for the vulnerable points where attacks, breaches and hacks can occur. These include on-site server protection, Amazon Web Services (AWS) and Microsoft Azure Cloud security options, and various coded encryption algorithms for newer IoT devices. Multiple options have become available to ensure that data protection at the device, in transfer, and at storage can be provided. These developments have also improved the foundation or environment from which solutions, products and/or services, can be introduced.

Secure Pay: “Collaboration comes with using partners like Azure and AWS, that’s got multiple certifications and security on data bases and where you’re with the powerhouse at the end of the day. So, they’ve deployed all of the security and you can use their systems in their secure manner, and having that ability, having a sense of comfort at the end of the day ... Azure employs billions of Rands to actually make sure that your data is secure.”

IoT Solutions: “These simple sensors operating at the edge ... We never let information go straight from the sensor to the Cloud. We have a gateway in the middle. The data goes from the sensor to the gateway. The gateway has got its own security protocols ... and has a secure message queue. Then it sends information to our Cloud environment.”

Insure: “Hybrid ... Day-to-day transactions of running stuff are in AWS. But store the personally identifiable information of the customer data in their own [server] ... This split model ... I think that’s definitely not a full proof thing, but it mitigates the risk.”

d) Finally, the issue of liability and responsibility for these breaches and hacks was discussed. It was observed that the blame for a compromised system required an understanding of where and why the infiltration had occurred. Various and extensive security systems were available and there was an onus on the organisations and the security solution providers to ensure that their protocols and protection measures were current within this continuously changing environment. However, there was also a recognised push to extend the responsibility and liability to the individual end-user as all participants within an interconnected environment needed to ensure that their point of entry into the system was secure.

Secure Pay: "If I'm responsible from a device to a platform, that's my responsibilities and liabilities. But if something happens after the platform, it's that person. That entity can't be held responsible ... Not one party will ever stand-alone. We've got to share that liability across, with what part of the network are you playing at."

Retail: "Macy's and Bloomingdale's got hacked yesterday or the day before. And it was a syndicate that just skims or uses password combinations and sometimes like that ... They obviously hacked credit card and personal data. And the question is, it's a two-way street because if people put in weak passwords and not unique stuff, those kinds of people could easily make those up with a tool. So definitely, it's a two-way thing because business is going to be able to do so much and sometimes you as weak as your most negligent person regardless of all the IT that you have."

Insure: "We're trying to move the ownership of the data to the user ... I think people owning their own data and the sensitivities around it, I think will actually increase."

## **5.4.2 Addressing Business-Related Issues and/or Challenges**

### *5.4.2.1 Addressing Issues and/or Challenges: Apprehension and General Uncertainty*

a) The participants identified that apprehension towards the IoT was in part due to the primary emphasis on the technology term and technical aspects rather than the technology's enabling capabilities and abilities that could be leveraged to solve problems.

Digital Solutions 2: "In this world of digital, we're not selling technology. I think it's an important thing to understand. We are selling the business solution ... Every time an organisation relegates this conversation to a technology conversation, I worry for them ... I'm certainly not fixated on the device ... IoT is one of the digital platforms that is giving the momentum and acceleration to the power of data that we experience at the moment. It generates data ... its certainly one of the enablers ... of democratisation of data ... The conversations need to elevate ... The most transformational impacts that I've experienced with

organisations is when we're not talking about the technology but focusing on the business solution.”

Telecoms Solutions: “IoT is about the Internet of Things, things being devices ... The real value is not in the thing itself. The real value is in the data that that thing actually delivers ... AI and data science and analytics need that information on that device in order to make decisions. So only once you have got this as the starting point can the rest actually do anything.”

Secure Pay: “A large part of the market was always concentrated on the sensor, at the site level ... IoT is not about that. IoT is about data at the end of the day. Getting all of these little devices spewing up the data, up to a centralised repository, and from there having an algorithm that is running to identify what does that customer wants to see ... what does the customer need ... in order to make business decisions.”

b) The participants expressed that it was incorrect to approach the environment in a manner that placed technology and solutions in front of the problem. Similar to the issues with connectivity, interoperability, and security and privacy of data, the identification of issues and then solving for those issues through available technology was seen as a more appropriate approach. The results revealed that this was a common opinion amongst the participants.

Digital Solutions 2: “The conversation I have with them is, tell me what your biggest business problem at the moment is that you need solved. Not here's a digital solution and this is where we can implement it. What is the business problem that you need to solve for? The business problem doesn't start with a technology challenge. It doesn't start with my technology needs to be replaced ... Business problems aren't typically a technology thing. We don't engage with a client that says which spec of IoT device or edge device should I use, and what hardware should we roll out and which Cloud service etc. We eventually get there ... [Need] to get an organisation to shift to I'm solving business problem. I'm just solving it with different means and thinking.”

Secure Pay: “Go and sit with a customer, understand his problem that's happening at site. So you know what needs to be resolved ... A large part of the guys that built solutions already, and they trying to find the problem. The problem in the industry is put this solution in. They should actually look at the customer first. What does the customer need at the end of the day? ... With

IoT, you got to understand the person's problem first before you can actually go and implement or go bouquet a solution to implement to fix his problem ... So, at the end of the day it is understanding the customers.”

MNO 2: “It needs to be much more simple and needs to speak directly to the problem it solves. It's how you can solve the problem and what's problem and what benefit you can solve ... Not about the technology ... It's also it's a matter of how they position IoT ... they speak about technology or a smart home. It's not about this.”

#### 5.4.2.2 *Addressing Issues and/or Challenges: Internal Cost Saving*

a) CAPEX investments have been reduced with assistance from advances in technology, the commoditisation of functional elements such as connectivity and devices, and with the aggregation of solutions and services. Therefore, the results found that these barriers to entry and participation, as well as the costs involved, were being lowered in this regard.

Digital Tech: “The reduced cost of the tag and the reader suddenly makes more sense ... You cut the costs from \$20 000 down to \$2000 ... The scale is tipped when the cost comes down to make it viable ... [If] you can merge these three use cases together, you can actually get three or four departments in an organisation to fit the bill for a system that addresses all of those needs ... Suddenly all of those make the use case more feasible as it is spread across different domains across the organisation.”

Digital Solutions 2: “The opening of the floodgates that we've seen over the last eighteen months to two years has been because we've been able to deploy IoT solutions very cheaply. The cost of deployment has dropped dramatically to a certain extent ... The technology is going to become massive and commoditised as a result.”

b) However, the results revealed that even though lowered costs may improve the value proposition for firms, the cost-benefit analysis still needs to justify and prove value for adoption to occur.

Digital Solutions 2: “The conversations to remove the barriers for IoT adoption is to engage with the executives around the value proposition, the business value, you can create for the organisation.”

Secure Pay: “Unless you can translate the value of that IoT solution ... saying those solutions costing 50 000 but you're going to make 200 000 in a month extra based on your bottom line. That translation in the monetising of the IoT has been a stumbling block over the past couple of years ... It's a grudge purchase ... You can't increase the cost base without adding any value.”

Digital Tech: “The mining industry, the assets they track and the machines they automate ... such a premium on that and the value of the resources that they working with ... The cost of failure is extremely high ... If you had a diamond mine is that worthwhile? Absolutely! Because within months you might recover those costs and much more ... So you save one rock truck or one collapse and you probably have paid for the entire platform from the repercussions of that and the loss of productivity ... It makes sense at those current cost thresholds.”

The advances in technology have allowed for the return in value to be demonstrated in both practical and financial terms. The increased use by more organisations and industries have allowed for a greater number and range of business cases to also emerge. Small trials with use of extracted data were suggested to develop POCs. The extrapolated value could then be defined in more concrete and predictable terms. This step-wise process allowed for issues of compatibility to be addressed, and for systems to be tailored accordingly – the participants did not advocate for pre-packaged solutions. This approach was found to assist in further decreasing the apprehension and reluctance to engage with this technology.

Digital Solutions 2: “It can be done in a way that doesn't expose the organisation to time and money risk ... Instead of deploying it to the entire supply chain, apply or deploy it to a component of the supply chain. The cost of doing that is very low or minimal. And what it does is that it then surfaces empirical data that you can extrapolate for the project. So you now able to go back to the EXCO, with real world data. You know this is the benefit that we can unlock and it's expected that the worst-case scenario is that if we extrapolate that to a broader roadmap implementation that that's more or less the savings or the benefits that we get from the initiative. It also allows us to test the user buy-in or the staff buy-in or the customer buy-in for the business, which is a big unknown. I think that's pretty much critical at the moment ... By having the ability to prototype test and surface some empirical data that you can extrapolate into broad implementation takes that anxiety away and reduces the

risk factor ... The advantage that we've got nowadays is that we don't have to do a leap of faith."

Telecoms Solutions: "The conversation and the pilot and the POC starts uncovering these gaps. It's about run the pilot ... Now we start seeing from the statistics and how the user experience increases where we provide value, which then speaks to the business case, which then lends itself to the forecast, which then takes you to the where the real ROI sits. So how do you take this extrapolated view and put it up against the sunken cost that you're looking at and starts making some sense ... That entity is going to be very reluctant to change any aspects of that environment unless you can unequivocally prove value to them".

IoT Solutions: "It should be about proof of value and I think if you can get to a place where you can rapidly deploy in a client environment and show them the value of it, cost and price is not an issue ... If you can show them the data ... their ability to unlock value. Price is not the issue ... How do you show the COO that in six weeks that you can unlock value in his business ... Then the calculation is not how much is the cost. Whether it's one rand or a billion rand ... if it's giving a 40% IRR, it doesn't matter."

c) The participants placed a notable emphasis on cost savings in described IoT examples. The results revealed that the ROI was easier to demonstrate in these instances and was more predictable through POCs and trials. Internal cost saving through enhanced operational efficiencies and improved productivity could be displayed through enabled data collection and analysis.

Digital Solutions 2: "The elimination of business costs. It's essentially cutting the waste out of organisations that are there ... that we've previously not been able to get to. That is the value proposition ... The key thing is that if you do implement an IoT solution to unlock those costs, if it's done properly, what you should see is a dramatic drop in your cost in the system over a period of time. And then it should stay there and that should become the new norm. The new benchmark."

IoT Devices: "We gave them the motivation of cost saving. That was it. That was the clincher. I mean just bring the numbers down on paper."

One of the participants – Secure Pay – was able to give an example that illustrated the practical nature of some solutions to assist with cost saving for organisations:

Secure Pay: “One of the biggest headaches for insurance companies is where geysers go ... [This] was done and implemented and tested in an environment with regards to putting an IoT device, a sensor inside the drip tray of that geyser. So, if it does drip, it sends an alert already and they send out a plumber to come and have a look at the geyser, if it's this or that element inside the geyser etc. Because with that solution, they could potentially save the industry a lot of money ... The biggest cost for an insurance company when a geyser goes, it's not the geyser itself. It's the damage that it causes. And you look at 150 to 220 litres of water, hot water, going through. So, your ceiling needs to be replaced, all of your goods inside that room need to be replaced, the electrical wiring, electrics, and the geyser etc. So, what they want to try to do in that scenario is try and have a preventative measure. So, to use that as a preventative measure, where they can read is the geyser going to fail in this short period of time, and then send out a pre-emptive person to come and look at the geyser and fix it before it causes all the damage. And in doing so, that will push up the profits of the organisation.”

d) The results showed that operational efficiencies can also be practically visualised and with the assistance of collected data, further areas of operational efficiency could be uncovered to produce further cost savings. The participants expressed that this would assist in demonstrating additional value to the cost-benefit analysis.

IoT Connect: “The more operationally complex something is, typically the impact of IoT can be much bigger because you get real-time visibility of operations and you can optimise much quicker.”

Digital Tech: “If you took a large open cast mine and you look at all the equipment on a mine ... You have a couple hundred devices or a couple of thousand devices ... Extrapolate that to failures that can be predicted, to equipment that you could say that the temperature on the site is increasing and you need to service them before the whole site shuts down. The recovery from loss of income and knock-on effect with customers and outages makes it viable ... The reality is that every business has been looking at ways to optimise their processes and tasks for a long time ... Most of industry is looking at a way to

streamline their processes and this is probably the easiest way to get there without necessarily having to change a lot of processes or structures.”

Digital Solutions 2: “[Now] I can see all that I’ve got. Data on all these departments and around all these functions but there’s darkness around something else, and now that’s very cheap to go and deploy a sensor into that environment ... And we could then focus on solving the client’s problem, which was typically unlocking efficiencies inside that business.”

e) One participant – Digital Solutions 2 – noted that the drive towards cost saving through technology-driven low-cost strategies was transient in nature but no less important in terms of profitability and competitiveness for organisations.

Digital Solutions 2: “There is a cost to the deployment of technology and you need to demonstrate that by deploying the technology that you can demonstrate a savings at a much higher multiple. It comes down to local competitiveness and global competitiveness and ensuring that you help those executives understand the importance of being the lowest cost producer ... That’s certainly a starting point that’s pretty much critical ... But also with the understanding that eventually everyone is going to go there ... And in this world being or getting the first mover advantage in being the lowest cost producer gives them an edge in the market. It brings additional margins for a longer period of time ... If you the last one, you may not get a chance to participate.”

f) Finally, the participants expressed that competitive advantages and improvements in company performance were driven by both internal cost savings and by external revenue generation.

Digital Solutions 2: “Ultimately you are solving one of two things. Either you want to become the highest value differentiator ... or you want to be the lowest cost producer ... [That] doesn’t mean you’re the lowest [cost] provider of service. It means that you want to be the most efficient in terms of how you provide that service.”

MNO 1: “More efficient, cuts out cost or helps customers to reach their customers better to generate more revenue. So it’s one of those, cut out costs, improve processes, or generate more revenue.”

Secure Pay: “There are two things, you want to make more money and you want to save costs.”

#### 5.4.2.3 *Addressing Issues and/or Challenges: External Revenue Generation*

a) Revenue generation was expressed by the participants as a further strategy for organisations to pursue to attain organisational goals and objectives. The diminishing effects inherent to low-cost strategies were observed to be a contributing factor. The advances in technology and the ability to utilise collected data were seen as a means for organisations to explore various revenue generating mechanisms that could create competitive advantages and differentiate organisations from competitors.

Digital Solutions 2: “The challenge with chasing efficiencies is that there's a diminishing effect. There's a point where you can't go any further unless you've got an event like IoT that finds the next chunk of savings. So, I think that the initial focus is on unlocking those efficiencies. The next big focus will be now when you reach the diminishing effect of those efficiencies, how do you look at that data to create impact. Because there's no limitation to the impact you can have.”

Secure Pay: “[Company X] reached this point of saturation with regards to the services and the products that you can give within that specific niche market ... You've got to find new avenues of growth and opportunities and IoT is one of them because you've already got the infrastructure ... Nothing's going to stop businesses from inventing because that's how you create the sustainability in the market.”

MNO 2: “If they keep doing their traditional business ... their future will not be great ... IoT is a way for them to create a very important revenue stream for now and in the future.”

One participant – Telecoms Solutions – was able to provide an illustration of how enabled technology, and data collection and utilisation, have enabled organisations to enhance and present existing products and/or services in creative and innovative ways.

Telecoms Solutions: “So it starts off with you ordering a pizza that goes the oven and into the system. It tells you the pizza has gone into the oven. That sensor is speaking not only that your pizza is being made but it tells you what's

the delivery time, and that speaks to the driver. The driver has an onboard navigation and a monitor ... He has now left the shop and tells you how long it's going to take. And that's how the IoT differs from monitoring for a singular purpose. The concept is not new. The services have been around. It's just the utilisation of those services and diversifying the way they work that has changed. And it's only becoming possible because of the technological interventions and the partnerships that have been made. So traditional companies are not doing what they started out to do and they are quite happy for it because the opportunities and the revenue opportunities that exist outside of what they do anyway and adding on that, that starts making sense to them. It's a progression with the information that you start gathering from that new aspect of your business and then expanding from that information into a further or new segment of your own business. So, you become a totally new entity.”

b) Revenue generation was explored with regard to the IoT and the consumer market. The participants identified that entering into the consumer market required separate attention. Notably, the participants observed that there was more apprehension and reluctance with mechanisms to engage the consumer market compared to internal cost saving strategies – the ROI was easier to demonstrate with the latter. The results showed that there was an established and extensive presence of the IoT in the consumer realm due to a combination of a business push and consumer demand for improved technology and associated features on various devices. This has allowed for connected devices, objects, and things to be extensively present within everyday lives. This was also a notable contrast from business circumstances where devices had to be implemented based on a cost-benefit analyses, acceptance, and adoption by organisations.

Digital Tech: “It has been happening slowly ... A lot of the devices out of the box ... [like] a lot of the new air conditioners ... are Wi-Fi enabled. People don't have a problem with that. They are happy about that. They expect it ... That is a perfect example of IoT in the making where every device, or the vast majority of devices, are going to become IoT capable out of the box ... Go to bed one night and wake up the next day and suddenly realise half my house is actually automated without it consciously happening ... New tech. It has a way of sneaking in and then suddenly it is always there, and we can't remember life that came before ... Its already very much happening and a lot of it is not advertised ... Like the washing machine that I looked at the other day, it is Wi-Fi

enabled ... but it's not being advertised as a key feature ... So that's the progression and in whatever cheap thing you buy in the next few months, it will probably be smart and Wi-Fi capable whether you want it or not."

IoT Devices: "It is kind of like you know the way Steve Jobs used to say. Design something in such a manner that people will go why else would it be any other way ... As an individual ... I suppose it's entrenched in everything. You know I go for a run. I've got my Garmin on. I come home ... Bang it's up on Garmin Connect. It's on Strava or whatever. But I think in business it's certainly something that is far more conscious. As an individual it's just there ... Listen it's coming ... It'll trickle down and it will happen and before you can wipe your eyes you'll just think back and you can't really remember when you didn't have a smartphone. I mean smartphones have only been around ten years."

Insure: "[People] will become numb to the fact that it's [IoT] there anyway. It's everywhere. You can't avoid it."

Retail: "It is present ... I mean the most powerful enabler for IoT is the mobile phone."

c) The technological aspects in terms of connectivity and interoperability within the environment were seen as key reasons for greater acceptance and personal use.

Digital Tech: "This stuff must just work for most of the mainstream public ... So I can get home and open the box and it just works. And from a consumer sector that is what is expected ... [For example] if you bought a Bluetooth speaker, you just assume that it's going to work with your laptop and your phone. It's not an option regardless of what brand that it won't. If they both Bluetooth capable you know it's that and that they should be able to speak. And from the consumer viewpoint that is what should happen ... The fact that it's compatible with any other device makes it a very viable thing to buy."

d) The participants voiced that a paradox in terms of cybersecurity and privacy concerns was present in the consumer environment. There was a high level of concern for data privacy, however, the convenience of data exchange and the requirement for exchange of data to access desired products and/or services was observed to bypass concerns.

Insure: “What I see in a lot of interactions is, from a consumer perspective, it almost seems to be a tolerance that if you can create a seamless convenient experience for me, it will almost trump my data privacy concerns which seems bizarre ... They've done it in a way that creates a more seamless experience for me. I derive value from it as a user. I kind of think turn a blind eye ... Because of the seamless nature of it, because of the convenience, I think it kind of gets kind of snuck in there without people realising ... They don't see it for what it is, and I think there's the moments that they've realised, £@\$%, that's true! You've been doing it for two years. I've never lost out of it anyway. If anything, I'm benefiting from the data being shared and available.”

IoT Solutions: “People are almost in a way less concerned about their personal data. They are almost sharing more willingly.”

Digital Solutions 2: “Many people are completely oblivious too how much they give up about themselves ... I think the general population doesn't care. But when you start thinking about specific events and you a bit knowledgeable, you might turn away from it.”

Digital Tech: “So over time the general population has come to accept the concepts of privacy in taking on a different form from what it used to be. It's so mainstream now that people just don't care ... Although there is a definite backlash, the reality is that as we have progressed down this road, it has become more and more acceptable.”

e) The risk-reward analysis that occurs with this underlying exchange of data was recognised by the participants. The results showed that the value in any exchange needed to outweigh the risks involved for resistance to be lowered, and for acceptance and adoption to occur.

IoT Connect: “It's always a trading game ... My sense of it is but why would you would use a product? Either because it is giving out a big benefit in some form of reward and then again, the effort and the risk of sharing your data must be low enough for that reward or the benefit to makes sense for you or otherwise you probably won't share it ... The risk of me doing that is not high enough for me to just stop using these services.”

Digital Solutions 1: “End-consumer is almost the same as a B2B ... [If] you can easily prove the value, you can easily prove the uptake on the usage of certain things. It's really much the same side of the other side of the coin.”

f) The results showed that the framing of the value proposition could lessen the conscious awareness of data exchange. This mechanism was found to decrease the reluctance of individuals to engage with this environment and with organisations through this technology. This ability to frame the context of data exchange in a more favourable manner was illustrated by one of the participants – Digital Tech:

Digital Tech: “So you live in Poffadder and you said that every night between 7-8pm I cannot make a phone call. You would have traditionally called the operator. Five to six to fifty times till eventually the call is escalated to an engineering department, and they or may not dispatch someone to drive to Poffadder and to your house. The person will drive there at 2pm in the afternoon when you don't have that problem. He will drive around site and will say that it was fine ... [Instead] load this App ... It is going to monitor your experience ... so we can see what is happening to your device between 7-8pm at night when you are trying to make calls. We will be able to see exactly which site you are connected to, the power your phone is transmitting ... We will diagnose what is going ... This is the service and this is an easy use-case ... If you market as, if I tell you this is what it does, you will not be happy to load it. If I change the story, if the promotion is to monitor the service, a VIP service, to monitor the performance ... [That] they will look after you to the ends of the earth. This is a privilege. This sounds better. How they pitch the service is important.”

g) The presence of different generations – Baby Boomers, Generation X's and Millennials – existing in the same time period was recognised by the participants to play a significant role in the presence, acceptance and use of these technologies.

IoT Solutions: “I think it's a generational question. I feel very uncomfortable sharing stuff on Facebook and I'm very wary. But there's a whole generation of people that doesn't feel uncomfortable. And I'm not sure whether that is a passing trend. There's a fundamental shift in being. I think that the new generation is very different. I don't think they're going to have the same fears.”

Digital Tech: “The younger generation is always the one that embraces it. Their entire lives will be spent with this open sharing of information and take a

photograph here and then it appears there and can share with them. So, there is no barrier to break down there. They have already embraced it. So, all this technology is actually inbred for the next generation. We're just laying the foundation for that, for what is inevitably going to happen. So, your parents, might not. Just one generation too far. I'm not comfortable sharing my information on social media platforms because I realise the impact of how far it can go, and you can never get rid of it. As a kid you probably don't have those concerns. I think of the repercussions. Interaction is completely different from the way that you and I grew up. And the way we grew up is completely different from the way our parents grew up etc ... The enablers have to be there in order for that mindset. And in some ways our generation will never embrace it like they will. So, this stuff we are working on now, it's not for us. It's for the coming generation. We won't have to twist their arms. It will just be."

Secure Pay: "Millennials are more open to you having information or having companies having information about them. So, depending on what information. So, when you're on Facebook, when you're on LinkedIn, when you're on Skype, when you on all of that ... If you're an older generation ... You don't like all these people having information about you ... the Millennials are more au fait with sharing information."

IoT Devices: "So I think from certainly you know the observations I've had ... the younger generation. It'll just be a continual growth on what's already there. Because a lot of these youngsters grew up with mobile phones ... So, I think resistance will be probably generational and it would probably become less just as the older folk die off and the younger folk move. I think that is just the way it's going to be."

This shift in generations was expressed as an example of the strength of social influence in this era. The technological advancements and the presence of this new state of existence were also found to have established new social requirements for continued participation within society – namely ability to communicate and interact through new means such as social media.

Digital Tech: "I believe people and the large majority don't have free will. You will accept what is acceptable by society, the masses. So, if you can swing public opinion to where it is acceptable, well then it is acceptable."

Secure Pay: “If you look at cellphones for instance. My gran was 90 and she was operating a cellphone. But she wasn't born in the cellphone era. She was born in 1926 but she had to learn to use a cellphone because it was a communication mechanism ... So, the older generation, although a large part of the people think, that you know, the guys aren't ready to accept technology or it's a hindrance to accept technology. The guys are accepting technology and the technological advancements. So, when you look at it, there's people that don't phone anymore, they use WhatsApp calling but they're in their 80's.”

Digital Solutions 1: “You know it's not even ten years ago the adoption of smartphones in the older age group, no-one would touch this thing ... My mother-in-law is 60 to 90% of her day is spent on Facebook, on her phone, and that's becoming prevalent.”

h) These developments were recognised by the participants to have lowered the levels of resistance for engagement and particularly for data exchange between individuals and businesses. This has created an environment where collected data has enabled the enhancement of traditional mechanisms in creative and innovative ways. Advertising and marketing were highlighted by participants as mechanisms that would benefit from these circumstances. Customer journeys and user experiences could become more focused and customised for specific groups and/or individuals. This enabled and enhanced capability that could assist businesses with improved market outcomes was illustrated and described in depth by one of the participants – Secure Pay:

Secure Pay: “Marketing is going to make a lot of money out of this because they can market to you directly, knowing your whereabouts, where are you located, where do you go, where you shop, what do you like to buy etc ... that all talks back to the marketing of one. Not everybody, like in the olden days ... For instance, if you hypothetically look at places to go on holiday or places for outdoor and they know your data. Whoever has the data, they know that Gavin's looked at hiking trails for Mount Everest. They will be able to already start advertising to you, saying Gav's in Sandton City and Due South is there. And we want to market walking boots or hiking boots to get 50% discount. They already send you an SMS. When you walk into the store into the shopping centre, saying Gav's approached. We've sent him an SMS and Due South got 50% off hiking boots or sleeping bags ... So hypothetically, if you're a clothing retailer, you understand that there are people, that into the store is a 26 old

female, on Wednesday, at one o'clock and they're going to the black slacks aisle. You can run a campaign to say and now as you understand your consumer that is entering your merchant store. Because by Wi-Fi and how you collect the data, and you got their cellphone. Whatever the case is from Wi-Fi hotspot for instance. So, you've got all of that data sitting in one central repository. You can then go back to the customer, the retailer, and say, okay, fine. Run an advert for 26year old females, at one o'clock on a Wednesday, promotional 25% off black slacks and you know that you can convert those people buying slacks now.”

One of the participants – MNO 1 – was able to express how collected data could be utilised by organisations in even more innovatively to improve market outcomes.

MNO 1: “If you just look at their customers, a normal consumer’s basket. They buy bread, milk, and sugar. So, if I get your spending patterns at shop A and B and C for argument's sake, and I work off a credit card company because I do this overlay of spending patterns. So now I am [Company X] for argument’s sake and I know what the average basket is. Now you buy, but you never buy bread and milk from me, so I can make the assumption that you buy that somewhere else. So now, why do I give you a discount on any of the stuff you buy from me anyway. I'm going to give you a bread and milk discount. A personalised discount. So, what do you do. I take that share of the wallet as well. So, I don't have to run a shelf of discount. I run a discount for you on bread and milk. You gonna spend your money. Three, four, five, six times in a row. You never going to back to [Company Y] again. That's the value of a using data.”

i) The environment in which businesses were competing and the ability to utilise technology and data to enhance and innovate mechanisms to engage individuals was recognised by the participants to also require a change in business models.

MNO 2: “I think we can see the future we see even more creative business models.”

Secure Pay: “IoT will play a part in disrupting the industry. You know part of all the digital technologies that are out there will disrupt business models.”

j) The results showed that the cost-benefit and/or risk-reward analysis was central to the value proposition. The ability to increase savings for individuals was seen as a key

driver for engagement. The value and benefit from cost savings was perceived to garner greater engagement and participation, even with grudge purchases such as insurance.

Digital Solutions 1: “They onboard because as you get savings here and savings there and a discount ... It's not going to be keep your data safest and who pushes the least amount of ads to you ... I can get 7%. Those guys were going to give only 5% back. It's going to be all about that. It's not going to be how safe you are ... That's the human psyche that's ... Because what talks louder than anything else, its your wallet.”

MNO 1: “Ninety-nine percent of things you buy ... they push it to you the way you want to consume it ... Some insurances struggle to introduce the installed devices that track your driving behavior. They said they don't want Big Brother to watch them. But there's the flip side. Install it and give you a discount. Tomorrow morning I'll phone you and install it ... I have to look after my cash flow and all those kinds of things. My disposable income is low. It's tough times out there.”

Telecoms Solutions: “Consumers are starting to understand that the cost of living is rising, that things are expensive. The reason I say this is people are looking at how do we save on services that we currently using. I need to start knowing that if I start seeing that this Eskom hike next month is going to add an extra R300 to my utilities and water. You start seeing from a budget perspective that something's got to give. I need to start managing things a lot better in order to manage the cost that I can spend versus the increases ... It affects them directly ... At a consumer level, if I start seeing the benefits of the savings ... the real cost implications that they see on a monthly basis.”

k) The participants identified relevance as another driver in the cost-benefit analysis. The participants expressed that individuals would pay a premium for certain products and/or services if the benefits were positioned as relevant and impactful for them – for example, health and family concerns as personal motivations.

Digital Solutions 2: “A wearable device that will measure my diabetic child's glucose levels every couple of minutes ... There's a greater incentive to do that. And it would be a great incentive for [Company X] to fund that from an equipment perspective. There's a great incentive from a parent to pay a subscription to have that monitored etc. Because one is [Company X] by doing

that is monitoring the child and perhaps by monitoring the child in a real-time basis they reduce long term health care costs related to the child or the risk of hospitalisation or death. And a parent is a parent ... Tracking of elderly people. If your parents are in their 70's or 80's and are refusing to go to an old age home. Your ability to track them whether they active or not, whether they're lying or standing, whether they fine. The same way you would track the safety of your house throughout the day when you at the office ... [That] would be of incredible value to you. And you would pay a premium to be able to do that."

MNO 1: "When it gets to wearables, like my health, this is going to monitor my health. That's a benefit, that's a big benefit for me ... I can get a pre-alert of predictive maintenance to go to a doctor ... So lose all of that personal information or whatever the case may be. Have no idea where it's going. Like it's going to the Cloud or whatever. But there's benefit in it for me."

Telecoms Solutions: "So, as a parent you want to look after your kids. You want to know what they are doing because there is too much bad happening out there. So, I consciously get these watches for the kids that I can call them, I can track them, I can listen to what's happening around them. Because I just want to know. It's a bit Big Brother. But I want to know. It's just not safe out there. So, I consciously, as a consumer, I will buy this."

I) The participants expressed that creativity with these drivers or levers was possible to improve engagement with individuals. It was recognised that innovative reward and incentive based programs combining the current presence and use of IoT devices – novelty and entertainment with gamification and online social communities – with both cost savings and a driver of relevance were presently successful. These combinations were found to improve the value proposition and encourage participation whilst diminishing the perceived risks involved with data exchange.

Insure: "Reduce your insurance premium by up to 2% year-on-year as you're living a healthier life. And we can see that change ... Exercise. Ultimately, it's going to fund it. You can live your healthy life and the benefits of it ... Encouraging activity, giving micro-rewards on a weekly basis for that ... Improves the mortality and morbidity of their clients on their product. So, they're able to offer insurance discounts on the product that they sell and then obviously the reward element is there for people engaging."

IoT Devices: “I actually read an article today where one of two universities in the UK have actually found crunched massive amounts of smart watch data and actually picked up arrhythmias. Which I think that's brilliant. So, I mean, I wear my watch all the time. If I can be preventative or pre-emptive ... that makes more sense. So then if the opportunity is that if you maintain a healthy lifestyle, I'm active and sporty and all that sort of stuff ... If can reduce my premium and increase my cover, then gosh, yes.”

These rewards and incentives have also had to be tailored for the specific market to which they have been directed. Organisations need to be aware that drivers or motivations for engagement need to be culturally and contextually specific to be more effective in certain instances. For example, health-driven incentives were more accepted and effective in some countries if they were specifically supported by medical evidence as these cultures responded to these values and intentions of the program. In other instances, the positioning of the reward was the driver instead of the intention of the program – corporate leave days. Therefore, the results revealed that positioning and alignment of intention and/or benefits were necessary for the value proposition to be accepted, adopted, and used. Trust in intention was important in expressed instances. One of the participants – Insure – was able to provide an example that illustrated this finding. This discussion highlighted the different levels of emphasis placed on the intentions and rewards by individuals based on factors such as society and culture. This revealed that knowledge of how individuals' respond differently could increase the effectiveness of mechanisms implemented to improve engagement with targeted consumers.

Insure: “Position ... Can be so critical around whether or not they engage ... You've got to adjust how you do that for a German market or a French market and I think most rigorously for that Japanese market. It's been very different ... And, I think the level of trust is quite different ... Generally, with skepticism in Japan around what we're selling ... very aware of the clinical underpinnings ... [It's a] science-based programme and we position it like that. Any kind of discussion with them, that's what you got to go with. The clinical foundation of why this is important and why you doing it as opposed to anything else ... In Germany, where we have a joint venture with [Company Y] there, it's very much about the health aspect. That's their motivator. The French, interesting there. I think we find with France and there's this tradition there that is more corporate based. So, it's kind of funded through the employer and then that changes the

dynamic as well ... They can tell people and prospective employees that they've got a wellness program. But people don't engage with it. So, the dynamic of how we position the program within corporate is quite different. So, it's much more closely aligned with benefits within the corporate. So, days or extra leave days and that kind of thing. So, the rewards differ quite a bit. And through that we get we get better engagement. Cultural definitely.”

m) The findings revealed that organisations could utilise these mechanisms individually to create competitive advantages and improve their company performance. However, partnerships and networks were found to be beneficial for all stakeholders involved. For consumers, ecosystems allowed for greater access to connected partners, and greater potential cost savings and benefits. For businesses, partnerships and networks improved their value propositions, and also extended their footprint and distribution channels. Therefore, the findings revealed that co-value creation through ecosystems were both present and increasingly important in creating competitive advantages and market outcomes for organisations in such an interconnected environment.

Insure: “If you come onto our platform, we've got a rewards partner ... Not just the reward partners but the device partners and the [X's], the [Y's]. The whole dynamic has changed ... [Company X] or [Company Y] ... [Company Z] ... [Company Z] probably has a truly global footprint ... You've got their scales there ... It's nice when we can do a partnership with them and then whichever market we go to, we know that they kind of there and that kind of integration is easy ... It becomes much more cost effective.”

Digital Solutions 1: “The world is moving at such a pace that will you be able to afford not to move to that ecosystem ... Need to be part of an ecosystem. You will just need to choose what ecosystem you are willing to live with ... Insurance company that partners with a medical aid company, that partners with a gas station. It partners with everyone. It's so attractive to use that system because they all collaborate, and they can give you the best value for money.”

Economies of scale and scope were possible through these mechanisms and were found to assist with competitive advantages for partners within those networks. These ecosystems and network effects were found to raise the barriers to entry against competitors. For example, pricing would be raised for organisations outside of these partner networks. Therefore, it was observed that organisations could improve their competitive advantage with participation within these partner networks.

Digital Solutions 1: “Will a company be able to survive outside of an ecosystem like that? ... You've got that ecosystem running and an outside insurance comes in. Will he be able to compete because everyone is just undercutting his prices? ... How do you keep your margins and how do you form new alliances to get better value to your customers?”

n) However, one participant – Digital Solutions 1 – noted that the ecosystem mechanism did not exclude the development of resistance behaviours despite the innovation and creativity and mechanisms to enhance the value proposition for consumers. Engagement with partners within ecosystems presented a “lock-in” principle for participants. Benefits escalate with the amount of partners added to the network and therefore “ring-fence” participating consumers. Therefore, if trust is compromised with any of these partners, movement from the ecosystem is difficult because of these network effects. However, resistance behaviour was still observed to emerge.

Digital Solutions 1: “[Company X] partnered with [Company Y] to get their cash back rewards. [Company W] partnered with [Company Z]. Everyone partnering with let's say a fuel provider. So, what's going to happen, if your trust is broken in [Company X], you going to re-evaluate your move to [Company X] and then you're going to have to move your ecosystem. You're not going to move just your bank. Are you going to suddenly not use [Company Y]? Are you going to [Company Z]? So, you got to move ecosystems instead of companies. You going to be between a rock and a hard place. It's going to be so difficult because suddenly you can't bank with these guys. How do you move your insurance? You need to move your gas station. You need to find a new way. You need to find a new everything. Because you always shopping at [Company Y]. Now you have to go to [Company Z]. So, it's very, very difficult actually. Very difficult thing to have to leave the ecosystem.”

### **5.4.3 Results Summary: Research Question 2**

Connectivity issues were found to be addressed through a combination of technological advances and by organisations providing solutions to these problems to ensure and/or enhance the functioning of the environment. Technological advances such as with Wi-Fi connectivity have allowed for the possibility of extended connectivity to be achieved even in remote areas that were once excluded due to their reliance on landline infrastructure. The compression of the high volumes of data into smaller

packets or bundles has assisted in areas with low bandwidth connectivity. These advancements have decreased the latency that was previously hampering the effectiveness of the environment.

The advancements in greater abilities at the edge – on the device – have also assisted in this regard. The issue of connectivity deadspots even in the presence of multiple connectivity network providers has allowed for organisations to provide consolidated solutions. The ability to aggregate multiple networks onto a single platform has allowed for these organisations to provide and assist with reliable and consistent connectivity, and in-turn has improved the overall value proposition and functionality of the environment.

This horizontal aggregation was also present in addressing identified interoperability issues. The ability to consolidate vertical OEM solutions together with the development of agnostic devices has allowed for the complete integrated value of solutions to be realised. This has also improved the environment from which solutions, products and/or services can be delivered.

Safety and security of collected data was found to have multiple options that could be implemented to protect the privacy of this data. These products and/or services targeted recognised areas of vulnerability – at the device, during transfer, and at storage on-site or in the Cloud. The need for cybersecurity, as with the need for connectivity and interoperability, has created opportunities for service providers to enter and participate in the value chain – for example, AWS and Microsoft Azure.

The increasing prevalence of cybersecurity hacks and breaches has also resulted in regulatory standards being formed – for example, the South African POPI Act and the European GDPR. The onus of liability and responsibility was found to be distributed amongst all participants within the system – the business, the security providers, as well as the end-user.

In addressing the general uncertainty and apprehension about the technology, the participants expressed that a shift in focus was required away from the actual technology. The participants had observed that the trend to provide or implement technological solutions before understanding any underlying problems first, was incorrect. The participants expressed that the fundamentals of problem solving remained the same – problem first, solution second, and use of available technology third.

Business adoption was centred about the cost-benefit analysis that organisations had to consider with any capital investment. CAPEX had been lowered due to advances in technology that have led to the commoditisation of devices as well as the decreased reliance on vertical OEM solutions. The findings showed there was a focus on the value that the technology could produce in terms of practical efficiency as well as financial returns.

The ROI was easier to demonstrate in these settings through trials and POCs combined with extrapolated data. It was observed that the participants placed an emphasis on low-cost strategies most likely due to this greater ability to show a visible, concrete, and more predictable ROI. Technology-driven cost saving strategies were recognised as transient in nature, especially with lowered barriers for adoption and use by competitors. Therefore, this was found to be an additional motivation for organisations to pursue external revenue generating mechanisms to remain competitive and sustainable.

The discussions on external revenue generation were focused on the consumer IoT market. Notably, there was much more reluctance voiced due to the complexities involved and the greater unknown returns compared to the demonstrable ROI with internal cost saving mechanisms. The participants acknowledged that available technology enabled and enhanced existing products and/services and also provided opportunities for creativity and innovation with existing mechanisms. Diversification was expressed as a means to achieve competitive advantages and improve market outcomes.

The established presence of the IoT within personal and everyday lives was succinctly expressed by one of the participants – IoT Devices:

IoT Devices: “ In business it's certainly something that is far more conscious. As an individual it's just there.”

This presence was found to be driven by both a business push and a consumer demand for upgraded and up-to-date features. Products and/or services also had to be compatible with modern existence, and reliable and fast connectivity and general interoperability were observed to influence greater engagement and participation. The results showed that there was a paradox that existed with regard to the importance of data privacy and security.

The convenience of data exchange and the requirement of data in return for access to products and/or services in this modern era has resulted in an observed decrease in conscious awareness of the resource being exchanged – data. The cost-benefit and/or risk-reward consideration in these scenarios was highlighted in these findings. Framing of value propositions and perceived higher value and greater benefits were expressed to assist further with ease of data exchange in these transactions.

The shift in generations was also expressed by the participants to play a significant role with regard to social influence as well as social acceptance of new technologies. The establishment of a new status quo was observed as continued participation within society required adoption and use – for example, social media and communication. Therefore, the findings presented an environment conducive for B2C engagements and possible revenue generation for organisations.

The enabled ability to collect data from individuals through IoT devices has been notably established. The ability to use this collected data within the cost-benefit and/or risk-reward equation has enabled organisations to enhance existing mechanisms with which to engage consumers. The findings showed how data could assist in value creation and capture through targeted advertising to individuals and groups, as well as how customised offerings based on data analysis and pattern recognition could improve market outcomes.

Effective value propositions were centred about cost saving and/or motivations of personal relevance for consumers – for example, health and family concerns as personal motivations. Combinations of these drivers with accepted and current use of IoT devices for novelty and entertainment were found to be creatively packaged – gamification and social online communities – with reward and incentive based programs. These combinations were found to enhance the value proposition as well as engagement further. These programs were more effective if aligned in intention and purpose to certain cultural environments. For example, evidence based medicine supporting corporate wellness programs for some cultures were found to more effective compared to corporate leave days and rewards for others.

Finally, the participants expressed that these mechanisms could be pursued individually by organisations to gain firm-centric competitive advantages and improve individual company performances. However, partner networks and ecosystems presented greater opportunities for co-value creation. These group mechanisms provided distribution channels and opportunities for economies of scale for participants,

and also raised the barriers to entry against competitors or non-participants of these ecosystems. The value proposition for customers was also enhanced through greater access to partner organisations, additional benefits and discounts. However, even though this presented greater value for all stakeholders involved, the findings revealed that resistance behaviours would still emerge if trust was compromised even in the presence of network effects and “lock-in” principles of ecosystems.

## 5.5 Results: Research Question 3

**What impacts and implications require consideration by organisations that have progressed to implementation and use of the IoT?**



**Figure 13: Overview of Themes for Research Question 3**

### 5.5.1 Impacts and Implications

#### 5.5.1.1 *Employment*

a) It was noted that present and past technological advances have had an impact on the workforce in some shape or form in history and that this was not a new topic of discussion. All of the participants agreed that employment would be impacted. It

emerged that technology could be viewed as a complement or as a substitute, and that positive and negative perceptions, responses, and reactions would depend on how the impact was conveyed.

IoT Devices: “[With] any new technology there will always be a shift in the workforce. I mean historically the industrial revolution you can see it there. You can see when there's been any big technological change there's always been a shift in the workforce. And I think there will always be the case ... I think you think you certainly will always find resistance to the new technology because there always is a certain amount of fear ... But suppose one also has to look at the kind of people that are there that fear new technology. So, if you've got ... and it's certainly not disrespectful ... If you have a lower educated person who is line worker and they are a task or a job-based individual. They can easily be replaced by robots, which are more efficient. That's the way it is. But if you've got somebody that's possibly a highly educated person, they'll look at efficiencies. That's a difficult one you know, when you throw humans into the mix. We are sensitive little creatures. Yeah. Personally, I think there will always be a resistance to a new technology. Doesn't matter what it is. There will always be a certain amount of fear ... you know, as technology changes ... I'm sure the horse and cart feared the automobile ... And then the automobile feared the bikes, and then the aircraft and so on and so forth. I don't believe that it's any different with any technology.”

b) Lower resistance was identified in instances where technology complemented individuals with tasks or removed and/or replaced unnecessary tasks to allow for greater efficiency.

Insure: “There is no debate that a call centre agent ... buffered with this technology solution, can't do a better job.”

Retail: “It's helping them do their job basically at the moment. If you look at an example, of scanning at a point of sale, it definitely is helping their jobs especially with a big order and also being able to be more mobile to go where the problem is. So, I'd say helping them more.”

Digital Solutions 1: “It's alleviating problems ... It's taking people away from the mundane things that can be automated and putting them in the work that they actually want to do ... Scenarios where managers were just doing Excel

spreadsheets ... [Organisations] can't afford to have a manager level employee doing that on a full-time basis."

Practical and logical reasons within work environments also assisted in lowering resistance and increasing acceptance of implemented technology in certain instances.

Secure Pay: "Refrigeration monitoring in the healthcare sector ... [It] has to be monitored every couple of hours and a person needs to manually go there with a book and record the actual temperature ... If that temperature dips or whatever the case is, the vaccines can go off. So, what happens is in that specific instance the temperature in the monitors that is put inside the fridge, reports up to a central platform and that actually does the monitoring without a person having to go to it."

Digital Solutions 2: "We can now send a machine to mine walls and pillars where is too dangerous and completely unethical to do that with the person. So, if there's an event and there's a machine underground, it doesn't matter. You've lost the machine and that's a cost element. Right. You never want that to happen with people."

c) Notably, the negative impacts on employees were emphasised by the participants.

Digital Solutions 1: "There are going to be a significant job losses and really a significant percentage of unemployment happening."

Insure: "At this point, it's not prevalent for people to go, \$@%#! This is my job at risk ... we joke about it. You know what, you an actuary and you smart. But at the end of the day, what you calculating can easily be duplicated. That element of it can ... At this point it seems quite non-threatening ... They embracing of it. It's technology. It's advancement. It's a tool for making my life easier. Until it suddenly it takes your job. Then it's different ... It will become quite real when you can say you don't need twenty okes here, you only need ten. Because half the volume can be filtered by a chatbot based technology."

Resistance in the form of rejection and opposition, especially in task-orientated occupations subject to displacement and/or substitution, were described by two of the participants – MNO 2 and IoT Connect:

MNO 2: "In many cases their employees are not really supporting it."

IoT Connect: “[IoT] makes companies more efficient that I've seen in practice ... But efficiency typically also means less people ... I've seen some stuff where stuff is actively not installed correctly.”

d) The participants noted that the pursuit of internal operational efficiencies and increased productivity through available technology would improve company performance and even the ability to scale. However, this would have a negative effect on current and future state of employment.

Digital Tech: “When the cost of IoT equipment reduces to the point that it's going to be cheaper to automate all the stuff than it is to have teams to do it, then the scales will tip ... Take the human factor out of the loop, reduce the cost, reduce the risk of human failure, be able to monitor something 24 hours a day instead of twice a day.”

Digital Solutions 1: “[Company X], they want to expand their business ... their employment ratio to customer ratio is fixed. If they've got a thousand customers, they need 50 employees ... They can't move to 2000 customers without employing more people. But with the help of RPA (robotic process automation), you can move to 2000 customers without increasing your employment ratio ... You don't maybe let people go but definitely you not going to need to employ extra people because you can rotate the skills sets that you have.”

e) “Up-skilling” and “the creation of new jobs” was consistently echoed as a common answer in these discussions. However, there was uncertainty expressed on how to practically and appropriately approach and manage these situations in reality.

Telecoms Solutions: “The standard answer for any future technology is, we will create new opportunities, we will up-skill these people ... The reality is that these people have jobs that are going to be lost tomorrow. That is the reality. How does one mitigate that one? These are standardised answers, but they don't define what the solution will be.”

Secure Pay: “There are good things that will come out of it [IoT] and there will be bad things that come out of it ... The negative ... It's replacing people's jobs and you've got to find a place for that person to operate in ... But that's where the problem comes in in my book. And what I've read in industry is that eventually there is going to be an impact and we don't really fully understand that impact yet because it's only the infancy with all these technologies.”

f) The participants identified that leadership and organisations needed to understand these impacts and implications, and carefully balance stakeholder versus shareholder interests in this regard. It was observed that outcomes were not inherent to the actual technology but were dependent on the direction of the organisation and on the practical application of how an organisation would achieve those objectives.

Telecoms Solutions: “The biggest pushback that you have now and in the foreseeable future is how power is being handed over into this automation environment and what does that mean socio-economically for jobs, work etc. ... I believe though that it is about identifying the criteria and objectives about what you, as an organisation, are wanting to achieve ... That will dictate how one will mitigate some of those [impacts].”

Secure Pay: “There's also the long-term sustainability of it. So you need to understand upfront what potentially could this tech do to your business. So at the end of the day, is it a staff related issue. Meaning that if you employ the tech you don't need ten staff members but can you employ that tech and can you then reskill those people as the industry is stating, or do you find them other jobs that may be created with this new tech coming out? So, it's a very delicate issue ... I don't think anybody can state that they clearly know what's happening or what will happen.”

Two participants – Secure Pay and Digital Solutions 2 – were able to provide in-depth and measured responses that addressed this issue with opinions that illustrated the delicate balance and consequences involved with these difficult decisions. The first participant – Secure Pay – was able to provide a perspective that emphasised the need for compassion and empathy in the decision making process. This highlighted the need to balance the impact of technology on company performance versus the impact of technology on people.

Secure Pay: “Shareholders need to really look at the humanity, the humanism part of it. I would never like to make a decision on a company that if you've got a thousand staff, to say I'm doing this decision, I'm going to save but I'm getting rid of a thousand staff ... It's a very, very gentle and also critical discussion ... Responsible leadership ... Leaders need to understand the impact of it and map out and have a balance of the tech that's coming in. What impact is there going to be, greater impact on the benefits and etc. or is that going to be a negative impact ... Can you get to a balanced equilibrium ... Decision makers,

they need to be cognisant of the fact of how that new technology will impact the organisation especially from an employee's perspective as well ... It's nice looking at that tech. Yes. But know a lot of thought has gone behind that tech to say how's it going to impact the organisation.”

The second participant – Digital Solutions 2 – provided a perspective that considered the broader socio-economic implications of technology adoption and use by organisations and countries. Traditional employment – formal occupations and/or task-orientated employment – was viewed as no longer suitable for the modern era. It was observed that this perspective was synonymous with some observations with regard to technology advancements. For example, the generational shift and the use of social media as the new status quo in communication has required older generations to engage in this manner in order to remain participants within society. The change in environment was viewed as requiring adaptation from organisations, communities, and countries to remain relevant and competitive. Short-term effects had to be considered, however, long-term consequences needed consideration as well. The researcher included the entire excerpt from this discussion, as the participant was able to eloquently relay this perspective.

Digital Solutions 2: “We are able to extend the competitive manufacturing ability of an old factory by leveraging IoT and basic automation and data ... Mining companies that have been able to extend the life of a mine by using digital solutions to operate the mine either by surfacing data through IoT or through automation, robotic mining etc. You could say well that's going to eliminate the job of the miner. Yes, it does ... but if a mine shuts down in the community, the effects are devastating.

Economies that have been at the leading edge of adopting technology and innovative solutions have grown economically quicker and created more jobs. I'm not a fan, and I say this very carefully considering our economic construct, of protecting jobs. We should rather be focusing our efforts on number one, re-skilling and re-tooling the resources that can still be re-skilled and re-tooled. And for those resources that are too late in life to be re-trained or re-skilled, is to create a social safety net that catches them and doesn't allow for them to fall through the cracks.

The adoption of innovative and digital technologies may eliminate certain jobs but it creates more of another kind of job, and it creates velocity within that

organisation or within that sector for the local economy ..., which is what the country, needs.

We are concerned about unemployment or creating unemployment by going digital ... If you unpack the logic, we're going digital to unlock efficiencies, to ensure we remain locally and globally competitive, so that we can compete and continue to provide a product or a service.

And we may lose some jobs, some functions along the way. If we don't do that and we the last one to become efficient ... perhaps we not survivors in the broader global game ... Therefore, the entire organisation loses those jobs and the impact on the economy is phenomenal.

We've got a choice to protect the job of the lemon picker or teach the lemon picker to drive a machine that can pick many lemons. So, if we choose to protect the job of the lemon picker at minimal wage, we're keeping that lemon picker in poverty. Their children won't have the means to get a proper education, unless they're exceptional and they've got the right breaks in life, and they themselves will become lemon pickers.

So, you protect the job and tick for short term KPI in that regard. However, if you teach that lemon picker to drive machines that picks many lemons, you've got to change the mindset in the sense that we then move from having one lemon farm to many lemon farms that you can service with the same number of resources.

The secondary and tertiary effects of that is that you then maximise the efficiency of lemon farming and then you can move from lemon farming and you can create lemon juice factories, lemon pie bakeries, lemon jam manufacturers etc. You create a tertiary industry that has to build and maintain these machines etc. And so that lemon pickers become more economically prosperous and therefore his kids will get a better chance at an education etc. and maybe become the engineers that build better machines in the future. So, you break the poverty cycle.”

#### 5.5.1.2 *Relationships*

a) Despite the advances in technology, the participants expressed that business fundamentals had remained the same. It was observed that an interconnected

environment enables more interactions between individuals, and individuals and organisations. Relationships are formed. However, even though technology had advanced to satisfy rapid fulfilment and convenience, basic service provision as well as product reliability and performance was still required in this technology-driven environment. Resistance behaviours presented if these fundamental elements were mismanaged.

MNO 1: “Not just going to be a price war anymore ... It’s all about service. I consume differently but it’s all about service. It’s not changing. If you can’t provide a good service, you’re going down. Guaranteed! ... Good quality service ... that will make it sustainable ... Brand loyalty will be there but it is always associated with the good service and then they will remain relevant ... Service has always been the core. People just take it for granted.”

Secure Pay: “If you, to a layman, say this is a device, it’s going to do ABC etc. ... then they more than happy. But if you’re a supplier and you go down and you supply that kit and you say everything is sorted but then something happens ... The end-point consumer says, wait hold up ... You never told me about this, you never told me about that. That is where they’re going to also build up that resistance. So that’s a given with any behavioral psychology of people.”

b) The participants acknowledged that acceptance and adoption of an organisation’s products and/or services does not guarantee continued use by consumers. Resistance can emerge or re-emerge if relationships are tested – for example, with poor service delivery. This was viewed as particularly important as there were multiple competitors delivering similar products and/or services – substitutes – that would be considered if dissatisfaction arose with the current provider and/or if the switching costs were low.

Digital Solutions 2: “While the value proposition is there and if there is nothing better than without a doubt. It’s the competitive nature of things. If there’s something better, then there’s a risk. Until there’s something better, nothing’s going to change.”

Digital Tech: “No one cares who is the provider ... If they give you a hard time, there are another 10 other routes that you can take.”

MNO 1: “Who is providing the fiber at home? I don’t care, it’s working. I don’t care. But switch it off and you going to hear me screaming ... [Shoes] if you

deliver and its wrong colour, I'm going to send you away. And next time I will use someone else ... Become bad, they move on.”

Telecoms Solutions: “Customers are not loyal to a service. Customers are fully aware in this day and age that a service, is a service, is a service ... 50 different people and I can choose any single one of them that I want.”

c) The participants identified that trust was an important factor to be considered in this environment. The misuse of data and unethical practices were questioned. The Cambridge Analytica example was quoted by some of the participants to illustrate this finding.

Telecoms Solutions: “The ethical aspect of it maybe something that's in question ... This is why there is a big discussion on ethical business processes about utilising information ... Things like the Zuckerberg case ... Everyone is coming under the microscope with what are you doing with this data ... It is, however, in a system that is still overseen by individuals and individuals are not always on par with the ethical code of what the industry and the institute is the aligned with.”

Digital Solutions 1: “It's going to be what you going to do with that data that becomes the proper issue ... Like what happened in the US with the presidency.”

Insure: “Facebook and all the bad press around that ... So much press around and how data is handled ... Feels like it's bubbling up now with what's going on.”

MNO 2: “There will be a problem of the companies that are using IoT and data in a wrong way.”

Breaches of trust on various levels were found to influence engagement. Third party sharing of information and/or spamming were given as examples to illustrate the perceived misuse of collected data by organisations.

IoT Connect: “How it gets misused is dependent on every single case ... What does annoy me a lot is as soon as you sign up for [Company X] products, so many people call you from [Company Y] ... They clearly sharing information out of their ecosystem. So, you know that does erode the relationship, the trust relationship.”

Insure: "So I think we've got to be really careful around people, just going this is just irritating, you are spamming me ... A lot of them are just a constant barrage of stuff and people are like delete the App. The problem is that once they switch it off, you kind of lose them and that's the big risk. If they go and like you know, push notifications, they disable that stuff etc. Your interaction with them and that one-on-one connection is just eroded."

Further examples of distrust and the possible presence of resistance behaviours were provided by the participants. These included unauthorised profiling and use of collected data contrary to what was agreed upon. These agreements and/or contracts were found to be both written and psychological in form.

MNO 2: "Let's say insurance companies, if they take data and they charge more, if they don't do the right thing. I think there will be in troubles and this will be a problem of IoT."

Digital Solutions 2: "Where the mistrust comes in, where the NO is ... Many people will not take the [Company X] offering, despite the fact that [Company X] says it won't repudiate your claim. To them it's well, but that the information is there and my driving could have been the reason for the accident and so they will not risk it from that perspective."

IoT Solutions: "One of the things around the unwritten rules around digital transformation is that you can gather customer's data and positively incentivise them to do things you want them to do. But, if you negatively disincentivise them with the data that you capture, they're not going to want to show you the data as you've violated that privacy."

MNO 1: "What's the benefit for me versus you want to understand my spending patterns to overlay debt with MasterCard information, with IDs, and you group it by that. That is not benefiting me."

d) The seamless nature of data exchange was noted to require reciprocal respect in the nature and in the manner it was given for utilisation by organisations. Implicit psychological agreements were found to be present that required transparent and considered management. Trust was expressed to be central in all relationships regardless if technology was present or not. Resistance behaviours would emerge if mismanagement existed.

Digital Solutions 2: “There’s a general trust that if I’m dealing with a reputable and listed corporate that they’ll be responsible with my data. And so they don’t read disclaimers or the terms and conditions, and they just provide their data.”

Digital Tech: “Once there’s that level of comfort, they happy to hand over everything. Social security numbers, photos of their kids, whatever. It doesn’t matter as there is that level of trust.”

IoT Connect: “I’m trading a lot of my data with Google ... It’s a personal choice ... I’ve decided that it’s okay to share my stuff with Google ... Where I am all day, what am I doing ... That is not a problem with certain providers ... Its a trust relationship.”

Insure: “It’s earning this trust credit ... Your data is important to us. We know your privacy is important. This is how we’re using it ... Just by being very upfront, very transparent ... There can be no room for misinterpretation.”

Secure Pay: “You can build the level of trust of the company. But you know, you do something wrong, do one thing wrong, and that trust is broken and it’s irreparable. It’s irreparable. So, when you look at all the tarnishing issues in industry and that a large part of the businesses loses billions in brand reputation if they break that level of trust. And in order to maintain that level of trust, you’ve got to have those principles in place. Those good values, and a company with good principles.”

### 5.5.1.3 *Trade-Offs in Decisions*

a) Throughout previous sections, participants identified multiple trade-offs that must be considered in the decision making process within this environment – cost-benefit analysis, risk-reward analysis, and challenges with regard to employment and technology implementation. Despite the presence and infiltration of technology into professional and personal environments, leaders are still required to balance shareholder versus stakeholder interests. Trust emerged as a prominent theme in these instances.

Digital Solutions 2: “It’s about responsible leadership for the responsible use of the technology ... It is something that’s taken incredibly seriously ... Generally corporates are responsible and sincere about their intent ... Ultimately you want to be in a world where there’s sufficient control in place that the corporates

themselves take responsibility for that ... But while there is a profit imperative, I think that will always be questioned. The cynical will always question, the wolf looking after the chicken ... It is an interesting dynamic.”

Secure Pay: “There's cases of the American car manufacturers where they did an analysis many years ago that if there was a fuel tank problem with one of the variations of vehicles. So, they did an analysis to say that if we left it like this, we're only going to be in for 500 million rand or dollars. If we change that we're going to be in for a billion. So that cost-benefit analysis. And so, they kept it. So, at the end of the day that comes back to responsible leadership and that is where the society needs to understand, and leaders, particularly leaders, need to understand on the benefits and the disadvantages of accepting technology and IoT solutions and all of that. And what is right for the consumer, what is right for the staff, what is right for the shareholders etc. And that's a learning curve for a lot of organisations.”

One of the participants – Secure Pay – expressed the necessity for leaders to be cognisant of their responsibility about ethical behaviour and decisions. Trust was again prominent in this instance.

Secure Pay: “The scandal with VW on carbon emissions etc. That was capitalistic driven ... I can guarantee you, when you are on the global scale, for me in my lifetime, I don't foresee another carbon emissions debacle happening in VW anymore. Ever. Because it's tarnished the brand. They've got a huge fine for it etc. But as a consumer that owns VW, you question the next time you buy a VW or are you going to buy VW because they did this and the carbon emissions that's given out in the Ozone ... You think about your children. What life are they going to live? So, it's a whole ripple effect from business throughout the generations and all of your decision-making. And that's why this whole environment is complex. And as a person knowing that the debacle happened with VW, I'm in two minds of next time I buy a vehicle. Do I buy a VW? Yes or no? ... Would I go for a cleaner alternative? ... Leaders that make decisions today are going to affect generations from now and they need to be able to make ethical responsible decisions in a business. And that's where you can keep and be authentic in building that trust relationship with your customer.”

#### 5.5.1.4 *The IoT Vision*

a) Finally, the culmination of the IoT into the envisioned paradigm of a fully interconnected and integrated environment was a theme that emerged from these discussions. The participants voiced belief that the present disorganised state of the IoT would slowly converge as more engagement and participation occurs, and more products and/or services are introduced and combined into more relevant and real solutions for organisations, individuals, and society. A more pronounced and visible presence would allow for the proposed paradigm to be realised.

MNO 1:” [Presently] it looks like an organised mess and this is more or less what it is ... You start small ... A smart suburb ... Change that suburb. Now the thing is automated and then starts to work and you make it bigger and bigger and bigger ... You don’t walk in tomorrow to build a smart city. In a perfect world, you try and do it in one go but its not ... First go to utilities, water, gas, and electricity. You get that right. Then if you're lucky, you get the roads right. You get traffic lights.”

b) The participants expressed that this would require greater sharing of information. It was observed that there was an emphasis for business to push the development of products and/or services and to create demand for real solutions.

Telecoms Solutions: “For IoT to make the impact that we expect it to make with all these forecasts, it needs to start being more prolific ... As that starts happening, more and more information is shared. More services become available. More problems are identified that you never knew about that you can start introducing ... The proliferation of it becomes a reality where the gimmicky stuff makes more sense ... That then becomes a caveat to getting to a point where smart cities become a reality instead of just this pie in the sky of disintermediated services.”

c) The participants expressed that real solutions to problems existed. They were found to be context and situation dependent. One participant – MNO 1 – expressed that First world problems require first world solutions and third world problems require third world solutions. This was expressed to illustrate that available technology can be applied everywhere but that solutions had to address the issues first. This reiterated earlier findings – problem first, solution second, and use of available technology third. Technology enabled solutions were effective and successful if relevant to the context and situation into which they were created and introduced. The confluence of various

factors has allowed for relevant solutions to emerge in some countries. For example, the development of effective technology enabled and enhanced security solutions were observed to be an appropriate response to the crime problem in South Africa.

MNO 1: “Some people in South Africa have no running water and we're talking about solutions for smart lights? ... What's the biggest issue in Europe when they look at smart cities? Waste management. In SA that is the last thing. We look at security. So there [in Europe], they're big issues. Waste Management? Honestly, we have it as well but it's not that big for us ... How do I apply a waste management state of the art solution in Nigeria? It can't work. But can I apply IoT in Nigeria? Yes. What? In health, how do they get the drugs to a remote area to make sure that vaccines are at the right temperatures, so I can save life? That's not relevant for Europe. They have hospitals and clinics that are working ... A low-key health solution it's not relevant for Europe ... I can still apply my technology but it is in a completely different way.”

IoT Connect: “Big driver of IoT innovation in South Africa is crime ... Putting the big crime problem together with the good engineering skills that SA has ... We really are producing world class security IoT products ... Why you would someone in Australia even bother with building it or America? It's not a big problem there ... Much bigger problem here that people are trying to solve with technology.”

### **5.5.2 Summary of Impacts and Implications: Employment, Relationships, Trade-Offs in Decisions, and the IoT Vision**

Employment was a polarising theme for the participants. There was a consensus amongst the participants that employment would be impacted. Positive responses were observed if the deployment of technology complemented and/or improved current circumstances. Negative responses were observed and experienced – MNO 2 and IoT Connect – where task-orientated employment had been substituted. This was notable consequence of technology-driven low-cost strategies. The role of leadership emerged as an important factor. The decision making process required a delicate balance between the impact of technology on the organisation with regard to competitive advantages and improved company performance, and the impact of technology on employees. Two extended excerpts from two participants were included – Secure Pay and Digital Solutions 2. These participants provided views that addressed the need for

empathy as well as the need for consideration of long-term socio-economic ramifications when discussing the theme of technology impacts on employment.

Despite the advancements, presence, and use of technology to enable engagements, the fundamental principles of product performance and service provision were expressed to remain unchanged. If relationships were mismanaged and if trust was compromised, resistance behaviours were expressed to emerge. Examples that illustrated various levels of data mismanagement were given – Cambridge Analytica, spamming, unauthorised profiling, third party sharing of information. Respectful reciprocal behaviour was expected with regard to ease of data exchange and subsequent use. Any breach of written and/or psychological contracts were seen to invoke resistance behaviours.

Responsible leadership was emphasised by the participants in creating and building both value and trust. Authenticity in purpose, intention and action were observed to be vital for continued trust and engagement with organisations. Failure to follow ethical principles was illustrated by examples given by one of the participants – Secure Pay and the VW carbon emissions scandal.

Finally, the formation of a fully functional and integrated environment was discussed – a smart city. The current disorganised state of the environment presented with developing pockets both in South Africa and abroad. There was an emphasis from the participants that the continued development would require a push from business to continue to develop products and/or services and to create demand for real solutions. It was observed that the element of continued data exchange was required and that this required relationships and trust to be managed appropriately in this regard. The development of relevant solutions were found to be situation and context dependent. The approach found in previous findings was reiterated in these instances – problem first, solution second, and use of available technology third.

## **5.6 CONCLUSION**

Chapter 5 presented the research findings based on the three research questions proposed in Chapter 3 of this research study. Chapter 6 follows with a discussion of these results.

## **CHAPTER 6: DISCUSSION**

### **6.1 Introduction**

Chapter 6 provides a detailed discussion from an analysis of the results that were presented in Chapter 5. The results are discussed in relation to each research question.

First, the discussion provides insights into the presence and relevance of resistance behaviours to innovations within issues and/or challenges of the IoT. Second, the discussion provides insights into the mechanisms in which more effective market outcomes can be achieved in this environment and through this technology. Third, the discussion provides insights into the impacts and implications of implementation and use that require consideration with regard to resistance behaviours and the IoT.

In comparing these insights with the extant literature, Chapter 6 adds to the existing body of knowledge on innovation resistance behaviours as well as to the growing body of knowledge with regard to the IoT. Through this approach and perspective, the researcher hoped to provide insights that would assist business strategies and models in realising competitive advantages and improving company performance.

### **6.2 Discussion of Research Question 1**

**Have innovation resistance behaviours been identified by organisations within issues and/or challenges of the IoT?**

#### **6.2.1 Relevance**

The results revealed that the concept of resistance behaviours towards innovations within the context of the IoT was a relevant discussion. The results confirmed the presence of these behaviours within the identified technology-related and business-related issues and/or challenges that had been highlighted as areas of possible concern in the academic literature review – Chapter 2.

These findings supported calls from authors in the academic literature calls for re-engagement with this concept and to explore its transferability within other contexts such as the IoT (Kleijnen et al., 2009; Lapointe & Rivard, 2005; Laukkanen, 2016).

## **6.2.2 Technology-Related Issues and/or Challenges**

### *6.2.2.1 Connectivity and Interoperability Issues*

The results unsurprisingly confirmed the existence of technology-related issues that have been described in the academic literature (Reaidy et al., 2015; Thiesse et al., 2011). These findings were supported by the academic literature in that connectivity is fundamental to the functioning of the IoT and that issues and/or challenges need to be addressed to ensure the environment has the ability to function as required (Botta et al., 2016; Lee & Lee, 2015).

Slow, poor or even failed connectivity, would impact the ability of a device, object or thing to be part of the IoT. This was observed to receive a negative response. The functional use barrier would emerge and result in varying degrees of resistance behaviour that have been described in the academic literature (Fournier, 1998; Kleijnen et al., 2009).

Scenarios involving infrastructure issues and capacity bandwidth saturation were described by the participants, which supported similar areas of concern mentioned in the academic literature (Botta et al., 2016; Lee & Lee, 2015). Notably, participants from Europe did not place as much of an emphasis on these connectivity issues as their South African counterparts. Therefore, this suggested that connectivity issues may be more of a concern in certain locations and need to be practically and initially considered before a solution, product and/or service is introduced under these circumstances.

A potential issue was described by one of the participants – IoT devices – where cross over of connectivity frequencies may interfere and produce unintended but severe consequences in an interconnected system. Therefore, this was observed to support authors in the academic literature that view trust in the functioning of technology as a requirement for acceptance and adoption (Hengstler et al., 2016; Karahanna et al., 2006; Lee & Moray, 1992). This example also illustrated the potential knock-on effects within an interconnected system.

Therefore, the researcher found that the impact of issues and/or challenges with Internet connectivity could invoke resistance behaviours to emerge towards the environment from which possibly viable solutions, products and/or services are launched. Trust in the functioning, presence, and performance of connectivity, were

found to be of importance with regard to the concept of resistance behaviours within this context of the IoT.

Similar findings concerning interoperability issues and/or challenges were found. Vertical OEM solutions and business models – used for a competitive advantage – were confirmed as an observed explanation for the lack of standardisation in the environment. One of the participants – Digital Solutions 1 – was able to illustrate and highlight the lack of integration between products and/or services with the relatable example of Apple devices and their isolated iOS platform that does not allow for integration with Android based devices and/or platforms. These findings found support by authors in the academic literature (Chan, 2015; Westerlund et al., 2014).

It was observed that these interoperability concerns complicated the potential as well as the value of a desired interconnected and integrated system. These observations found support from several authors in the academic literature (Al-Fuqaha et al., 2015; Atzori et al., 2010; Chan, 2015; Gubbi et al., 2013; Koshizuka & Sakamura, 2010; Lee & Lee, 2015; Miorandi et al., 2012; Westerlund et al., 2014; Whitmore et al., 2015; Wortmann & Flütcher, 2015). It was observed that the functional use barrier would again be invoked under such circumstances, and result in an unfavourable response to a viable solution, product and/or service.

Therefore, technology-related issues and challenges were found to impact the value proposition of the environment. Negative impacts would allow for described functional and psychological barriers to emerge, and for varying levels of resistance behaviours to ensue (Fournier, 1998; Gatignon & Robertson, 1985; Herbig & Day, 1992; Kleijnen et al., 2009; Laukkanen, 2016; Mani & Chouk, 2017; Patsiotis et al., 2013; Ram, 1989; Ram & Sheth, 1989; Szmigin & Foxall, 1998; Woodside & Biemans, 2005). Therefore, the environment from which solutions, products and/or services are introduced requires consideration to effect better outcomes.

#### 6.2.2.2 *Security and Privacy of Data*

The emphasis on cybersecurity issues and data privacy concerns by multiple authors in the academic literature (Atzori et al., 2010; Hsu & Yeh, 2017; Juels, 2006; Mani & Chouk, 2017; Whitmore et al., 2015; Weber, 2010) was supported by findings in this research study. All of the participants confirmed multiple points of concern that have been targets for a number of cybersecurity attacks. One of the participants – IoT Solutions – provided an account of a temperature sensor as the point of entry to a

casino's main financial system to illustrate the vulnerability of many interconnected systems. Similar scenarios raised questions with regard to liability and responsibility for cybersecurity breaches and further highlighted the risks involved.

The exposure of professional and/or personal data was of most concern and supported similar findings by authors in the academic literature (Lee & Lee, 2015; Miorandi et al., 2012). The findings supported the emergence of functional risk barriers in these scenarios due to the potential and/or actual harm caused to an organisation or individual (Gatignon & Robertson, 1985; Herbig & Day, 1992; Kleijnen et al., 2009; Laukkanen, 2016; Mani & Chouk, 2017; Patsiotis et al., 2013; Ram & Sheth, 1989; Szmigin & Foxall, 1998; Woodside & Biemans, 2005). Psychological and cognitive barriers to the discontinuity that may follow, were observed under these circumstances.

These barriers have been well described in the academic literature (Fortin & Renton, 2003; Gatignon & Robertson, 1985; Heidenreich & Handrich, 2015; Heidenreich & Kraemer, 2015, 2016; Herbig & Day, 1992; Kleijnen et al., 2009; Laukkanen et al., 2009; Laukkanen, 2016; Mani & Chouk, 2017; Molesworth & Suortti, 2002; Patsiotis et al., 2013; Ram & Sheth, 1989; Talke & Heidenreich, 2014). These findings suggested that the gravity of the impact has the potential to influence the emergence of varying degrees of resistance behaviour. This was found to support the continuum of resistance described in the academic literature (Fournier, 1998; Kleijnen et al., 2009).

Lower levels of engagement and participation have been described in the academic literature if security and privacy of data are threatened (Atzori et al., 2010; Gubbi et al., 2013; Lee & Lee, 2015; Miorandi et al., 2012; Whitmore et al., 2015). Therefore, it was observed that the development and creation of trust in the technology, described by numerous authors in the academic literature literature (Hengstler et al., 2016; Karahanna et al., 2006; Lee & Moray, 1992; MacVaugh & Schiavone, 2010; Wejnert, 2002), is central to the value proposition of the environment. These observations were aligned to similar findings with regard to technology-related concerns of connectivity and interoperability.

### **6.2.3 Business-Related Issues and Considerations**

#### *6.2.3.1 Apprehension and General Uncertainty*

The results revealed that there is some general reluctance surrounding new technologies. The technology was perceived as still developing despite the push and

hype from industry and competitors to engage with the technology and participate within the environment. The findings revealed that the learning curve associated with this perception was a potential reason for the observed apprehension. These observations support authors in the academic literature that have expressed a lack of precedents with which to assist organisations with decisions involving new technologies (Chan, 2015; Dijkman et al., 2015; Fichman et al., 2005; Lee & Lee, 2015; Westerlund et al., 2014).

The findings also revealed an inclination to preserve the status quo under certain conditions. This was observed to be present within personal risk decisions as well as within established organisations. This form of passive resistance behaviours has been well described by several authors in the academic literature (Heidenreich & Handrich, 2015; Heidenreich & Kraemer, 2015; Heidenreich & Spieth, 2013; Talke & Heidenreich, 2014).

#### 6.2.3.2 *Internal Cost Saving*

The findings revealed that the cost-benefit analysis requires practical consideration with regard to new technology adoption and technology-driven cost saving initiatives. The findings revealed that high capital investments comprised of vertical OEM solutions and their specific hardware devices, software platforms, cybersecurity measures, and upgrades to equipment and old facilities. Therefore, the described value barrier was found to be of importance in these instances (Gatignon & Robertson, 1985; Herbig & Day, 1992; Kleijnen et al., 2009; Laukkanen, 2016; Mani & Chouk, 2017; Patsiotis et al., 2013; Ram & Sheth, 1989; Szmigin & Foxall, 1998; Woodside & Biemans, 2005).

Notably, other factors that may result in a lack of engagement were also provided. One of the participants – IoT Solutions – was able to highlight the consideration of broader macro-economic and geo-political concerns in this regard. Therefore, these findings revealed that business adoption and implementation are not guaranteed due to uncertainties that can complicate the cost-benefit analysis. The impact of high costs and the incomplete value of a partially interconnected system were observed as concerns from which described resistance behaviours would emerge from functional and value barriers.

### 6.2.3.3 *External Revenue Generation*

The results showed the complexity of the consumer IoT market. The findings revealed that general difficulties with product and/or service introductions were also present – barriers to entry, the need for distribution channels, advertising, marketing, and partners. Two of the participants – IoT Connect and MNO 2 – expressed recent failures, which highlighted the documented failure rates in the academic literature (Castellion & Markham, 2013; Heidenreich & Kraemer, 2016). Observed slower than predicted adoption in the consumer market was found to support assertions from the academic literature that the mere presence of an innovation does not guarantee success (Porter, 1985; Sirdeshmukh et al., 2002).

The results revealed that the cost-benefit and/or risk-reward analysis was central in these engagements. Therefore, partially providing an explanation for the poor adoption rates expressed by the participants. This described functional value barrier parallels the aforementioned cost-benefit analysis that organisations consider with regard to technology-driven cost saving strategies (Gatignon & Robertson, 1985; Herbig & Day, 1992; Kleijnen et al., 2009; Laukkanen, 2016; Mani & Chouk, 2017; Patsiotis et al., 2013; Ram & Sheth, 1989; Szmigin & Foxall, 1998; Woodside & Biemans, 2005). It was observed that high costs and low affordability possibly restrict the availability, accessibility, and use of products and/or services, to certain higher income brackets.

The findings postulated that novelty and/or entertainment were the current drivers or motivations for adoption and use in the consumer market. It was observed that concerns and possible distrust in technology existed beyond these purposes. These findings support the need for trust in the intention and purpose of technology that has been described by authors in the academic literature (Castelfranchi & Falcone, 2000; Ghazizadeh et al., 2012; Hengstler et al., 2016; Karahanna et al., 2006; Lee & Moray, 1992; Lee & See, 2004; Slovic, 1993). One of the participants – Digital Tech – provided a scenario where the ability to trust autonomous technology to run a baby's bath water was questioned.

Further examples were given by the participants that again illustrated scenarios where the presence of described functional and psychological barriers would allow for resistance behaviours to emerge. These included descriptions of digital and/or physical intrusiveness through Alexa home assistants and even Google Maps – these examples were provided by Insure and IoT Devices respectively. Technological advances were also found to challenge traditional beliefs and value structures. For example, one of the

participants – MNO 1 – questioned the replacement of reading and books by digital assistants. These findings revealed that adoption and use was present despite the presence of these varied concerns and supported the described dichotomy of the existence of both adoption and resistance in the lifetime of an innovation (Ram, 1987).

#### **6.2.4 Summary of the Discussion of Research Question 1**

In answering Research Question 1, the findings established that innovation resistance behaviours were present in the context of identified and multiple technology-related and business-related issues and/or challenges with the IoT. These findings have shown that the concept of innovation resistance is transferable and relevant to the context of the IoT. Therefore, the results of Research Question 1 have affirmed calls from authors in the academic literature to re-engage with the concept of innovation resistance behaviour and to garner deeper insights into the issues and/or challenges within the IoT context (Heidenreich & Kraemer, 2015; Lee & Lee, 2015; Mani & Chouk, 2017; Patsiotis et al., 2013; Porter & Heppelmann, 2014; Schneider & Spieth, 2013).

Specific issues and/or challenges and circumstances invoking resistance behaviours were expressed in the findings, which supported observations and descriptions in the academic literature. These included examples with regard to connectivity, interoperability, and the security and privacy of data. Further examples involving internal cost savings and external revenue generation were also provided.

These findings showed that the impact of the issue and/or challenge experienced would determine the subsequent response and behaviour. The response along the described continuum of resistance varied dependent on the impact and context. It was notable that the gravity of the impact would influence a greater response – for example, in terms of cybersecurity threats. This observation found support amongst authors in the academic literature (Kleijnen et al., 2009; Laukkanen, 2016).

The findings revealed that other factors were possibly responsible for the presence of resistance behaviours. These included conditions that did not involve specific aspects of the IoT – namely macro-economic and geo-political scenarios, the infancy of the technology and environment, and general factors affecting entry and introduction of products and/or services to the consumer market.

The findings revealed that the cost-benefit and/or risk-reward analyses were prominent in decisions about adoption versus resistance. High costs and greater risks were observed to be associated with varying degrees of resistance behaviours. It was

observed that the value proposition was a focal area that could sway engagement levels. The findings also revealed that the underlying theme of trust was an important consideration. If trust was compromised in any of these instances, irrespective of the value proposition, resistance behaviour would emerge.

The findings also showed that adoption and resistance can co-exist and provided support for the academic literature in this regard (Chiesa & Frattini, 2011; Heidenreich & Kraemer, 2016; Heidenreich & Spieth, 2013; Kleijnen et al., 2009; Ram, 1987, 1989; Ram & Sheth, 1989). The lack of complete and/or continuous adoption and the presence of failures strengthens the argument against the pro-change bias in the academic literature (Heidenreich & Kraemer, 2016; Heidenreich & Spieth, 2013; Kleijnen et al., 2009; Laukkanen et al., 2008; Laukkanen, 2016; McKnight et al., 2002; Ram, 1987; Rogers, 2003; Speier & Venkatesh, 2002; Talke & Heidenreich, 2014).

Therefore, even though the issues and/or challenges within this context may not be all encompassing, the presence of innovation resistance behaviours highlights that this phenomenon is still relevant and may provide insights to assist with improved acceptance and adoption of solutions, products and/or services. Therefore, this discussion about the results of this research study provides support to authors in the academic literature for warranted re-engagement with this concept and its underlying constructs (Kleijnen et al., 2009; Lapointe & Rivard, 2005; Laukkanen, 2016).

This discussion also supports calls from other authors in the academic literature for further research into the issues and/or challenges with regard to new technologies to help inform decisions regarding their applicability and more effective implementation (Lee & Lee, 2015; Patsiotis et al., 2013; Porter & Heppelmann, 2014; Schneider & Spieth, 2013).

### **6.3 Discussion of Research Question 2**

**How have innovation resistance behaviours within issues and/or challenges of the IoT been addressed by organisations in creating competitive advantages and improvements in company performance?**

### **6.3.1 Addressing Technology-Related Issues and/or Challenges**

#### *6.3.1.1 Addressing Issues and/or Challenges: Connectivity and Interoperability*

The findings showed that technological advancements have assisted with the addressing of technology-related issues and/or challenges. For example, the development of Wi-Fi connectivity has increased the accessibility to Internet connectivity and allowed for areas to “leap-frog” technology milestones. Smaller data packets have decreased the size of collected data and decreased the burden of oversaturation of low bandwidth networks. This has increased collection and transfer speeds, and decreased issues with action latency. It was observed that these developments have created conditions for an environment in which an interconnected system can exist and function. Therefore, the value proposition of the environment, from which to introduce solutions, products and/or services, has improved under these conditions.

The findings also revealed the ability of connectivity service providers – Telecoms and MNOs – to capitalise on their existing competencies in connectivity with the monetisation of this fundamental requirement. It was also observed that other organisations had been able to consolidate the different network coverage areas of multiple service providers to improve the consistency, reliability and network coverage, of connectivity for end-users.

This approach with regard to consolidation was also observed with issues and/or challenges related to interoperability. Horizontal aggregation of vertical OEM solutions were now able to show the greater value associated with a more integrated environment and/or system. The agnostication and commoditisation of devices have also assisted in this regard. Finally, technological advancements of greater autonomy on the edge, have also lowered action latency concerns and improved the value proposition for interconnected environments and/or systems. The findings showed that technological innovation can enable organisations a chance at reinvention and/or new market opportunities, which supported authors in the academic literature (Porter, 1985; Sun et al., 2012).

It was observed that these developments had lowered the barriers for engagement and participation, and had were elements to consider in assessing an environments’ positioning for acceptance, adoption, and use. It was observed that there were participants who created or ensured the functioning of the environment and/or system

for suppliers and/or consumers of solutions, products and/or services within the environment. Competitive advantages had been forged by organisations ensuring and providing fundamental elements to the existence of the environment and/or system, and by suppliers utilising the enabled capabilities of the environment to enhance their value propositions to end-users.

It was observed that problems had been identified and solutions implemented with technology that was available. Therefore, these findings supported calls from authors in the academic literature for approaches to inform business strategies and models within this context (Casadesus-Masanell & Ricart, 2010; Chan, 2015; Dijkman et al., 2015; Hsu & Yeh, 2017; Metallo et al., 2018; Whitmore et al., 2015).

#### 6.3.1.2 *Addressing Issues and/or Challenges: Security and Privacy of Data*

The results showed that technological advancements have assisted with the abilities to launch cybersecurity attacks and to protect against them. The incidence and prevalence of breaches and hacks have surfaced issues that have been countered with multiple options in cybersecurity. It was observed that cybersecurity providers – such as AWS and Microsoft Azure – have enhanced the value proposition of the environment and/or system. This ability to provide protection in an environment and/or system was observed to reduce apprehension and resistance behaviours that may be present under contrasting circumstances. This observation supported several authors in the academic literature that have found that trust and the credibility of known entities are important considerations with regard to countering resistance behaviours (Hengstler et al., 2016; Herbig & Day, 1992; Kleijnen et al., 2009; Oreg, 2006; Patsiotis et al., 2013).

The findings also showed that the emergence of formal regulations – South African POPI Act and the European GDPR – has legitimised the presence and broader acceptance of this environment. The rules embodied within these regulations was also observed to assist with greater confidence from stakeholders with this environment as well as with organisations that acted in accordance of these rules and regulations in governance and accountability measures. It was observed that these findings support the assertion in the academic literature that greater acceptance, engagement, and participation, is influenced by instilling trust in society (Karjaluo et al., 2002; Laukkanen, 2016; Weber, 2009, 2011).

Therefore, these findings and observations conclude that an environment, conducive to acceptance, has been established for adoption and use of solutions, products and/or

services to follow. These results have supported calls from authors in the academic literature for further studies to explore perspectives in improving the effectiveness of strategies in this context (Lee & Lee, 2015; Patsiotis et al., 2013; Porter & Heppelmann, 2014; Schneider & Spieth, 2013).

### **6.3.2 Addressing Business-Related Issues and/or Challenges**

#### *6.3.2.1 Addressing Issues and/or Challenges: General Uncertainty and Apprehension*

The findings revealed that there is an industry and competitive push to engage with new technologies within a still developing environment. The findings revealed that this is occurring without an established or comprehensive understanding of how to utilise and leverage the capabilities inherent to the technology. Therefore, these findings supported calls from authors in the academic literature to explore concepts as well as practical approaches that could inform applicability and more effective implementation (Casadesus-Masanell & Ricart, 2010; Dijkman et al., 2015; Lee & Lee, 2015; Patsiotis et al., 2013; Porter & Heppelmann, 2014; Schneider & Spieth, 2013; Whitmore et al., 2015).

The focus on the hype and on the actual technology was seen to cloud judgement from a simple problem-to-solution orientated approach. Fundamentals of identifying the problem first were advocated, followed by possible solutions to the issue, with which available technology could be used to assist. This was observed to be similar to the approaches used with regard to addressing technology-related issues and/or challenges.

#### *6.3.2.2 Addressing Issues and/or Challenges: Internal Cost Saving*

The findings showed that the cost-benefit analysis was central under conditions involving internal cost saving strategies. The commoditisation of devices and the consolidation of vertical OEM solutions have assisted with lowered costs on the cost-side of the equation. Therefore, solutions for technology-driven cost savings have become more affordable. The value proposition or benefit-side of the equation was found to be the focus in discussed scenarios. Trials, POCs, and business cases with use of collected data, supported suggested mechanisms in the academic literature to justify the value of these proposals (Debruyne et al., 2002; Heidenreich & Handrich, 2015; Heidenreich & Kraemer, 2015; Heidenreich & Spieth, 2013; MacVaugh &

Schiavone, 2010; Ram & Sheth, 1989). The ability to tailor and develop solutions with customer feedback was also found to support continued stakeholder engagement advocated by authors in the academic literature to create and further relationships and trust (Ghazizadeh et al., 2012; Hengstler et al., 2016; Lee & See, 2004).

The ability to collect data for analysis and extrapolation has also assisted with justification of more demonstrable and predictable returns (Hui, 2014; Fichman et al., 2005; Lee & Lee, 2015). This was observed to decrease the emergence of resistance behaviours such as with the personal risk involved in technology-related acquisition decisions and even with the stagnant inertia found in established practices and organisations. It was observed that these mechanisms demonstrated and proved value but also increased the influence of trust in the ability of the proposed solution to deliver competitive advantages and improved company performance. Therefore, trust was again observed to be a vital component to the value proposition, which supported findings by several authors in the academic literature (Ghazizadeh et al., 2012; Lee & See, 2004; Rousseau et al., 1998; Sirdeshmukh et al., 2002).

#### 6.3.2.3 *Addressing Issues and/or Challenges: External Revenue Generation*

The results showed that the cost-benefit and/or risk-reward analysis was a central consideration in business approaches to the consumer market. The findings recognised the effect of diminishing returns from cost saving strategies, and the need to seek external revenue generation. These observations found support from authors and previous studies in the academic literature (Dijkman et al., 2015; Heidenreich & Kraemer, 2016; Martin et al., 2016; Miorandi et al., 2012; Porter, 1985; Prins & Verhoef, 2007).

The results showed that methods focused on revenue generation could be enabled through the presence and use of available technology. Differentiation and competitive advantages were possible in an environment where acceptance of new technologies had been established. This observation was succinctly expressed by one of the participants – IoT Devices:

IoT Devices: “ In business it’s certainly something that is far more conscious. As an individual it’s just there.”

It was observed that the existence and extensive presence of new technologies in everyday lives was in part due to a combined business push and consumer demand for new technological features on products and/or services. Enhanced connectivity and

interoperability were found assist in positively influencing on the value proposition of offered products and/or services in these settings. These findings lent support to the technology acceptance and diffusion literature (Davis et al., 1989; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000; Venkatesh et al., 2003).

However, the findings have established and supported the academic literature in that adoption and resistance can concurrently exist, and that an emphasis on these adoption-related characteristics may not be enough to defer the emergence of resistance behaviours (Chiesa & Frattini, 2011; Fortin & Renton, 2003; Heidenreich & Kraemer, 2016; Heidenreich & Spieth, 2013; Kleijnen et al., 2009; Ram, 1987, 1989; Ram & Sheth, 1989). Therefore, it was observed that insights gained through mechanisms to counter the emergence of resistance behaviours, supported calls from authors in the academic literature for research into approaches to effect better use of new technologies (Casadesus-Masanell & Ricart, 2010; Chan, 2015; Dijkman et al., 2015; Hsu & Yeh, 2017; Metallo et al., 2018; Whitmore et al., 2015).

It was observed that the resource of exchange in this environment was of collected data from enabled devices. The findings revealed that an environment for ease of data exchange had been established through a combination of influences and developments. However, the ease of which data was exchanged in this environment was found to be in contrast to the expressed gravitas assigned to the safety and security of collected data. For example, convenience in return for products and/or services illustrated this finding. One of the participants – Digital Tech – provided an example to illustrate the presence of convenience and framing to reduce resistance behaviours towards monitoring and tracking.

Framing or the communication of value has been advocated by authors in the academic literature to assist in the creation of trust to decrease the presence and emergence of resistance behaviours (Hengstler et al., 2016; Herbig & Day, 1992; Kleijnen et al., 2009; Oreg, 2006; Patsiotis et al., 2013; Ram, 1989; Slovic, 1993). The example of UberEATS (Hui, 2014) also illustrates this observation where financial details, personal identification, and geographic location, have been exchanged for the experience of a convenient product and/or service in this interconnected environment.

The generational shift and the presence of a diverse range of age groups – Baby Boomers, Generation X's, and Millenials – have been suggested by authors in the academic literature to influence both adoption and resistance behaviours (Ram, 1987; Laukkanen, 2016; Laukkanen et al., 2007; Moschis, 2003). The findings supported the

academic literature in this instance. This favourable environment for data exchange was found to be influenced by the growing presence of younger generations within society. The findings supported observations by authors in academic literature of the influence of social trustworthiness in the acceptance and adoption of new technologies (MacVaugh & Schiavone, 2010; Wejnert, 2002). The researcher also observed that this generational shift has also resulted in changes in mechanisms with which society interacts. Social media and forms of communication – WhatsApp – have grown in use and become the new norm for individuals to remain participants within society.

The findings showed that the convergence of these multiple factors has assisted with the development of an environment accepting of and requiring ease of data exchange. The findings revealed that connected technology merely enables engagements and interactions and allows for data exchanges to occur. The findings also revealed that perceived risks and associated resistance behaviours about data exchange through enabled technologies have been reduced. Therefore, a favourable environment has developed and is present for available technology to be utilised by organisations to engage with individuals and society.

The issue of cost – described in Section 5.3.3.3 – alluded to the challenge of affordability that may affect greater penetration into the consumer market. Under these circumstances, there was an observed focus on the value-side of the cost-benefit and/or risk-reward equation in attempts to influence and engage individuals. The findings revealed that collected data through enabled devices was of most relevance for businesses, and where data analysis and pattern recognition could be followed by innovative and effective utilisation. Examples were provided in targeted advertising and marketing, as well as customised offerings to illustrate these findings. Therefore, the findings showed that existing methods used to influence behaviours could be enhanced through available technology.

Even more nuanced approaches were described in the findings that placed emphasis on relevant concerns or motivations to influence greater engagement and participation – for example, discretionary income, and health and family predicaments. These drivers and/or levers were found to be creatively combined in reward and incentive based programs that increased the perceived value of the products and/or services.

The findings revealed that these programs needed to be tailored in intention and purpose under certain cultural circumstances and/or tailored with regard to reward or incentive positioning to effect greater engagement and participation. For example,

corporate wellness programs scientifically supported by evidence based medicine were better received in certain cultures when compared to others, and for example, corporate leave days were found influence greater engagement in certain cultures when compared to others. The findings also revealed that the current accepted use of enabled technologies for novelty and entertainment purposes as well as for social participation and communication, had been creatively incorporated into these mechanisms to influence engagement and participation. For example, micro-rewards combined with gamification and online social communities.

The findings also revealed that these enhanced mechanisms could be performed individually by organisations with a firm-centric focus or within partner networks and ecosystems. Both methods in the pursuit of competitive advantages have been supported by authors in the academic literature (Chan, 2015; Hui, 2014; Metallo et al., 2018; Möller et al., 2005; Westerlund et al., 2014; Whitmore et al., 2015). However, the findings showed that there was an emphasis on partnerships and networks within this environment to create and capture value. The interconnected nature of the IoT was found to be aligned to these structures.

Ecosystems were found to be mutually beneficial for stakeholders involved. Value propositions for consumers were increased through greater access to multiple products and/or services. The improved price-to-performance benefits from partners within the network was observed to influence greater engagement. The findings showed that partner organisations benefitted from shared resources and distribution channels, as well as the potential for economies of scale and scope. These findings suggested that ecosystems presented an effective mechanism to organisations who were unable to overcome resistance behaviours individually.

The findings also showed that the emergence of ecosystems would raise the barriers to entry against competitors based on these network effects and also force organisations to compete in this manner. These observations supported authors in the academic literature who have expressed that opportunities for some organisations can disrupt others (Porter, 1985; Sun et al., 2012) as well as other authors who have suggested that a shift from traditional firm-centric to ecosystem-based business models are required for organisations to remain competitive within this environment (Chan, 2015; Hui, 2014; Metallo et al., 2018; Möller et al., 2005; Westerlund et al., 2014; Whitmore et al., 2015).

However, authors in the academic literature have found that ecosystems develop over time and during early stages may lack the required structures and/or partners to be properly positioned for value creation and capture (Hui, 2014; Metallo, 2018; Möller et al., 2005; Whitmore et al., 2015). Therefore, the presence of still developing ecosystems within an immature environment lacking these elements may also provide some explanation to the expressed lower than expected levels of adoption in the findings.

However, results have shown that effective implementation of new technologies is possible within an environment that has accepted their presence and use. These approaches were observed to provide an enhanced and compelling argument to trigger engagement and trust, which supported authors in the academic literature (Ghazizadeh et al., 2012; Heidenreich & Handrich, 2015; Heidenreich & Kraemer, 2015; Heidenreich & Spieth, 2013; Hengstler et al., 2016; Kleijnen et al., 2009; Laukkanen, 2016; Lee & See, 2004; Ram, 1987; Talke & Heidenreich, 2014).

Therefore, these findings show support for calls from authors in the academic literature to explore more effective use of new technologies through approaches used to counter the presence and emergence of innovation resistance behaviours (Chan, 2015; Casadesus-Masanell & Ricart, 2010; Dijkman et al., 2015; Lee & Lee, 2015; Metallo et al., 2018; Patsiotis et al., 2013; Porter & Heppelmann, 2014; Schneider & Spieth, 2013; Whitmore et al., 2015).

However, the findings also revealed that resistance behaviours may still emerge despite these approaches and mechanisms. Ecosystems present a situation wherein “lock-in” principles exist – namely where individuals are bound by the network effects inherent to the system. However, even though these principles afford protection to partner organisations within these ecosystems through raised switching costs for consumers, organisations still need to be cognisant of fundamentals that govern engagements and interactions for resistance behaviours to remain silenced. This need to consider factors affecting stakeholder engagement has been expressed by authors in the academic literature (Chan, 2015; Möller et al., 2005; Westerlund et al., 2014). These circumstances and instances are explored further in the discussion of Research Question 3.

### **6.3.3 Summary of the Discussion of Research Question 2**

Research Question 2 aimed to assess approaches been used by organisations to address identified issues and/or challenges within the context of the IoT. Research Question 1 identified the presence and relevance of the concept of innovation resistance in these instances.

The findings showed that specific technology-related issues and/or challenges had been addressed through technological advancements and by organisations identifying areas of concern and utilising available technology to effect solutions. The findings revealed that the apprehension and general uncertainty about new technologies was lessened with a simple approach that shifted the emphasis away from technology. A problem-to-solution orientated perspective was emphasised in the findings to reduce the reluctance associated with this rapidly-changing environment – problem first, solution second, and use of available technology third.

In addressing specific concerns with regard to connectivity, interoperability, and data security and privacy, The findings showed that an environment has been created from which solutions, products and/or services could be introduced. A functioning environment is required to allow for effective introductions. Connectivity is of primary importance. Issues and/or challenges can be addressed to improve the functioning of connectivity, however, if connectivity is not present resistance behaviours are invoked. Interoperability assists in the enhanced functioning of solutions, products and/or services, however, introductions are still possible without this capability even though greater interoperability is preferred. Security and privacy of data is a requirement and multiple options are available to ensure trust and engagement can occur even in the presence of these concerns.

The findings showed that organisations have benefitted from lowered costs associated with technology-driven cost saving deployments. There was an observed emphasis on the value aspect of the cost-benefit equation. More predictable, visible and justifiable outcomes through use of data with trials, POCs and business cases found support from authors in the literature to lower resistance behaviours in these instances (Hui, 2014; Fichman et al., 2005; Lee & Lee, 2015). However, operational efficiencies were found to have diminishing returns in the results and supported authors in the academic literature that have expressed similar opinions (Dijkman et al., 2015; Heidenreich & Kraemer, 2016; Martin et al., 2016; Miorandi et al., 2012; Porter, 1985; Prins & Verhoef, 2007).

Additional revenue streams to improve company performance have been advocated by authors in the academic literature (Heidenreich & Kraemer, 2016; Martin et al., 2016; Miorandi et al., 2012; Prins & Verhoef, 2007). The results showed that the consumer IoT environment was established and favourable from which external revenue generation could be pursued. The findings showed that the presence of required new technologies within the consumer market was driven both by a business push and a consumer pull for more advanced technological features.

The main barrier observed in the academic literature review and in the findings of this research study revolved about issues of data security and privacy (Atzori et al., 2010; Hsu & Yeh, 2017; Juels, 2006; Lee & Lee, 2015; Mani & Chouk, 2017; Miorandi et al., 2012; Weber, 2010; Whitmore et al., 2015). However, a paradox was found to exist within the consumer environment despite this described and notable functional risk barrier (Gatignon & Robertson, 1985; Herbig & Day, 1992; Kleijnen et al., 2009; Laukkanen, 2016; Mani & Chouk, 2017; Patsiotis et al., 2013; Ram & Sheth, 1989; Szmigin & Foxall, 1998; Woodside & Biemans, 2005). Convenience and framing of situations were found to supersede these concerns about data security and privacy. The example of UberEATS was provided to illustrate this finding (Hui, 2014).

The generational shift – from Baby Boomers and Generation X's to Millennials – was observed to play a significant role in the development of this environment. The environment also requires data exchange to occur for access to current products and/or services. The ability to communicate as well as participate within current society were also found to be relevant factors contributing to this development. WhatsApp and social media were provided as examples in these instances. The convergence of these developments was found to reveal the influence of social acceptance.

Therefore, the findings revealed that a favourable foundation has been established from which organisations can engage individuals and society with regard to revenue generation. The cost-benefit and/or risk-reward analysis was found to be central in these approaches. Cost was identified as a possible limiting factor as affordability restricted the ability to engage with a wider audience. The value proposition was emphasised under these circumstances to lower resistance behaviours.

Technology was found to enable the ease of data exchange in this environment. Analysis of collected data and subsequent creative implementations were found to be utilised to influence greater engagement and participation through enhanced existing mechanisms such as advertising, marketing, and customised offerings. These

mechanisms and enhanced methods with which to influence engagement were channelled through these enabled and interconnected devices.

The findings also found that drivers or relevant personal motivations – for example, health and family – were recognised to be effective levers about which to incorporate into reward and incentive programs. It was also observed that these programs also leveraged the observed acceptance and use for adoption of new technologies as a means to encourage greater engagement. This was found in the use of new technologies for novelty and entertainment purposes with the gamification of micro-rewards, and their use for communication and participation in modern society with the inclusion of online social communities. The findings also revealed generic reward and incentive programs required adjustments aligned to culture and context to effect better engagement and participation. This adaptation was found with regard to both the intention and purpose of the program as well as the rewards and incentives.

The presence and existence of trust was found to be a common theme within these mechanisms to improve the value proposition and effect better outcomes. This included trust in the intention and purpose of the technology, the organisation, and the product and/or service offered. This finding found support from authors in the academic literature that have positioned trust as the element encompassing engagements and relationships (Ghazizadeh et al., 2012; Hengstler et al., 2016; Lee & See, 2004).

Finally, individual firm-centric outcomes with regard to competitive advantages and improved market outcomes were found to be possible through these enhanced mechanisms. However, partner networks and ecosystems were found to be possible and more suitable to such an interconnected environment, which supported similar views by authors in the academic literature (Chan, 2015; Hui, 2014; Metallo et al., 2018; Möller et al., 2005; Westerlund et al., 2014; Whitmore et al., 2015). The network effects from these interdependent relationships were found to enhance the value in the propositions for consumers and also enable competitive advantages for the business participants involved.

However, even though the “lock-in” principle and network effects were observed to raise the switching costs for consumers and offer some protection for organisations within these networks in this regard, the findings revealed that trust and fundamentals are essential in engagements and relationships. Research Question 3 explores these conditions in greater detail.

Therefore, in answering Research Question 2, an exploration of approaches to counter innovation resistance behaviours in addressing identified issues and/or challenges within this context has provided some insights into mechanisms used to effect better market outcomes. This has answered calls from the authors in the academic literature for business logic more suitable in this environment to effect better implementation from the IoT (Casadesus-Masanell & Ricart, 2010; Chan, 2015; Dijkman et al., 2015; Hsu & Yeh, 2017; Metallo et al., 2018; Whitmore et al., 2015).

## **6.4 Discussion of Research Question 3**

**What impacts and implications require consideration by organisations that have progressed to implementation and use of the IoT?**

### **6.4.1 Impacts and Implications**

#### *6.4.1.1 Employment*

The findings supported authors in the academic literature that the discussions about the topic of technology and employment were not new discussion but was observed to have become more prevalent due to the current hype surrounding new technologies (Lee & Lee, 2015; Zysman & Kenney, 2018). There was a consensus amongst the participants that employment would be impacted.

The findings revealed that more receptive responses were present if new technology introductions had been perceived and/or framed to be useful, practical, and logical. New technology introductions were received positively if the technology complemented and/or improved the circumstances within the current environment. These observations supported authors in the academic literature that have found acceptance is more likely where technology has been positioned to assist rather than exert power over individuals (Castelfranchi & Falcone, 2000; Ghazizadeh et al., 2012; Hengstler et al., 2016; Lee & See, 2004; Slovic, 1993).

However, the enabling abilities of technology to drive improvements in company performance and create competitive advantages through operational efficiencies and economies of scale were found to have potential negative impacts on employment. This observation supported authors in the academic literature that view positive and negative outcomes as not being inherent to technology itself but dependent on how it is

positioned (Lee & Lee, 2015; Porter, 1985; Zysman & Kenney, 2018). These findings suggest that framing and communication are required as mechanisms with which to reduce the observed fear of displacement, to contextualise the benefits, and to establish trust in the intention and purpose of new technology introductions. Trust was found to be central in these engagements and was supported by authors in the academic literature as required in lessening the emergence of resistance behaviours. (Castelfranchi & Falcone, 2000; Ghazizadeh et al., 2012; Hengstler et al., 2016; Karahanna et al., 2006; Lee & Moray, 1992; Lee & See, 2004; Slovic, 1993).

The findings revealed that negative responses and reactions have been observed where technology has substituted and/or displaced employees. Two of the participants were able to account experiences where resistance behaviour in the form of rejection and opposition were observed with regard to new technology implementation and the impact on employees – MNO 2 and IoT Connect. These findings supported the literature that revealed that employment is susceptible and vulnerable with organisational strategies geared towards cost savings and that these responses deserve consideration (Frey & Osborne, 2017; Lee & See, 2004; Zwick, 2002).

These findings were observed to support the emergence of described functional risk, and situational and cognitive barriers, that would invoke varying degrees of resistance behaviours (Fortin & Renton, 2003; Gatignon & Robertson, 1985; Heidenreich & Handrich, 2015; Heidenreich & Kraemer, 2015, 2016; Herbig & Day, 1992; Kleijnen et al., 2009; Laukkanen et al., 2009; Laukkanen, 2016; Mani & Chouk, 2017; Molesworth & Suortti, 2002; Patsiotis et al., 2013; Ram & Sheth, 1989; Szmigin & Foxall, 1998; Talke & Heidenreich, 2014; Woodside & Biemans, 2005). These findings lend further support against the pro-change bias in the academic literature as all innovations cannot be assumed to be good, and acceptance and adoption is not a given (Heidenreich & Kraemer, 2016; Heidenreich & Spieth, 2013; Kleijnen et al., 2009; Laukkanen et al., 2008; Laukkanen, 2016; McKnight et al., 2002; Ram, 1987; Rogers, 2003; Speier & Venkatesh, 2002; Talke & Heidenreich, 2014).

The findings revealed that there remains much uncertainty with regard to approaches involving new technologies and employment. The findings showed that the topic was complicated but required a balanced consideration for the impacts and implications on employees as well as the broader socio-economic ramifications. These findings supported similar observations held by authors in the academic literature (Frey & Osborne, 2017; Zwick, 2002).

#### 6.4.1.2 *Relationships*

It was observed that the development and presence of an interconnected environment through new technologies – such as the IoT – had enabled engagements and interactions. It was observed that fundamentals governing product reliability and/or performance, and service quality and/or delivery, are still required in the presence or absence of technology in this digitally enhanced era.

Despite the high switching costs involved under certain conditions – for example, in ecosystems and described network effects – that individuals would seek other similar products and/or services if these fundamentals were not met. The growth and availability of substitute products and/or services within this environment was recognised in the findings. Therefore, it was observed that resistance behaviours can emerge despite adoption and despite enhanced value propositions. If trust and the fundamentals about product and/or service provision are compromised, resistance behaviours emerge. These findings revealed that the transactional perception of engagements in this environment are inappropriate. These observations found support from authors in the literature that have found lowered levels of trust and higher degrees of resistance behaviours in poor and/or mismanaged relationships (Ghazizadeh et al., 2012; Hengstler et al., 2016; Lee & See, 2004; McKnight et al., 2002; Slovic, 1993).

Examples of mismanagement were provided in the findings with regard to data exchange. These included spamming, third party sharing of information, and unauthorised user profiling. The Cambridge Analytica and Facebook scandal was given as a prominent and relevant example by the participants as well as in the literature review (Meredith, 2018).

An environment for ease of data exchange was found to be established. The researcher observed that trust may be easily given in this environment but that reciprocal respect and care in use was expected with regard to explicit written and/or implicit psychological contracts with these engagements and interactions. The findings revealed that this mismanagement of confidential information conflicted with societal ethics and/or individual values and belief structures, which have been described by several authors in the academic literature as barriers leading to the emergence of resistance behaviours (Fortin & Renton, 2003; Gatignon & Robertson, 1985; Herbig & Day, 1992; Kleijnen et al., 2009; Laukkanen, 2016; Mani & Chouk, 2017; Molesworth & Suortti, 2002; Patsiotis et al., 2013; Ram & Sheth, 1989; Thiesse et al., 2011).

Therefore, the findings revealed that the development of distrust and/or product and/or service provision below expectations, may result in the emergence of resistance behaviours.

#### 6.4.1.3 *Trade-Offs in Decisions*

The findings showed that leaders need to balance the interests of shareholders and stakeholders in their decisions. The results were supported by authors in the academic literature that have expressed the need for decisions to be aligned in a consistent and congruent manner with the overall strategy and direction of the organisation (Chan, 2015; Porter, 1985).

The findings have revealed that leaders require not only a comprehensive understanding of the actual technology and its capabilities, the current state of the environment, and an understanding of mechanisms through which goals and objectives can be attained, but also of the impacts and implications that their decisions can have in pursuit of competitive advantages and improvements in company performance. Ethical and responsible leadership was emphasised in the findings to underlie these requirements and were found to be linked to the described principles of trust in the academic literature (Ghazizadeh et al., 2012; Hengstler et al., 2016; Lee & See, 2004).

Leaders and their organisations are more exposed in such an interconnected and interactive environment where social influence plays a major role in the continued success and sustainability of these organisations. Examples provided in the findings – for example, Facebook and VW – were supported by several authors in the academic literature that have expressed similar views on social influence, trust, and organisational outcomes (Ghazizadeh et al., 2012; Hengstler et al., 2016; Herbig & Day, 1992; Karahanna et al., 2006; Karjaluoto et al., 2002; Kleijnen et al., 2009; Laukkanen, 2016; Lee & Moray, 1992; Lee & See, 2004; Oreg, 2006; Patsiotis et al., 2013; Slovic, 1993; Weber, 2009, 2011).

#### 6.4.1.4 *The IoT Vision*

The findings showed that the IoT envisioned paradigm described by several authors in the academic literature, currently presents in a disorganised fashion (Atzori et al., 2010; Gubbi et al., 2013; Lee & Lee, 2015; Metallo et al., 2018; Miorandi et al., 2012; Whitmore et al., 2015; Wortmann & Flütcher, 2015). The researcher observed that greater engagement and participation are requirements for a completely

interconnected and integrated environment to be realised – for example, a smart city. However, engagement and participation require trust and responsible reciprocated use of data in this environment.

The findings provided examples to illustrate how real problems have been identified and resolved through solutions incorporating available technologies – for example, the South African crime problem and developed security solutions. It was found that context and relevance influenced the effectiveness of market penetration and engagement – examples of solutions for Africa and Europe were given to illustrate these observations. Therefore, even though technology assisted solutions could be applicable in various instances, applicability was observed to be dependent on the problem and the situation in which the problem existed.

The findings revealed that the creation and implementation of more problem directed and more context focused solutions would allow for greater visibility of their effectiveness. It was observed that the convergence of more effective real solutions would eventually result in a fully interconnected and integrated system. However, the findings have shown that the process slows if resistance behaviours are not recognised and addressed.

#### **6.4.2 Summary of the Discussion of Research Question 3**

In answering Research Question 3, the research study explored the impacts and implications associated with pursuing competitive advantages and improvements in company performance within this environment. The findings revealed that balanced considerations, ethical leadership, and responsible use, are required in this context.

The results showed that technology-driven cost saving strategies require consideration for the impact and implications on employees. The findings showed that positive responses were received if technology complemented circumstances, whereas negative responses were encountered if technology substituted and displaced employees. The findings revealed the varied opinions that exist with regard to technology impacts on employment. The views given supported authors in the academic literature that have explored these challenges surrounding the susceptibility and security of current professions as well as the broader socio-economic ramifications, in an environment of rapidly advancing technologies (Frey & Osborne, 2017; Zwick, 2002). The findings revealed that a greater appreciation and deeper

understanding is required of leaders when balancing shareholder versus stakeholder interests.

The findings also revealed that the pursuit of organisational goals and objectives requires a broader awareness of the impacts and implications from decisions involving engagements and interactions with individuals and society. The findings revealed that the principle of trust, as well as fundamentals involved with product and/or service provision, are still essentials for success and sustainability, and for resistance behaviours to remain silent. The findings have revealed that an environment conducive for acceptable and ease of data exchange has been created. The findings have also shown that enabled technology has allowed for enhancements of mechanisms to influence consumers. However, the researcher observed that the ease of data exchange during engagements and transactions requires a reciprocated level of respect with regard to its use. Any breaches in explicit written and/or implicit psychological contracts formed during engagements and interactions have been observed to result in distrust and the emergence of resistance behaviours.

Examples provided in the findings in this regard found support in the academic literature where these conflicts with individual values and/or societal ethics have been followed by degrees of resistance behaviours (Fortin & Renton, 2003; Gatignon & Robertson, 1985; Ghazizadeh et al., 2012; Hengstler et al., 2016; Herbig & Day, 1992; Kleijnen et al., 2009; Laukkanen, 2016; Lee & See, 2004; Mani & Chouk, 2017; McKnight et al., 2002; Molesworth & Suortti, 2002; Patsiotis et al., 2013; Ram & Sheth, 1989; Slovic, 1993; Thiesse et al., 2011). The findings revealed that under such circumstances resistance behaviours would present even if the switching costs were high. The findings revealed that the availability of similar and/or substitute products and/or services posed a threat to organisations that breached these principles. The findings revealed that trust is an overarching principle in engagements and interactions in this interconnected environment. If trust is compromised, described resistance behaviours emerge (Ghazizadeh et al., 2012; Hengstler et al., 2016; Lee & See, 2004; Rousseau et al., 1998; Sirdeshmukh et al., 2002; Slovic, 1993).

Finally, the results showed that the combined findings in this research study impacted the development and formation of the envisioned IoT paradigm of a fully interconnected and integrated system – encapsulated by the creation of a smart city. The findings revealed that greater engagement and participation were required for realisation of this IoT vision. This required organisations to supply and create demand for solutions, products and/or services. However, the findings have shown that this

requires responsible use of data in an environment that is currently accepting of this practice. The findings also echoed the basic approaches identified in the results of this research study that have emphasised a problem-to-solution strategy that incorporates the use of available technology to effect better outcomes. This findings revealed that context and relevance also require consideration in this regard. The findings revealed that the convergence of these solutions would allow for the IoT vision to become a reality. However, the researcher observed that the emergence of resistance behaviours would impact these developments.

Therefore, in answering Research Question 3, the findings have reaffirmed the relevance and importance of the concept of innovation resistance behaviours as well as the underlying principles required to counter its presence and emergence. These findings have lent further support to the findings in Research Question 1 and Research Question 2.

## **6.5 Conclusion**

Chapter 6 presented a discussion on the results of this research study. The discussion of Research Question 1 revealed that organisations and/or managers have identified issues and/or challenges in the context have the IoT wherein resistance behaviours towards innovations emerge. Therefore, it was established that the concept of resistance behaviours towards innovations was transferable and relevant within this context. This was found to answer calls from authors in the academic literature for re-engagement with this concept (Heidenreich & Kraemer, 2015; Kleijnen et al., 2009; Lapointe & Rivard, 2005; Laukkanen, 2016; Mani & Chouk, 2017).

Identified issues and/or challenges from the academic literature review in Chapter 2 were confirmed. These included technology-related concerns about connectivity, interoperability, and security and privacy of data. Business-related concerns about technology-driven cost saving strategies as well as external revenue generation were also found to be present. These identified areas of concern were found to present with concomitant described resistance behaviours. It was observed that the impact of the issue and/or challenge would influence the emergence of varying degrees of described resistance behaviours as described in the academic literature.

The discussion of Research Question 2 revealed that approaches used by organisations and/or managers to address these identified issues and/or challenges in

the context of the IoT, have taken the influence of these resistance behaviours towards innovations into account. The cost-benefit and/or risk-reward analysis featured prominently in the findings. The value proposition was emphasised in these equations for both internal cost savings as well as external revenue generation. The findings revealed that more predictable justifications could be provided for internal mechanisms, whereas external mechanisms required additional measures of benefit to demonstrate value and lower resistance levels.

The findings revealed that enabled technology allowed for data exchange, and engagements and interactions, within a currently accepted environment in the consumer realm. The findings showed various existing mechanisms can be innovatively enhanced through data analysis and application, and combinations of current use with motivators of personal relevance in reward and incentive based programs. The principle of trust was found to be linked to the value proposition (Ghazizadeh et al., 2012; Lee & See, 2004; Rousseau et al., 1998; Sirdeshmukh et al., 2002). If this principle of trust was compromised, resistance behaviours were found to emerge despite the presence of enhanced value propositions and high switching costs.

The discussion of Research Question 3 revealed that impacts and implications of implementation and/or use of new technologies requires consideration to avoid the emergence of resistance behaviours. The principle of trust was again found to be central in this regard, and a requirement in the pursuit of organisational goals and objectives. Balanced consideration and responsible leadership also featured in the findings with regard to technology-driven operational efficiencies and the impact on employment, and with respectful reciprocal use in data exchange with regard to individuals and society.

The combined findings of this research study have provided support with regard to the research problem and research aims established in Chapter 1. This research study has provided empirical evidence in support of calls from authors for re-engagement with this underappreciated concept in the academic literature, and has also established that prior conceptualisations with regard to innovation resistance are transferable and relevant in the context of the IoT (Kleijnen et al., 2009; Lapointe & Rivard, 2005; Laukkanen, 2016).

This research study addressed the lack of studies about the managerial, economic, behavioural, and social challenges involved with new technologies such as the IoT and provided a more informed and comprehensive understanding of possible reasons

behind the resistance encountered with their presence and use. This research study has also shown that insights gained through this perspective can inform business logic, strategies and models, in this technology enabled environment. This has answered calls from authors in the academic literature to effect better use of the IoT in creating competitive advantages and improving company performance (Casadesus-Masanell & Ricart, 2010; Chan, 2015; Dijkman et al., 2015; Hsu & Yeh, 2017; Metallo et al., 2018; Whitmore et al., 2015).

Chapter 7 follows and presents the conclusions to this research study.

# **CHAPTER 7: CONCLUSION AND RECOMMENDATIONS**

## **7.1 Introduction**

This research study explored the concept of innovation resistance in the context of new technologies. The IoT was considered to be a rich and relevant area in which to explore this described phenomenon. Several authors had argued that there was a significant pro-change bias in the academic literature, which was heavily slanted towards acceptance and diffusion (Heidenreich & Kraemer, 2016; Heidenreich & Spieth, 2013; Kleijnen et al., 2009; Laukkanen et al., 2008; Laukkanen, 2016; McKnight et al., 2002; Ram, 1987; Rogers, 2003; Speier & Venkatesh, 2002; Talke & Heidenreich, 2014). The researcher found that there was expressed neglect towards the underappreciated concept of resistance behaviours towards innovations in the academic literature (Bradley & Stewart, 2002; Gatignon & Robertson, 1985, 1989; Heidenreich & Kraemer, 2016; Kleijnen et al., 2009; Kuisma et al., 2007; Lapointe & Rivard, 2005; Laukkanen, 2016; Mani & Chouk, 2017; Martin et al., 2016; Molesworth & Suortti, 2002; Ram, 1987; Ram & Sheth, 1989; Rogers, 2003; Talke & Heidenreich, 2014).

First, this research study sought to establish if the concept of innovation resistance was transferable to the context of the IoT and if re-engagement with this described phenomenon was warranted as well as relevant in this setting. Second, insights garnered from this perspective aimed to answer further calls from the academic literature for a more comprehensive understanding with regard to challenges – business, economic, social, and behavioural – about new technologies to inform mechanisms to effect greater value creation through them (Chan, 2015; Lee & Lee, 2015; Metallo et al., 2018; Patsiotis et al., 2013; Porter & Heppelmann, 2014; Schneider & Spieth, 2013).

Chapter 7 presents the conclusions to this research study through a summary of the most pertinent findings. A framework informed from these conclusions is then proposed. This is followed by implications for academic knowledge and business application. The limitations of this research study are presented before concluding with suggestions for areas of future research.

## 7.2 Research Findings

This exploratory research study successfully answered the research problem and aims in Chapter 1. This research study is significant as it has established that prior and perceived conceptualisations of innovation resistance are both transferable as well as relevant to the IoT context (Kleijnen et al., 2009; Lapointe & Rivard, 2005; Laukkanen, 2016). This research study has provided an empirical foundation from which business, economic, social, and behavioural issues and/ or challenges involved with new technologies were explored (Lee & Lee, 2015; Patsiotis et al., 2013; Porter & Heppelmann, 2014; Schneider & Spieth, 2013). This research study was able to garner insights through this perspective to better inform value creation and capture through new technologies within the context of the IoT. Therefore, this research study provides academic knowledge for practical application to effect competitive advantages and improvements in company performance (Chan, 2015; Metallo et al., 2018).

The IoT presents a mechanism through which general business objectives in value creation, delivery, and capture, as well as critical goals of profitability, cost minimisation, differentiation, and revenue generation can be attained (Porter, 1985; Porter & Heppelmann, 2014). Therefore, this new technology provides access to the projected \$14.4 trillion in value through the combination of lowered costs and increased revenues, if mechanisms through these strategies can be better informed (Dijkman et al., 2015).

First, the presence of innovation resistance behaviours was established within identified issues and/or challenges that are currently present within the IoT environment. These prominently featured in the academic literature and were confirmed in the findings. These were found to be in instances about the environment, as well as about the circumstances surrounding technology-driven internal cost savings and external revenue generation.

Second, by addressing these identified issues and/or challenges associated with the IoT, it was found that a functional and accepting environment needs to be present from which solutions, products and/or services can be introduced to effect better market outcomes in both professional and personal settings. Connectivity is a pre-requisite requirement. A thing cannot become part of the IoT without Internet connectivity. Improved connectivity as well as interoperability, enhance the value proposition. Security and privacy of data are of primary concern within this interconnected environment

Third, technology-driven internal cost savings can be implemented to attain operational efficiencies. Justifiable outcomes can be more definitively predicted in these scenarios through financial calculations as well as with practical demonstrations through POCs and trials that have been combined with extrapolated data (Fichman et al., 2005; Lee & Lee, 2015). The cost-benefit analysis is key in these instances. However, a balanced consideration is required by leaders in these settings, as the implementation of technology in the pursuit of organisational goals and objectives will have an observed and acknowledged impact on employees and employment, and the emergence of resistance behaviours under these circumstances has been shown (Frey & Osbourne, 2017; Lee & Lee, 2015; Zwick, 2002; Zysman & Kenney, 2018).

Fourth, the diminishing returns with low-cost strategies was recognised in the findings. These observations found support from authors in the academic literature (Dijkman et al., 2015; Porter, 1985). External revenue generation through diversification of products and/or services is possible through new technologies and was explored in the setting of consumer IoT (Heidenreich & Kraemer, 2016; Martin et al., 2016; Miorandi et al., 2012; Prins & Verhoef, 2007).

The findings showed that acceptance has been established in the consumer market through a confluence of factors. The generational shift from Baby Boomers to Generations X's to Millennials as well as requirements to communicate and participate within modern society were found to prominently feature in the findings. This accepting environment has allowed for a favourable ease of data exchange setting to be present from which organisations can engage and leverage consumers.

The IoT was found to be an enabler for data to be collected, stored, and analysed. The IoT was found to be an enabler of engagements and interactions. Action on data analysis and pattern recognition has enhanced existing mechanisms such as advertising, marketing, and individualised offerings, to influence greater engagement.

The cost-benefit and/or risk-reward analysis was found to be of focal interest with the value proposition receiving the most attention. Value was enhanced through further innovative and creative combinations that included leveraging personal motivations – such as discretionary income, health and family – within reward and incentive based programs, as well as including the current and prominent use of new technologies within this environment – for example, with the gamification of rewards and online social communities.

These reward and incentive based programs were further enhanced through partner networks. Emphasis on the intention and purpose of the program, or on the rewards and benefits provided, were found to be more effective when tailored to the culture and context to which they were positioned. These ecosystems have been advocated by authors in the academic literature as suitable for an interconnected environment such as the IoT (Chan, 2015; Hui, 2014; Metallo et al., 2018; Möller et al., 2005; Westerlund et al., 2014; Whitmore et al., 2015).

Fifth, however, even though these ecosystems may hold mutual benefits for stakeholders involved, it was found that fundamental business principles and the principle of trust were of paramount importance in these engagements and interactions, despite the presence of raised switching costs through network effects. If the principle of trust is compromised and/or fundamentals in product and/or service provision are below expectations, resistance behaviours emerge. Trust is an overarching theme that requires recognition and greater attention.

Finally, the envisioned IoT paradigm expressed by multiple authors in the academic literature is currently in a disorganised state (Atzori et al., 2010; Gubbi et al., 2013; Lee & Lee, 2015; Metallo et al., 2018; Miorandi et al., 2012; Whitmore et al., 2015; Wortmann & Flütcher, 2015). The findings revealed that the presence of resistance behaviours within issues and/or challenges within the IoT environment provide some explanation for this current predicament. Development of real solutions based on context and relevance, were observed to be more effective. The greater visibility of socio-economic solutions would allow for the real value of a fully interconnected and integrated system to converge and be realised – such as with the desired smart city.

### **7.2.1 Considerations: Innovation Resistance and Issues and/or Challenges in the IoT**

The underappreciated concept of innovation resistance was found to have a prominent presence within the context of issues and/or challenges with regard to the IoT (Bradley & Stewart, 2002; Gatignou & Robertson, 1985, 1989; Heidenreich & Kraemer, 2016; Kleijnen et al., 2009; Kuisma et al., 2007; Lapointe & Rivard, 2005; Laukkanen, 2016; Mani & Chouk, 2017; Martin et al., 2016; Molesworth & Suortti, 2002; Patsiotis et al., 2013; Ram, 1987, 1989; Ram & Sheth, 1989; Rogers, 2003; Talke & Heidenreich, 2014). This was found to support the researcher and authors in the academic literature that there is pro-change bias towards technology acceptance and diffusion (Heidenreich & Kraemer, 2016; Heidenreich & Spieth, 2013; Kleijnen et al., 2009;

Laukkanen et al., 2008; Laukkanen, 2016; McKnight et al., 2002; Ram, 1987; Rogers, 2003; Speier & Venkatesh, 2002; Talke & Heidenreich, 2014).

Varying degrees of described active and/or passive resistance behaviours were found to be dependent on the gravity of the impact encountered and under the circumstances in which the impact had occurred (Fournier, 1998; Kleijnen et al., 2009). Unsurprisingly, described functional use barriers were found to be prominent but not exclusive to issues and/or challenges surrounding connectivity and interoperability, and described risk barriers were also observed to be more notable about security and privacy of data concerns. Security and privacy of data was of high priority, and supported the emphasis on these concerns from authors in the academic literature (Atzori et al., 2010; Juels, 2006; Mani & Chouk, 2017; Whitmore et al., 2015).

It was observed that the presence of these technology-related issues and/or challenges affected the functioning and value proposition of the environment, and therefore the effective introduction of proposed solutions, products and/or services. Even if proposals are viable, there will be less engagement and participation if the environment is not functional. Therefore, these technology-related elements require consideration. This was found to support similar views in the academic literature (Atzori et al., 2010; Gubbi et al., 2013; Miorandi et al., 2012; Whitmore et al., 2015).

Notably, the functional value barrier or the price-to-performance barrier was found to be central in considerations with regard to cost-benefit and/or risk-reward analyses (Gatignon & Robertson, 1985; Herbig & Day, 1992; Kleijnen et al., 2009; Laukkanen, 2016; Mani & Chouk, 2017; Patsiotis et al., 2013; Ram & Sheth, 1989; Szmigin & Foxall, 1998; Woodside & Biemans, 2005). High costs were found to place strain on the value proposition and drive resistance behaviours in these scenarios. This was supported by authors in the academic literature (Fichman et al., 2005; Hsu & Yeh, 2017; Sun et al., 2012).

Various described psychological, situational, and cognitive barriers, were found in these settings that also allowed for resistance behaviours to emerge towards proposals and introductions (Fortin & Renton, 2003; Gatignon & Robertson, 1985; Heidenreich & Handrich, 2015; Heidenreich & Kraemer, 2015; Heidenreich & Spieth, 2013; Herbig & Day, 1992; Kleijnen et al., 2009; Laukkanen, 2016; Mani & Chouk, 2017; Molesworth & Suortti, 2002; Patsiotis et al., 2013; Ram & Sheth, 1989; Talke & Heidenreich, 2014).

## **7.2.2 Considerations: Mechanisms to Address Innovation Resistance and Issues and/or Challenges in the IoT**

In exploring the mechanisms with which to address these identified issues and/or challenges as well as the confirmed emergence of resistance behaviours, it was found that technological advances have allowed for organisations to enter the value chain to provide solutions, products and/or service to ensure the functioning of the environment. Service providers in connectivity, interoperability, and cybersecurity, were found to feature in this regard. Faster and more reliable and consistent connectivity has enhanced this pre-requisite element in this context. The ability to consolidate and aggregate previously isolated and vertical systems has also allowed for improved functionality and integration of solutions, products and/or services. This development creates greater value visibility as well as possibilities within a system.

Security and privacy of collected data is of paramount importance and various options are available to ensure protection. However, cybersecurity threats and attacks remain prevalent and the ramifications can be severe and extensive. These findings are supported by several authors in the academic literature (Atzori et al., 2010; Gubbi et al., 2013; Lee & Lee, 2015; Miorandi et al., 2012). The development of global regulations – such as the South African POPI Act and the European GDPR – was observed to legitimise the presence of this interconnected environment as well as to provide rules towards governance and accountability.

The cost-benefit analysis in technology-driven cost saving strategies has been assisted by technological advances that have lowered some of the costs involved. High costs were observed to limit accessibility and availability to some consumer segments. Greater predictability of ROI was shown to be present with trials, POCS, and business cases, to justify technology-driven cost saving measures. These findings were supported by authors in the academic literature and were observed to decrease the risks involved for decision makers (Fichman et al., 2005; Lee & Lee, 2015).

However, several authors in the academic literature have highlighted both the positive and negative impacts of technology on employment (Frey & Osborne, 2017; Lee & Lee, 2015; Zwick, 2002; Zysman & Kenney, 2018). The findings supported the literature in this regard and observed that leaders need to carefully balance shareholder and stakeholder interests in these instances as this provides a setting in which resistance behaviours can emerge.

Risks have been mitigated to some extent in the consumer market with regard to data exchange due in part to the convergence of several factors that have resulted in a current environment accepting of this practice. These factors include the aforementioned generational shift, the new norms that have been established in society for communication and participation, and the required exchange of data for products and/or services designed for the desired and expected convenience of this era.

Technology enables data exchange as well as engagements and interactions, which has allowed for data to be collected and then analysed. Enhanced advertising, targeted marketing, as well as the creative customisation of offerings have all been used to inform and direct influence more appropriately. The innovative combination of relevant personal motivations – such as disposable income, health, and family – within reward and incentive based programs have been used to enhance and increase the perceived value proposition of products and/or services. The current use of new technologies for entertainment purposes and social participation has also been creatively included with these combinations to influence greater engagement and participation – for example, gamification of rewards and online social communities.

Partner networks have been advocated by authors in the academic literature and were found to be suited for this interconnected environment (Chan, 2015; Möller et al., 2005; Vargo & Lusch, 2004; Westerlund et al., 2014). These ecosystems were found to be mutually beneficial for all stakeholders involved.

### **7.2.3 Considerations: Implementation and Use**

However, resistance behaviours can still emerge even in the presence of enhanced and/or increased value propositions, and network effects and raised switching costs associated with ecosystems and partner networks. If expectations with product and/or service provision are not met, and if the principle of trust is compromised any in manner, barriers emerge, and resistance behaviours follow. Several authors in the academic literature have emphasised the importance of the principle of trust (Ghazizadeh et al., 2012; Lee & See, 2004; Rousseau et al., 1998).

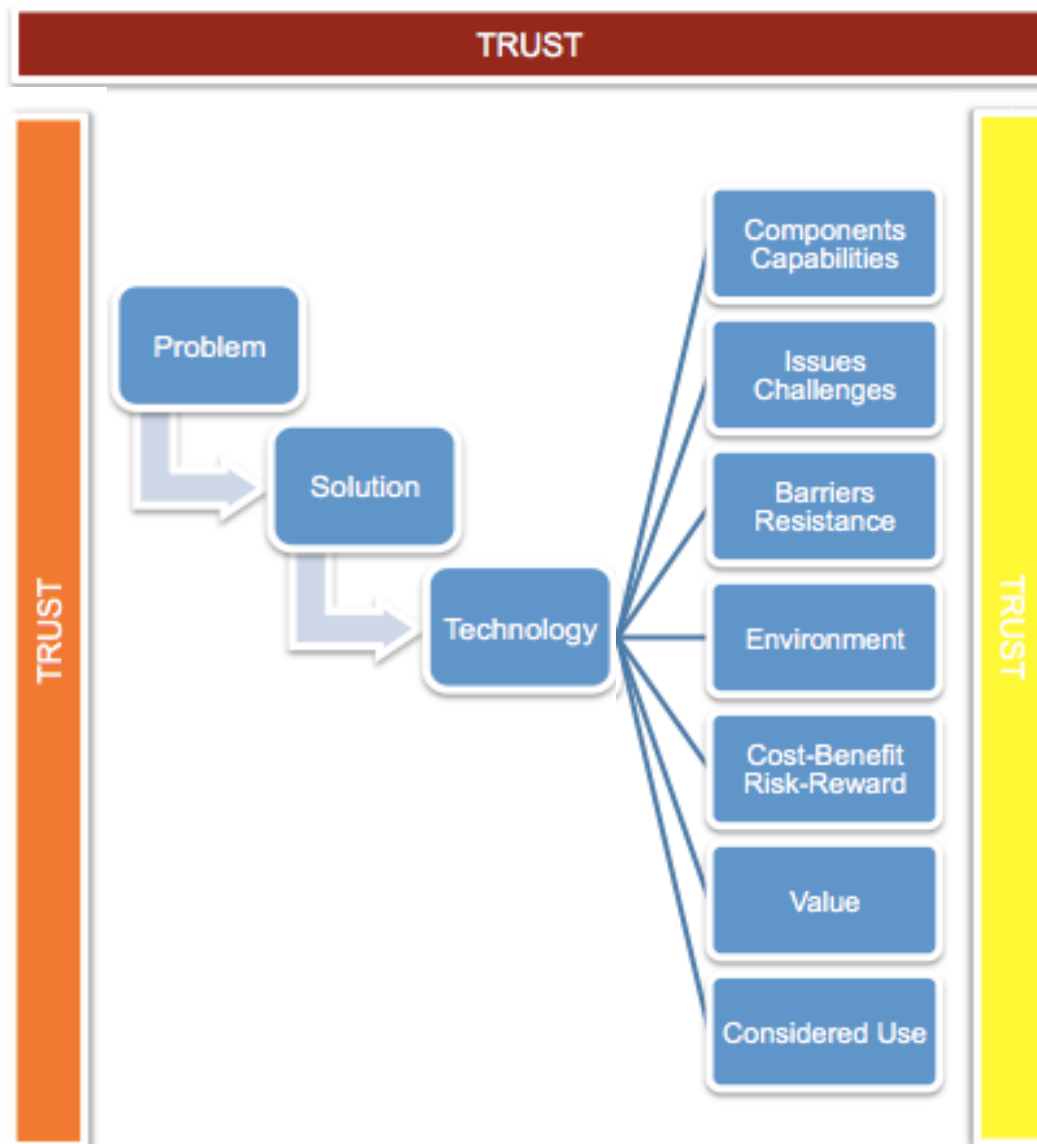
The findings supported the academic literature and found that trust underpins the engagements through enabled technology. The findings revealed that explicit and/or implicit reciprocal respect is expected in return for the ease of data exchange. Disregard or a lack of consideration for this principle in improper use of data and/or

mismanagement of these relationships was found to compromise the principle of trust in these instances and for the value proposition to falter. Therefore, continued success and sustainability of solutions, products and/or services, as well as organisations, requires greater attention and appreciation of these factors. Even though the environment seems to have change with the advances in technology and a focus on technology in this developing digital economy, basic business principles still apply.

### **7.3 A Proposed Framework**

The academic literature was found to project substantial financial returns through the combination of lowered costs and increased revenues among companies and industries through the use of the IoT (Dijkman et al., 2015). The findings supported the literature with a notable push from business, industry, and competitors, to adopt new technologies in this regard. However, authors in the academic literature have expressed that outcomes are not inherent to the capabilities of the technology itself, and that success or failure is not guaranteed through the simple presence of a technology (Porter, 1985; Zysman & Kenney, 2018).

Therefore, based on a deeper understanding from insights garnered in this research study, Section 7.3 proposes a framework that is aligned to these current circumstances with which businesses can utilise in similar settings across a wide variety of industries. This research study garnered insights from a heterogeneous group of organisations and senior managers across the value chain of the IoT that are involved in a broad spectrum of industries. Therefore, transferability, as is the goal of exploratory qualitative research, is possible with this framework (Bloomberg & Volpe, 2012).



**Figure 14: Technology Value Framework**

This model encapsulates the key insights derived and provides a logical approach aligned with the structure of the research questions and identified themes throughout this research study. It was observed that a simple approach towards technology in this digitally-focused era was possible – problem first, solution second, and use of available technology third. This was found to be common to organisations and for approaches addressing technology-related as well as business-related issues and/or challenges within this context.

Even though technology is positioned in the centre, the framework illustrates the various elements that guide value creation and capture through enabled technology. The model spans from left to right and begins with identification of the problem, which

is then followed by possible solutions. Technology is considered after these initial steps and as a reminder that available technology enables solutions to problems.

**Components and Capabilities:** An understanding of the components and capabilities is required to comprehend how the technology may enable and enhance mechanisms to increase engagement and participation. In terms of the IoT, the technology is an enabler of data exchange and interactions, and can be utilised to enhance mechanisms to influence engagement.

**Issues and/or Challenges:** This highlights the areas wherein innovation resistance behaviours may emerge. These may be technology-related and/or business-related concerns.

**Barriers and Resistance:** This allows for consideration of functional, psychological, cognitive and situational barriers that may result in varying degrees of active and/or passive innovation resistance behaviours.

**Environment:** The environment should be assessed for functionality, acceptance, and current use by stakeholders. The environment is viewed as a platform from which solutions, products and/or services can be introduced. Other factors within industry as well as the broader macro-economic environment should also be considered – for example, competitors and geopolitical concerns respectively.

**Cost-Benefit and/or Risk-Reward analysis:** This was observed to be central in decisions towards technology adoption and/or resistance. High costs and high risks – for example, capital investments, and security and privacy of data – invoke functional value barriers, risk barriers, as well as cognitive barriers, resulting in resistance behaviours towards innovations. These conscious and/or subconscious equations require justification to shift the balance from highlighted costs involved towards more desired outcomes.

**Value:** An emphasis on the value proposition is required even in the presence of lowered costs and/or decreased risks. In terms of the IoT, the technology can be utilised in existing mechanisms in creative and innovative ways and combinations to enhance and increase the value proposition.

**Considered Use:** The impacts and implications of implementation and use require a comprehensive understanding and appreciation of the ramifications that may follow as resistance behaviours may emerge under these circumstances.

Trust: The principle of trust encompasses the entire process and requires attention. The rules of engagement and the fundamentals of good business have not changed. They should not be ignored even in the presence of new technologies. The borders and colour scheme are used to represent the varying levels of resistance that may result if the principle of trust is compromised.

## **7.4 Implications for Business**

The implications are twofold, academically to re-engage, enhance, and extend the current literature on innovation resistance. These insights have practical implications for organisations and managers in the pursuit of competitive advantages and improvements in company performance. From a managerial perspective, the research study provided important insights, in addition to the proposed framework, for business practitioners.

- Resistance behaviours towards innovations exist and requires consideration.
- Resistance behaviours feature prominently within issues and/or challenges encountered.
- Varying degrees of resistance behaviours emerge based on impact, context, and the circumstances in which they are found.
- A comprehensive understanding of the technology and its capabilities is required.
- An interconnected, integrated, and interactive environment is currently positioned for of the IoT.
- The IoT is an enabler – an enabler of data exchange and of engagements.
- Collected data through enabled devices is the resource through which existing mechanisms to influence greater engagement and participation can be enhanced.
- The cost-benefit and/or risk-reward analysis is central to approaches and strategies.
- Enhanced value propositions can influence lower levels of resistance behaviours.
- Value provided needs to be relevant to the value receiver in order to motivate for the desired response.
- Generic reward and incentive programs need to be tailored to cultures and conditions to improve effectiveness.

- Partner networks and ecosystems are mutually beneficial and are suited to this interconnected environment.
- Advances in technology and enhanced value propositions do not preclude good business principles and/or the rules of engagement – the principle of trust and the fundamentals of product and/or service provision are linked to the value proposition.
- Trust is an overarching principle that requires attention.
- Implementation and responsible use needs to be considered.
- Problem first, solution second, and use of available technology third.

## **7.5 Limitations**

As it is the case with most research, this research study also had some limitations.

- This was an exploratory study with a small sample size and therefore generalisability of the results was limited.
- This was a cross-sectional study and was limited to findings, observations, and perspectives at that point in time.
- Qualitative research is subjective in nature and may have been affected by researcher as well as participant biases.
- The research study was limited in geographical scope due to the small sample of South African and European participants.

## **7.6 Suggestions for Future Research**

The insights gained from this research study suggest potential future research possibilities.

- Replication of the study with a larger sample size and across more geographical regions.
- A longitudinal study that could demonstrate changes in findings, observations, and perspectives.
- Replication of the study in the context of other emerging technologies – for example, machine learning and AI – to enhance validity and applicability of these findings and observations to other forms of new technologies.
- A qualitative study on consumers' observations and perceptions with regard to

the IoT would triangulate business perceptions and potentially assess if mechanisms utilised by organisations are aligned.

- A qualitative comparative analysis to understand which barriers, if addressed, lead to improved performance and outcomes.
- A quantitative study to validate the suggested framework in assessing the importance of each level suggested in the proposed model.
- An explorative study on further mechanisms used in this context to create and capture value.

## **7.7 Conclusion**

This research study therefore advanced the theoretical understanding of innovation resistance behaviours and offered implications for management theory and practice in the context of the IoT. This research study contributed to the extant literature regarding the importance, presence, and need for re-engagement with the innovation resistance literature. This research study illustrated how value creation and capture can be achieved by identifying and addressing factors and circumstances that influence the emergence of innovation resistance behaviours.

Through the exploratory and qualitative interviews with twelve senior managers involved along the IoT value chain, insights were derived that added to empirical knowledge of both the innovation resistance and the IoT literature. This research study confirmed the relevance and existence of innovation resistance within the context of the IoT. This research study provided insights into mechanisms available through this technology that can be used to address identified issues and/or challenges in creating competitive advantages and improvements in company performance. Therefore, the research study has answered the research problem and achieved the objectives established in Chapter 1. Key elements that emerged from this research study were encapsulated into a proposed framework. Reference to this framework can provide guidance and prove useful as a tool for organisations and managers in technology-focused environments.

## REFERENCE LIST

- Al-Fuqaha, A., Guizani, M., Mohammadi, M., Aledhari, M., & Ayyash, M. (2015). Internet of Things: A survey on enabling technologies, protocols, and applications. *IEEE Communications Surveys & Tutorials*, 17(4), 2347-2376.
- Ashton, K. (2009). That 'Internet of Things' thing. *RFID Journal*, 22(7), 97-114.
- Atzori, L., Iera, A., & Morabito, G. (2010). The Internet of Things: A survey. *Computer Networks*, 54(15), 2787-2805.
- Bayus, B. L., Erickson, G., & Jacobson, R. (2003). The financial rewards of new product introductions in the personal computer industry. *Management Science*, 49(2), 197-210.
- Bloomberg, L. D., & Volpe, M. (2012). *Completing your qualitative dissertation: A roadmap from beginning to end* (2nd ed.). Thousand Oaks, CA: Sage.
- Botta, A., De Donato, W., Persico, V., & Pescapé, A. (2016). Integration of Cloud computing and Internet of Things: a survey. *Future Generation Computer Systems*, 56, 684-700.
- Bradley, L., & Stewart, K. (2002). A Delphi study of the drivers and inhibitors of Internet banking. *International Journal of Bank Marketing*, 20(6), 250-260.
- Bucherer, E., Eisert, U., & Gassmann, O. (2012). Towards systematic business model innovation: lessons from product innovation management. *Creativity And Innovation Management*, 21(2), 183-198.
- Caboz, J. (2018, July 31). Here are the areas that could be hit by loadshedding on August 1. *Business Insider South Africa*. Retrieved from <https://www.businessinsider.co.za/theres-a-high-risk-of-loadshedding-tonight-these-areas-are-most-likely-to-be-hit-in-case-of-blackouts-2018-7-4>
- Cadwalladr, C. (2018, May 6). Cambridge Analytica has gone. But what has it left in its wake? *The Guardian*. Retrieved from <https://www.theguardian.com/uk-news/2018/may/06/cambridge-analytica-gone-what-has-it-left-in-its-wake>
- Casadesus-Masanell, R., & Ricart, J. E. (2010). From strategy to business models and onto tactics. *Long Range Planning*, 43(2/3), 195-215.

- Castelfranchi, C., & Falcone, R. (2000). Trust and control: A dialectic link. *Applied Artificial Intelligence*, 14(8), 799-823.
- Castellion, G., & Markham, S. K. (2013). Perspective: New product failure rates: Influence of argumentum ad populum and self - interest. *Journal of Product Innovation Management*, 30(5), 976-979.
- Chan, H. C. (2015). Internet of Things business models. *Journal of Service Science and Management*, 8(4), 552-568.
- Chiesa, V., & Frattini, F. (2011). Commercializing technological innovation: Learning from failures in high - tech markets. *Journal of Product Innovation Management*, 28(4), 437-454.
- Claudy, M. C., Garcia, R., & O'Driscoll, A. (2015). Consumer resistance to innovation— a behavioral reasoning perspective. *Journal of the Academy of Marketing Science*, 43(4), 528-544.
- Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Thousand Oaks, CA: Sage.
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management Science*, 35(8), 982-1003.
- Debruyne, M., Rudy, M., Griffin, A., Hart, S., Hultink, E. J., & Robben, H. (2002). The impact of new product launch strategies on competitive reaction in industrial markets. *Journal of Product Innovation Management*, 19(2), 159-170.
- Denzin, N. K. (2001). *Interpretive interactionism* (2nd ed.). Newbury Park, C: Sage.
- Dijkman, R. M., Sprenkels, B., Peeters, T., & Janssen, A. (2015). Business models for the Internet of Things. *International Journal of Information Management*, 35(6), 672-678.
- Edwards, L. (2013, May 31). What you need to know about POPI. *GDPR: Report*. Retrieved from <https://gdpr.report/news/2018/05/31/what-you-need-to-know-about-popi/>
- Ellis-Petersen, H. (2018, October 2). What caused the Indonesia tsunami and could lives have been saved? *The Guardian*. Retrieved from

<https://www.theguardian.com/world/2018/oct/02/what-caused-palu-indonesia-tsunami-and-could-lives-have-been-saved>

- Ferreira, J. B., da Rocha, A., & da Silva, J. F. (2014). Impacts of technology readiness on emotions and cognition in Brazil. *Journal of Business Research*, 67(5), 865-873.
- Fichman, R. G., Keil, M., & Tiwana, A. (2005). Beyond valuation: "Options thinking" in IT project management. *California Management Review*, 47(2), 74-96.
- Foroudi, P., Gupta, S., Sivarajah, U., & Broderick, A. (2018). Investigating the effects of smart technology on customer dynamics and customer experience. *Computers in Human Behavior*, 80, 271-282.
- Forsythe, S. M., & Shi, B. (2003). Consumer patronage and risk perceptions in Internet shopping. *Journal of Business Research*, 56(11), 867-875.
- Fortin, D. R., & Renton, M. S. (2003). Consumer acceptance of genetically modified foods in New Zealand. *British Food Journal*, 105(1/2), 42-58.
- Fournier, S. (1998). Special Session Summary Consumer Resistance: Societal motivations, consumer manifestations, and implications in the marketing domain. *Advances in Consumer Research*, 25, 88-90.
- Frankenberger, K., Weiblen, T., Csik, M., & Gassmann, O. (2013). The 4I-framework of business model innovation: A structured view on process phases and challenges. *International Journal of Product Development*, 18(3/4), 249-273.
- Frey, C. B., & Osborne, M.A. (2017). The future of employment: How susceptible are jobs to computerisation? *Technological Forecasting and Social Change*, 114, 254-280.
- Garcia, R., & Atkin, T. (2006). Co-opetition for the diffusion of resistant innovations: A case study in the global wine industry using an agent-based model. *Institute of Advanced Studies*, 05(002), 1-22.
- Gatignon, H., & Robertson, T. S. (1985). A propositional inventory for new diffusion research. *Journal Of Consumer Research*, 11(4), 849-867.
- Gatignon, H., & Robertson, T. S. (1989). Technology diffusion: an empirical test of competitive effects. *The Journal of Marketing*, 53(1), 35-49.

- Ghazizadeh, M., Lee, J. D., & Boyle, L. N. (2012). Extending the technology acceptance model to assess automation. *Cognition, Technology & Work*, 14(1), 39-49.
- Gubbi, J., Buyya, R., Marusic, S., & Palaniswami, M. (2013). Internet of Things (IoT): A vision, architectural elements, and future directions. *Future Generation Computer Systems*, 29(7), 1645-1660.
- Guinard, D., Trifa, V., Karnouskos, S., Spiess, P., & Savio, D. (2010). Interacting with the SOA-based Internet of things: Discovery, query, selection, and on-demand provisioning of web services. *IEEE Transactions on Services Computing*, 3(3), 223-235.
- Heidenreich, S., & Handrich, M. (2015). What about passive innovation resistance? Investigating adoption - related behavior from a resistance perspective. *Journal of Product Innovation Management*, 32(6), 878-903.
- Heidenreich, S., & Kraemer, T. (2015). Passive innovation resistance: The curse of innovation? Investigating consequences for innovative consumer behavior. *Journal of Economic Psychology*, 51, 134-151.
- Heidenreich, S., & Kraemer, T. (2016). Innovations – doomed to fail? Investigating strategies to overcome passive innovation resistance. *Journal of Product Innovation Management*, 33(3), 277-297.
- Heidenreich, S., & Spieth, P. (2013). Why innovations fail – The case of passive and active innovation resistance. *International Journal of Innovation Management*, 17(05), 1350021.
- Hengstler, M., Enkel, E., & Duelli, S. (2016). Applied artificial intelligence and trust – The case of autonomous vehicles and medical assistance devices. *Technological Forecasting and Social Change*, 105, 105-120.
- Herbig, P. A., & Day, R. L. (1992). Customer acceptance: The key to successful introductions of innovations. *Marketing Intelligence & Planning*, 10(1), 4-15.
- Hsieh, H.-F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research*, 15(9), 1277-1288.

- Hsu, C. L., & Lin, J. C. C. (2016). An empirical examination of consumer adoption of Internet of Things services: Network externalities and concern for information privacy perspectives. *Computers in Human Behavior*, 62, 516-527.
- Hsu, C. W., & Yeh, C. C. (2017). Understanding the factors affecting the adoption of the Internet of Things. *Technology Analysis & Strategic Management*, 29(9), 1089-1102.
- Hui, G. (2014). How the Internet of Things changes business models. *Harvard Business Review*, 92(7/8), 1-5.
- Hung, M. (2017). Leading the IoT: Gartner insights on how to lead in a connected world. *Gartner Research*, 1-29. Retrieved from [https://www.gartner.com/imagesrv/books/iot/iotEbook\\_digital.pdf](https://www.gartner.com/imagesrv/books/iot/iotEbook_digital.pdf)
- Isaac, M., & Frenkel, S. (2018, September 28). Facebook Security Breach Exposes Accounts of 50 Million Users. *The New York Times*. Retrieved from <https://www.nytimes.com/2018/09/28/technology/facebook-hack-data-breach.html>
- Juels, A. (2006). RFID security and privacy: A research survey. *IEEE Journal On Selected Areas In Communications*, 24(2), 381-394.
- Karahanna, E., Agarwal, R., & Angst, C. M. (2006). Reconceptualising compatibility beliefs in technology acceptance research. *MIS Quarterly*, 30(4), 781-804.
- Karjaluoto, H., Mattila, M., & Pento, T. (2002). Electronic banking in Finland: Consumer beliefs and reactions to a new delivery channel. *Journal of Financial Services Marketing*, 6(4), 346-361.
- Kasperson, R. E., Renn, O., Slovic, P., Brown, H.S., Emel, J., Goble, R., Kasperson, J.X., & Ratick, S. (1988). The social amplification of risk: A conceptual framework. *Risk Analysis*, 8(2), 177-187.
- Kleijnen, M., Lee, N., & Wetzels, M. (2009). An exploration of consumer resistance to innovation and its antecedents. *Journal of Economic Psychology*, 30(3), 344-357.
- Kothari, C.R. (2004). *Research methodology: methods and techniques* (2nd ed.). India: New Age International Limited Publishers.

- Koshizuka, N., & Sakamura, K. (2010). Ubiquitous ID: Standards for ubiquitous computing and the Internet of Things. *IEEE Pervasive Computing*, 9(4), 98-101.
- Kuisma, T., Laukkanen, T., & Hiltunen, M. (2007). Mapping the reasons for resistance to Internet banking: A means-end approach. *International Journal of Information Management*, 27(2), 75-85.
- Lapointe, L., & Rivard, S. (2005). A multilevel model of resistance to information technology implementation. *MIS Quarterly*, 29(3), 461-491.
- Laukkanen, P., Sinkkonen, S., & Laukkanen, T. (2008). Consumer resistance to Internet banking: Postponers, opponents and rejectors. *International Journal of Bank Marketing*, 26(6), 440-455.
- Laukkanen, T. (2016). Consumer adoption versus rejection decisions in seemingly similar service innovations: The case of the Internet and mobile banking. *Journal of Business Research*, 69(7), 2432-2439.
- Laukkanen, T., Sinkkonen, S., & Laukkanen, P. (2009). Communication strategies to overcome functional and psychological resistance to Internet banking. *International Journal of Information Management*, 29(2), 111-118.
- Laukkanen, T., Sinkkonen, S., Kivijärvi, M., & Laukkanen, P. (2007). Innovation resistance among mature consumers. *Journal of Consumer Marketing*, 24(7), 419-427.
- Lee, I., & Lee, K. (2015). The Internet of Things (IoT): Applications, investments, and challenges for enterprises. *Business Horizons*, 58(4), 431-440.
- Lee, J., & Moray, N. (1992). Trust, control strategies and allocation of function in human-machine systems. *Ergonomics*, 35(10), 1243-1270.
- Lee, J. D., & See, K. A. (2004). Trust in automation: Designing for appropriate reliance. *Human Factors*, 46(1), 50-80.
- Lee, Y., Kozar, K. A., & Larsen, K. R. (2003). The Technology Acceptance Model: Past, present, and future. *Communications Of The Association For Information Systems*, 12(1), 50.

- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic Inquiry* (1st ed.). Beverly Hills, CA: Sage.
- MacVaugh, J., & Schiavone, F. (2010). Limits to the diffusion of innovation: A literature review and integrative model. *European Journal of Innovation Management*, 13(2), 197-221.
- Mani, Z., & Chouk, I. (2017). Drivers of consumers' resistance to smart products. *Journal of Marketing Management*, 33(1-2), 76-97.
- Manyika, J., Chui, M., Bisson, P., Woetzel, J., Dobbs, R., Bughin, J., & Aharon, D. (2015). The Internet of Things: Mapping the Value Beyond the Hype. *McKinsey Global Institute: McKinsey & Company*. Retrieved from <https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/the-internet-of-things-the-value-of-digitizing-the-physical-world>
- Martin, D., Gustafsson, A., & Choi, S. (2016). Service innovation, renewal, and adoption/rejection in dynamic global contexts. *Journal of Business Research*, 69(7), 2397-2400.
- Maxwell, J. A. (2005). *Qualitative research design: An interactive approach* (2nd ed.). Thousand Oaks, CA: Sage.
- McKnight, D. H., Choudhury, V., & Kacmar, C. (2002). The impact of initial consumer trust on intentions to transact with a web site: A trust building model. *The Journal of Strategic Information Systems*, 11(3-4), 297-323.
- Meredith, S. (2018, April 10). Facebook – Cambridge Analytica: A timeline of the data hijacking scandal. *CNBC*. Retrieved from <https://www.cnn.com/2018/04/10/facebook-cambridge-analytica-a-timeline-of-the-data-hijacking-scandal.html>
- Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation* (4th ed.). San Francisco, CA: John Wiley & Sons.
- Metallo, C., Agrifoglio, R., Schiavone, F., & Mueller, J. (2018). Understanding business model in the Internet of Things industry. *Technological Forecasting and Social Change*. Advance online publication. Retrieved from <https://doi.org/10.1016/j.techfore.2018.01.020>

- Miorandi, D., Sicari, S., De Pellegrini, F., & Chlamtac, I. (2012). Internet of Things: Vision, applications and research challenges. *Ad Hoc Networks*, 10(7), 1497-1516.
- Molesworth, M., & Suortti, J. P. (2002). Buying cars online: the adoption of the web for high - involvement, high - cost purchases. *Journal of Consumer Behaviour*, 2(2), 155-168.
- Möller, K., Rajala, A., & Svahn, S. (2005). Strategic business nets – their type and management. *Journal of Business Research*, 58(9), 1274-1284.
- Moschis, G. P. (2003). Marketing to older adults: An updated overview of present knowledge and practice. *Journal of Consumer Marketing*, 20(6), 516-525.
- Neate, R. (2018, July 26). Over \$119bn wiped off Facebook's market cap after growth shock: Shares crash as social network admits user growth fell after Cambridge Analytica breach. *The Guardian*. Retrieved from <https://www.theguardian.com/technology/2018/jul/26/facebook-market-cap-falls-109bn-dollars-after-growth-shock>
- Nienaber, A. M., & Schewe, G. (2014). Enhancing trust or reducing perceived risk, what matters more when launching a new product? *International Journal of Innovation Management*, 18(1), 1-24.
- Nylén, D., & Holmström, J. (2015). Digital innovation strategy: A framework for diagnosing and improving digital product and service innovation. *Business Horizons*, 58(1), 57-67.
- Oreg, S. (2003). Resistance to change: Developing and individual differences measure. *Journal of Applied Psychology*, 88(4), 680-693.
- Oreg, S. (2006). Personality, context, and resistance to organizational change. *European Journal of Work and Organizational Psychology*, 15(1), 73-101.
- Parry, R. L. (2017, August 24). The school beneath the wave: the unimaginable tragedy of Japan's tsunami. *The Guardian*. Retrieved from <https://www.theguardian.com/world/2017/aug/24/the-school-beneath-the-wave-the-unimaginable-tragedy-of-japans-tsunami>

- Patsiotis, A. G., Hughes, T., & Webber, D. J. (2013). An examination of consumers' resistance to computer-based technologies. *Journal of Services Marketing*, 27(4), 294-311.
- Patton, M. Q. (2001). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage.
- Phelan, D. (2018, September 27). Apple watch series 4: When will the brilliant ECG feature arrive in the States and worldwide. *Forbes*. Retrieved from <https://www.forbes.com/sites/davidphelan/2018/09/27/apple-watch-series-4-when-will-the-ecg-feature-arrive-in-the-states-and-worldwide/#49319ece3a09>
- Porter, M. E. (1985). Technology and competitive advantage. *Journal Of Business Strategy*, 5(3), 60-78.
- Porter, M. E., & Heppelmann, J. E. (2014). How smart, connected products are transforming competition. *Harvard Business Review*, 92(11), 64-88.
- Prins, R., & Verhoef, P. C. (2007). Marketing communication drivers of adoption timing of a new e-service among existing customers. *Journal of Marketing*, 71(2), 169-183.
- Ram, S. (1987). A model of innovation resistance. *Advances in Consumer Research*, 14(1), 208-212.
- Ram, S. (1989). Successful innovation using strategies to reduce consumer resistance: An empirical test. *Journal of Product Innovation Management*, 6(1), 20-34.
- Ram, S., & Sheth, J. N. (1989). Consumer resistance to innovations: The marketing problem and its solutions. *Journal of Consumer Marketing*, 6(2), 5-14.
- Reaidy, P. J., Gunasekaran, A., & Spalanzani, A. (2015). Bottom-up approach based on Internet of Things for order fulfillment in a collaborative warehousing environment. *International Journal of Production Economics*, 159, 29-40.
- Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York, NY: The Free Press.

- Rose, K., Eldridge, S., & Chapin, L. (2015). The Internet of Things: An Overview – Understanding the Issues and Challenges of a More Connected World. *The Internet Society*, 1-50.
- Rousseau, D. M., Sitkin, S. B., Burt, R. S., & Camerer, C. (1998). Not so different after all: A cross-discipline view of trust. *Academy Of Management Review*, 23(3), 393-404.
- Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students* (5th ed.). Essex, England: Pearson.
- Saunders, M. N., & Lewis, P. (2012). *Doing research in business and management* (1st ed.). Edinburgh Gate: Pearson.
- Schneider, S., & Spieth, P. (2013). Business model innovation: Towards an integrated future research agenda. *International Journal of Innovation Management*, 17(1), 1340001.
- Schram, T. H. (2003). *Conceptualising qualitative inquiry: Mindwork for fieldwork in education and the social sciences* (1st ed.). Upper Saddle River, N.J: Prentice Hall.
- Sirdeshmukh, D., Singh, J., & Sabol, B. (2002). Consumer trust, value, and loyalty in relational exchanges. *Journal of Marketing*, 66(1), 15-37.
- Slater, S. F., & Mohr, J. J. (2006). Successful development and commercialization of technological innovation: Insights based on strategy type. *Journal of Product Innovation Management*, 23(1), 26-33.
- Slovic, P. (1993). Perceived risk, trust, and democracy. *Risk Analysis*, 13(6), 675-682.
- Speier, C., & Venkatesh, V. (2002). The hidden minefields in the adoption of sales force automation technologies. *Journal of Marketing*, 66(3), 98-111.
- Spiess, J., T'Joens, Y., Dragnea, R., Spencer, P., & Philippart, L. (2014). Using big data to improve customer experience and business performance. *Bell Labs Technical Journal*, 18(4), 3-17.
- Sun, Y., Yan, H., Lu, C., Bie, R., & Thomas, P. (2012). A holistic approach to visualizing business models for the Internet of Things. *Communications in Mobile Computing*, 1(1), 4.

- Szmigin, I., & Foxall, G. (1998). Three forms of innovation resistance: The case of retail payment methods. *Technovation*, 18(6-7), 459-468.
- Talke, K., & Heidenreich, S. (2014). How to overcome pro - change bias: Incorporating passive and active innovation resistance in innovation decision models. *Journal of Product Innovation Management*, 31(5), 894-907.
- Thiesse, F., Staake, T., Schmitt, P., & Fleisch, E. (2011). The rise of the “next-generation bar code”: An international RFID adoption study. *Supply Chain Management: An International Journal*, 16(5), 328-345.
- Thiesse, F. (2007). RFID, privacy and the perception of risk: A strategic framework. *The Journal of Strategic Information Systems*, 16(2), 214-232.
- Vargo, S. L., & Lusch, R. F. (2004). Evolving to a new dominant logic for marketing. *Journal of Marketing*, 68(1), 1-17.
- Venkatesh, V., & Bala, H. (2008). Technology Acceptance Model 3 and a research agenda on interventions. *Decision Sciences*, 39(2), 273-315.
- Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the Technology Acceptance Model: Four longitudinal field studies. *Management Science*, 46(2), 186-204.
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 425-478.
- Weber, R. H. (2009). Internet of Things – Need for a new legal environment? *Computer Law & Security Review*, 25(6), 522-527.
- Weber, R. H. (2010). Internet of Things – New security and privacy challenges. *Computer Law & Security Review*, 26(1), 23-30.
- Weber, R. H. (2011). Accountability in the Internet of Things. *Computer Law & Security Review*, 27(2), 133-138.
- Wejnert, B. (2002). Integrating models of diffusion of innovations: A conceptual framework. *Annual Review Of Sociology*, 28(1), 297-326.

- Westerlund, M., Leminen, S., & Rajahonka, M. (2014). Designing business models for the Internet of Things. *Technology Innovation Management Review*, 4(7), 5-14.
- Whitmore, A., Agarwal, A., & Da Xu, L. (2015). The Internet of Things – A survey of topics and trends. *Information Systems Frontiers*, 17(2), 261-274.
- Wildemuth, B. M. (2017). *Applications of social research methods to questions in information and library science* (2nd ed.). Santa Barbara, CA: Libraries Unlimited.
- Williams, C. (2007). Research methods. *Journal of Business and Economic Research*, 5(3), 65-71.
- Woodside, A. G., & Biemans, W. G. (2005). Modeling innovation, manufacturing, diffusion and adoption/rejection processes. *Journal of Business & Industrial Marketing*, 20(7), 380-393.
- Wortmann, F., & Flütcher, K. (2015). Internet of Things. *Business and Information Systems Engineering*, 57(3), 221–224.
- Yin, R. K. (2015). *Qualitative research from start to finish* (2nd ed.). New York, NY: The Guilford Press.
- Zwick, T. (2002). Employee resistance against innovations. *International Journal of Manpower*, 23(6), 542-552.
- Zysman, J., & Kenney, M. (2018). The next phase in the digital revolution: Intelligent tools, platforms, growth, employment. *Communications of the ACM*, 61(2), 54-63.

# ANNEXURES

## Annexure A: Ethical Clearance

**Gordon  
Institute  
of Business  
Science**  
University  
of Pretoria

14 June 2018

Shang Gavin

Dear Gavin

*Please be advised that your application for Ethical Clearance has been approved.*

*You are therefore allowed to continue collecting your data.*

*Please note that approval is granted based on the methodology and research instruments provided in the application. If there is any deviation change or addition to the research method or tools, a supplementary application for approval must be obtained*

*We wish you everything of the best for the rest of the project.*

*Kind Regards*

GIBS MBA Research Ethical Clearance Committee

## Annexure B: Informed Consent Form

**Gordon Institute  
of Business Science**  
University of Pretoria

### Informed Consent Form

This study has been reviewed and approved by the GIBS MBA Research Ethical Clearance Committee.

The study aims to gather insights about innovation resistance in the context of the Internet of Things (IoT) and how businesses may utilise this knowledge to enhance their competitive advantage and company performance.

**Your participation is voluntary, and you can withdraw at any time without penalty.**

All data will be reported anonymously, with identifiers used in place of your name, your company's name, and names of any partners and/or competitors.

If you have any concerns, please contact my supervisor or myself at the contact details provided below.

Researcher: Gavin Shang

Research Supervisor: Simon Swanich

Email: [gavshang@gmail.com](mailto:gavshang@gmail.com)

Email: [swanich@gmail.com](mailto:swanich@gmail.com)

Phone: +27 82 886 4384

Phone: +27 72 888 6888

Signature of participant: \_\_\_\_\_

Date: \_\_\_\_\_ 2018

Signature of researcher: \_\_\_\_\_

Date: \_\_\_\_\_ 2018

# Annexure C: Interview Schedule



Interview number:

Date:

Name of Organisation:

Industry:

- 1) How do you define or describe the IoT?
  - a) Examples
- 2) How is organisation involved in the IoT value chain?
  - a) B2B or B2C or both
  - b) IoT solution, product and/or service
- 3) Why did the organisation decide on incorporating the IoT into its business strategy? What reasons should organisations consider when considering incorporating the IoT into their business strategies?
  - a) Industry adoption, competitive environment
  - b) Cost saving with low cost strategy
  - c) Revenue generation
  - d) Improve company performance, competitive advantages, market outcomes
- 4) What challenges are discussed when the IoT was considered as a potential part of the business strategy? What challenges develop with implementation?
  - a) Technical (connectivity, interoperability, security and privacy of data)
  - b) Business (CAPEX and ROI, uncertainties)
  - c) Individual (use, value, risk, price-to-performance, tradition, image, society)
- 5) How were these addressed?
  - a) Technical
  - b) Business
  - c) Individual
- 6) How do the challenges and their management affect business strategies and business models?
  - a) Firm-centric
  - b) Ecosystem
- 7) Are there any impacts that need to be considered with an IoT implementation?
  - a) Employment
  - b) Use (paradox)
- 8) What are the challenges in maintaining an IoT driven strategy?
  - a) Trust, relationships, communication
  - b) Engagement, society
- 9) What lessons have been learned from any failures to create and capture value through the IoT?
  - a) Own
  - b) Industry

## Annexure D: ATLAS.ti Codebook

### Individual codes

- Action latency
- Adapt business model
- Adoption of technology
- Agnostic devices
- Android vs. Apple
- Asset tracking
- AWS or Azure
- Blind spots
- Business case
- Business models
- Business partners
- Business problem
- CAPEX
- Change management
- Choice of services
- Cloud level
- Commercial devices
- Commoditisation of sensors
- Competency curse
- Connectivity
- Consumer IoT
- Context
- Convenience
- Correct conversation
- Cost

- Cost control and savings
- Cost of living
- Culture
- Data collection
- Data ethics
- Data exchange
- Data hack analogy
- Data hack positive
- Data hack risks
- Data machine analytics
- Data misuse
- Data packets
- Data privacy
- Data purity
- Data value
- Decision making
- Definition
- Definition IoT tech
- Demographics
- Deployment difficulties
- Device complexity
- Device connectivity and interoperability difficulties
- Digital conversation
- Disincentivise
- Diversification of business
- Economic imperative
- Economies of scale
- Ecosystem

- Edge
- Edge examples
- Edge security
- Education
- Employment
- Employment complement
- Employment economic effects
- Employment economic example
- Employment opposition
- Employment substitution
- Evolution
- Examples
- Failure
- Global
- Hype
- Incorrect conversation
- Individual adoption
- Individual data privacy concerns
- Individual data privacy understanding
- Individual experience
- Individual profiles
- Individual relevance
- Individualisation
- Infrastructure
- Interoperable platforms
- Intrusive
- IoT business
- IoT competition

- IoT concept
- IoT investment
- IoT product
- IoT suppliers
- Leadership
- Learning curve
- Less resistance
- Liability
- Liability shared
- Loss of autonomy
- Low cost strategy
- Lower costs involved
- Market segments
- Media
- Mistrust
- Motivation
- Partner networks
- Personal use
- Plug and play
- POC
- Porters
- Predictive maintenance
- Profits
- Proof of value
- Push
- Regulations
- Resistance relevant
- Responsible use

- Reward or incentive programs
- Risk decision
- ROI
- Security concerns
- Security layers
- Security options
- Service
- Smart Cities
- Societal influence
- Solution to problem
- South Africa
- Targeted marketing
- Targeted marketing negative
- Technology evolution
- Tesla
- Traditions
- Transformational roadmap
- Trust
- Uncertainty
- Understand the business
- Understanding of IoT
- Unlock efficiencies
- User profiling
- Vertical

## **Codes groups**

### **RQ1: Identify Issues and/or Challenges:**

- RQ1: T1 Resistance: Relevance
- RQ1: T2 Technology-Related: Connectivity and Interoperability
- RQ1: T3 Technology-Related: Security and Privacy of Data
- RQ1: T4 Business-Related: Apprehension and General Uncertainty
- RQ1: T5 Business-Related: Internal Cost Saving
- RQ1: T6 Business-Related: External Revenue Generation

### **RQ2: Address Issues and/or Challenges:**

- RQ2: T1 Addressing Technology-Related: Connectivity and Interoperability
- RQ2: T2 Addressing Technology-Related: Security and Privacy of Data
- RQ2: T3 Addressing Business-Related: Apprehension and General Uncertainty
- RQ2: T4 Addressing Business-Related: Internal Cost Saving
- RQ2: T5 Addressing Business-Related: External Revenue Generation

### **RQ3: Impacts and Implications:**

- RQ3: T1 Employment
- RQ3: T2 Relationships
- RQ3: T3 Trade-Offs in Decisions
- RQ3: T4 The IoT Vision