The role of 4th industrial revolution technologies in driving competitive advantage in the South African beverage manufacturing industry

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By

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Date: 09 December 2022

Academic Integrity Declaration

I declare that the role of 4th industrial revolution technologies in driving competitive advantage in the South African beverage manufacturing industry is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

I further declare that I submitted the thesis/dissertation to originality checking software and that it falls within the accepted requirements for originality.

I further declare that I have not previously submitted this work, or part of it, for examination at Unisa for another qualification or at any other higher education institution.

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Dedication

To my family, firstly my dad Johnny Govender, may you rest in peace, I love and miss you. My Fiancée Maniza Darmalingam, my mother Tilly Govender and my brother Ryan Govender. Thank you all for getting me to this point in my life. I have nothing but love for you all.

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I would firstly like to thank God for giving me the courage to take on this difficult journey, for watching over me and for providing me with the strength to get through this journey.

I thank my supervisor, Dr Oluwamayowa Ogundaini for the guidance, support and time taken to provide me with detailed feedback during this research. I appreciate you, this research would not of proceed to completion without your support.

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Abstract

Fourth industrial revolution technology (4IR-T) applications are associated with benefits such as cost-efficient measures to enhance productivity, use of effective communication channels to improve relationships between businesses and customers, and the potential to drive sustainable competitive advantage. However, organisations within South Africa's beverage manufacturing industry are slow to adopt 4IR-T. This research aimed to explore the role of 4IR-T in driving competitive advantage within beverage manufacturing organisations in the FMCG industry of South Africa. The objective of this research was to determine how 4IR-T can be used to enhance competitive advantage within beverage manufacturing organisations hence, the research question, how can 4IR-T drive competitive advantage in beverage manufacturing organisations, guided this research.

This qualitative research used a case study strategy to collect data from a beverage manufacturing organisation in South Africa via semi-structured interviews and a focus group. A purposive sampling method was applied to select twelve participants that included middle, senior and executive managers who have decision making power. A thematic analysis of the data was conducted, and the Technology-Organisation-Environment (TOE) framework was used as a lens to determine the role of 4IR-T in driving competitive advantage with beverage manufacturing organisations. A focus group was further performed to conduct member checking.

Findings and discussion revealed various TOE factors that either promote or inhibit the adoption of 4IR-T. Perceived benefits, relative advantage, current state of competitive advantage and 4IR-T characteristics were factors found to enable 4IR-T adoption from a Technology and organisational perspective. However, barriers mostly from an organisation perspective were found, such as insufficient capital investment, cost of 4IR-T, inadequate skills capacity, which inhibit and slow the adoption of 4IR-T. Risks from an environmental perspective also inhibited the adoption of 4IR-T such as loadshedding, labour regulations and job redundancy. These barriers and risks thus, inhibit the drive for competitive advantage within the beverage manufacturing organisation.

This study concludes and recommends that beverage organisations increase the speed with which they adopt 4IR-T by investing with a long-term focus, training, and upskilling employees, top management promoting 4IR-T with a digital strategy and the organisation using 4IR-T to prevent supply chain disruptions.

Keywords: Competitive Advantage, Industry 4.0, Fourth Industrial revolution technologies (4IR-T), FMCG industry, Supply chain, Information communication technology (ICT).

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List of Acronyms

4IR – 4th Industrial Revolution

4IR-T – 4th Industrial Revolution Technologies

AI – Artificial Intelligence

BDA -Big Data Analytics

CCBA-K – Coca Cola Beverages Africa – Kenya

CEO – Chief executive Officer

CFO – Chief Financial Officer

CIO – Chief Information Officer

Co2 – Carbon Dioxide

CPS – Cyber Physical Systems

CRM – Customer relationship management

DMD – Digital Marketing Devices

DT – Digital Technologies

ERP – Enterprise Resource Planning

FMCG – Fast Moving Consumer Goods

GDP – Gross Domestic Product

GVC – Global Value Chains

ICT – Information and Communication Technology

IoT – Internet of Things

MBV- Market Based View

MEA – Mobile Enterprise Application

ML – Machine Learning

POPIA – Protection of Personal Information Act

RBV – Resource Based View

RF – Radio Frequency

RO – Research Objective

RQ – Research Question

RFID – Radio Frequency Identification

SA – South Africa

SCM – Supply Chain Management

SME – Small and Medium Enterprises

SMME – Small Medium Microenterprises

Stats SA – Statistics South Africa

FMCG_B – The Beverage Organisation

TOE – Technology-Organisational-Environment

UNISA GBSL – University of South Africa Graduate School of Business Leadership

VOIP – Voice over internet Protocol

Chapter 1 – Introduction

1.1 Introduction

American engineers developed digital technologies based on mathematical concepts suggested by a German mathematician, Gottfried Wilhelm Leibniz who proposed a binary computing system (Leibniz, 2008; Hilliard, 2015). Digital Technologies (DT) covers a range of software applications and hardware (Tulinayo *et al*., 2018). For example, computers, computer chips and the internet form a part of the third industrial revolution between 1969 till date; manual activities became automated with the use of electronics and information technology (Klingenberg & Junior, 2017; Poloz, 2021). Other DT applications include Cyber Physical systems (CPS) Artificial Intelligence (AI), Machine Learning, Mobile, Cloud including the "as a Service" options and Internet of Things (IoT). These aforementioned technologies are associated with fourth industrial revolution or Industry 4.0 (Buer *et al.*, 2021). Industry 4.0 was first used at the Hannover Fair in Germany (Finotto *et al.*, 2019; Sarı *et al.*, 2020). The German government then developed a national policy dispersed to the rest of the world as the fourth Industrial revolution (4IR).

This research is primarily concerned with the beverage manufacturing industry and the role of 4IR-T in driving competitive advantage within this industry as a focus area of research. To frame the context of this research, a background to the research problem is introduced in section 1.1, followed by a problem statement in section 1.2, research aim and objectives in section 1.3, main research question in section 1.4 and sub research questions in 1.4.1, the research strategy of this study in section 1.5, significance of this research in section 1.6, ethical considerations of the research in section 1.7. Section 1.8 presents the delineation of the research, the structure of the research in section 1.9 and section 1.10 concludes the chapter.

1.1.1 Capabilities of 4IR Technologies

4IR technologies (4IR-T) have the capabilities to increase operational excellence by creating new products, services and business models; increasing customer and supplier intimacy; improve decision making; ensure survival of firms and increase firms competitive advantage (Laudon & Laudon, 2020). For example the use of big data analytics (BDA) has enabled organisations to enhance and improve their performance concerning supply chain management operations, improve managerial decision making, drive innovation to provide competitive advantage (Bag *et al.*, 2020). A study conducted by Ngai *et al.*, (2021) showed that the implementation of chatbots have effectively improved handling of customer queries and customer relationships. 4IR-T investments made by an organisation are translated into value activities such new knowledge to innovate, improved customer services, coordination with suppliers and benefits from efficient processes (Martínez-Caro *et al*., 2020).

The benefits of 4IR-T enable productivity improvements, cost reductions organisational agility and drive the potentials for competitive advantage (Coskun-Setirek and Tanrikulu, 2021; Wamba, 2022). Wamba (2022) suggest that agility is an adequate means of ensuring quickness and effectiveness during business model adjustments and is emerging as a critical organisational asset to innovate and achieve competitive advantage. The concept competitive advantage has a long history in the strategy literature. Porter (1985) introduced the concept of competitive advantage in his book. Porter (1985) states that competitive advantage stems from the firm's ability to create superior value for its buyers.

Porter (1985) adds that superior value stems from offering lower prices than competitors for equivalent benefits or providing unique benefits that more than offset a higher price (Sigalas, 2015; Nayak *et al.*, 2021). Porter (1985) suggest that competitive advantage can be achieved through implementing a strategy that has lower costs or is different from other organisations. Purbasari *et al* (2020) and Porter (1985) emphasized the strategic value of technology for competitive advantage (Nayak *et al.,* 2021). When strategically deployed, technology capabilities can be used to manage the value offerings of products or services to customers.

The hype around 4IR and the capabilities of the technologies have influenced its adoption in different sectors of service delivery such as health, education, and business (Bongomin *et al.*, 2020). For example, 4IR-T such as automation and data exchange in CPS, IOT, cloud computing and AI, have the ability to change the way organizations in the Beverage and fast moving consumer goods (FMCG) industry function (Nainaar & Masson, 2018; Purbasari *et al.*, 2020). FMCG refers to products that have a short service life, a fast consumption rate that consumers need to buy repeatedly (Benfratello, 2021). FMCG products mostly include perishable foods, beverages, cosmetics, over the counter drugs. The application of DT can reduce costs of production within the value chain operations and how customer experience the value of the products. Value chain operations may include operational logistics, sales and marketing and customer service and secondary activities namely infrastructure, technology, human capital management and procurement (Porter, 1987).

1.1.2 Applications of 4IR-T

Organizations in the FMCG industry can use a combination of 4IR-T to ensure sustained competitive advantage. Automation and integration between systems would allow organizations to streamline processes in their value chain. Streamlining the value chain with the adoption of 4IR-T would enable value chains to be localised, more cooperative and create sustainability benefits to the customers and organisations (Nainaar & Masson, 2018). For example, 4IR-T could enable organisations in the beverage industry to automate various value chain activities and limit human intervention (Purbasari *et al.*, 2020; Serumaga-Zake *et al.*, 2021). Automation using 4IR-T could lead to improved speed of

production, improved customer service, reduced cost, increased revenue and more data visibility between systems that lead to improved decision making, creating competitive advantage (Purbasari *et al*., 2020). Adoption of 4IR-T can also facilitate a sustainable manufacturing process or smart factory that ensures monitoring between activities, for example reduction in energy and water consumption that contribute to environment sustainability (Onu & Mbohwa, 2021).

Previous studies have shown that the adoption of 4IR-T within the FMCG more specifically, the food and beverage industry can aid organisations to create considerable value added, monetary gain and competitive advantage (Van Den Berg & Van Der Lingen, 2019; Martínez-Caro *et al*., 2020; Saryatmo & Sukhotu, 2021). A study of the Indonesian food and beverage industry revealed that organisations that have digitised their supply chain activities have benefitted positively on operational performance components such as cost reduction, quality, and production (Saryatmo & Sukhotu, 2021). The study found that quality, productivity, and cost reduction is improved with the adoption of 4IR-T such as big data analytics, IOT, cloud computing and robotics within their supply chain activities. These improvements have led to the ability to enhance supply chain performance, share information, innovate, reduce costs in business processes and enhanced revenue growth. The authors concluded that moving toward a digital supply chain can strengthen these organisations market competitiveness (Saryatmo & Sukhotu, 2021).

Otieno and Angira (2021) performed a study on Coca Cola Beverages Africa within the Kenya (CCBA-K) beverage manufacturing industry. The study revealed that CCBA-K have embraced technology to improve efficiencies, effective order fulfilment times and customer service. AI and robotics are combined with a central Enterprise Resource Planning system (ERP) to provide a robust integration throughout their value chain. This has significantly reduced fulfilment plans, improved forecasting, and efficiencies. The authors concluded that adoption of 4IR-T within their value chain activities resulted in increased production capacity and lowered cost of production thereby ensuring CCBA-K have remained competitive in Kenya (Otieno & Angira, 2021).

A study conducted on the South African beverage industry around competitive advantage found that adoption of 4IR-T will allow beverage organisations to modernise operations, understand customer requirements, gain new customers and discover new opportunities (Nainaar & Masson, 2018). This would ensure that competitive advantage is sustained. The application of 4IR-T to the FMCG industry would allow food and beverage organisations to transition to a fully automated warehouse which would contribute to the digital transformation of their logistics process (Iliashenko *et al.*, 2019). Beverage and food organisations that invest in 4IR-T such as big data analytics and develop data driven strategies would be able to enhance their manufacturing capabilities, product quality and market competitiveness (Saryatmo & Sukhotu, 2021). From the consumer of FMCG products perspective, the

implementation of 4IR-T by organisations would ensure direct access with the organisations, thereby improving communication and customer relations (Martínez-Caro *et al.*, 2020).

1.1.3 Background to the Research Problem

For business organisations to remain relevant and sustain competitive advantage, keep customers satisfied and survive the digital economy, there is a need to adopt 4IR-T and ensure digital presence (Purbasari *et al.*, 2020;Otieno & Angira, 2021;Classen *et al.*, 2021;Buer *et al.*, 2021). Nainaar and Masson (2018) characterized the Fast-moving consumer goods (FMCG) industry as one in which the goods are retailed for consistent periods and profits are driven by sales volumes. FMCG products are usually targeted at consumers with disposable incomes to increase the FMCG market (Benfratello, 2021). However, with the dwindling disposable income of consumers due to inflation affecting fuel and food prices, electricity and healthcare, organizations should adopt 4IR-T as a means to sustain competitive advantage (Coskun-Setirek & Tanrikulu, 2021).

The adoption of 4IR-T and legacy information and communication technologies (ICTs) is no longer an option but one of survival otherwise organizations in this industry risk being left behind. Therefore, organisations in the FMCG industry need to ensure a better understanding of the process of adopting 4IR-T urgently and create a digital presence that will enable them to compete with larger organisations (Gagnon & Toulouse, 1996; Lawson *et al.*, 2003;Classen *et al.*, 2021). Organizations in the beverage industry are relatively slow to adopt 4IR-T in their environments and have not taken full advantage of technology developments to transform their traditional business model to an e-business model to remain competitive (Pillay, 2016; Martínez-Caro *et al.*, 2020). While there is a degree of understanding and awareness of how 4IR-T can ensure sustained competitive advantage for business there is a lack of awareness, knowledge of these technologies and how these technologies can benefit the business (Ismail *et al.*, 2011; Sarı, *et al.,* 2020).

Past research has shown that there are various factors that influence 4IR-T adoption within organisations which can be established using the Technology-Organisational-Environment (TOE) framework (Van Dyk & Van Belle, 2019; Igwe *et al.*, 2020; Otieno &Angira, 2021). The TOE framework was designed by Tornatzky and Fleischer in 1990 to determine technology adoption within an organisation (Igwe *et al.*, 2020). Organisations are influenced in their decision to adopt 4IR-T by the TOE factors. For example, technology factors include relative advantage, compatibility and complexity of a technology (Classen *et al.*, 2021). Organisation factors include organisation size, top management support and prior technology experience (Igwe *et al.*, 2020). Igwe *et al.*, (2020) suggest that the environmental factors include size of the industry, level of competition in the industry and regulations.

The Technology aspect of the TOE framework include technologies that might be applicable to the organisation including technologies being used, available technologies not being used and innovative technologies that might enable the organisation to evolve and adapt (Van Dyk & Van Belle, 2019). For example factors such as perceived usefulness and ease of use of 4IR-T would be considered technology factors that affect the adoption of DT (Igwe *et al.*, 2020). Van Dyk and Van Belle (2019) also found that 4IR-T like cloud, AI and Machine learning adoption could provide relative advantage such as reduced cost, customer satisfaction and competitive advantage. 4IR-T would allow the organisation to collect, analyse and interpret data which would optimize their value chain ultimately increasing profit and competitive advantage. However, the study also revealed perceived barriers such as infrastructure impact, security risks and lack of talent – technical skills (Van Dyk & Van Belle, 2019).

The Organisational aspect of the TOE framework looks at the structures, resources and well as the size of the organisation (Eze *et al.*, 2020). At the forefront of organisational factors is cost of implementation and capital investment in 4IR-T and ICT (Pillay, 2016; Mulaudzi, 2017; Bagale *et al.*, 2021; Serumaga-Zake *et al.*, 2021). With South Africa being a developing country, FMCG organizations lack the needed capital and managerial know-how to adopt and implement 4IR-T within their environments (Akintelu *et al.*, 2016; Sarı *et al*, 2020). Limited resources in terms of time, management, training and personnel are considered organisational factors(Classen *et al.*, 2021). A lack of a clear and coherent digital strategy to drive transformation with an organisation and a lack of leadership that steers the direction and company culture to a digital mindset are barriers that could affect the adoption of 4IR-T (Van Dyk & Van Belle, 2019).

A study conducted by Martínez-Caro *et al.*, (2020) suggest that organisational culture is prerequisite for 4IR-T adoption. Managers should identify attributes of the existing culture that slow digital technology adoption and reduce or remove these attributes. At the same time establish cultural attributes that support successful digital adoption to increase the rate of digital technology adoption. With defining an organisational culture that better supports their digital strategy, managers can expect to receive greater benefits. The study concluded that managers should define digital strategy and direct digital investments to critical areas within the organisation in order to obtain operative and strategic advantages through 4IR-T usage and value creation (Martínez-Caro *et al.*, 2020).

The environmental aspect of the framework focuses on the size of the business, its competitors, macroeconomic perspective and the regulatory background (Eze *et al.*, 2020). Further factors such as size of the industry, government regulations, competitive pressure and external pressure from customers and suppliers influence the adoption of 4IR-T (Igwe *et al.*, 2020). Environmental factors usually have a positive influence on the organisations adoption of 4IR-T to maintain their competitiveness due to the organisations fear or losing to competitors (Classen *et al*, 2021). However,

certain environmental factors such as lack of external support, limited internet connectivity, time required to learn and use the 4IR-T and regulations could lead to 4IR-T not being adopted by beverage manufacturing organisations (Van Dyk & Van Belle, 2019;Eze *et al.*, 2020).

A study conducted by Mulaudzi (2017) found that organisations risk decreasing customer and supplier intimacy with the slow adoption rate of 4IR-T which could be obtained with Vertical and Horizontal systems integration. Another study conducted by Serumaga-Zake *et al.*, (2021) found that organisations in developing countries may not have the financial means to investigate the opportunities of 4IR-T or vertical and horizontal integrations. Systems integrations refers to DT that allow individual systems to be analysed as a whole considering the productive flow (Pérez-Lara *et al.*, 2020). Vertical Integration and flow refers to the organisations activities development and execution including basic elements like the organisation structure, human factor, department relationships and management level (Pérez-Lara *et al.*, 2020). Horizontal integration and flow refers to the external relationships and would establish supplier and customer network integrations and information and management systems (Pérez-Lara *et al.*, 2020).

The technology, organisation, and environment factors can be perceived to either positively or negatively influence 4IR-T adoption in the beverage industry based on the existing situation and the need to sustain competitive advantage especially as the effect of COVID-19 pandemic is eased. The cost, limited resources, complexity of the 4IR-T, required skills and training; lack of a clearly defined technology strategy, lack of top-down leadership and a legacy culture are barriers to 4IR-T adoption. It remains unclear, how organisations in the FMCG organisations of South Africa are attempting to address the barriers mentioned to sustain competitive advantage and ensure their survival.

1.2 Research Problem

In South Africa, consumers' disposable income is dwindling at an increasing rate because of a strained economy, hence organizations in the FMCG industry need to create value for their consumers by being innovative to increase perceived use value or create disruptive innovation (Nainaar & Masson, 2018). According to Stats SA (2022) and the Gross Domestic Product (GDP) report for quarter 4 released in March 2022, household final consumption expenditure was R2,9 trillion which showed an increase of 5.7% compared to 2020. Food and non-alcoholic beverages contributed 3.2% of this increase (Gray, 2021). Manufacturing sales amounted to R195 Billion of which food and beverage was R50 Billion of which beverages contributed R13 Billion (Statistics South Africa, 2022). This means that beverage consumption contributed 26% of FMCG product sales.

4IR-T can provide beverage manufacturing organizations tools needed to achieve cost containment, increase value for the consumer, increase productivity and differentiate products thus enhancing

competitive advantage (Nainaar and Masson, 2018; Eze *et al.*, 2020; Drydakis, 2022) . Despite the potential benefits that 4IR-T offers, the adoption rate is slow in South Africa compared to high income countries (Eze *et al*., 2020). The slow adoption of 4IR-T within FMCG industry will hinder the organisations' ability to remain competitive in this industry; understand customer needs, transform business operations, gain new customers and discover innovative opportunities (Van Dyk & Van Belle, 2019). If FMCG organizations do not place particular focus on the digital transformation of their processes and value chain, they risk a chance at non-survival in the industry, loss of competitive advantage, ineffective cost of productivity and the loss of market shares.

1.3 Aims and Objectives of the Research

1.3.1 Research Aim

The aim of this research is to explore the role of fourth industrial revolution technologies (4IR-T) in driving competitive advantage within beverage manufacturing organisations in the FMCG industry of South Africa.

1.3.2 Research Objective

To determine how 4IR-T can be used to enhance competitive advantage within the beverage manufacturing organisations in the FMCG industry of South Africa.

1.4 Research Questions

1.4.1 Main Research Question

How can fourth industrial revolution technologies (4IR-T) drive competitive advantage in the beverage manufacturing organisations?

1.4.2 Sub Research Questions

Table 1: Research Sub Question and Objectives

Sub Research Questions	***Research Objectives***
1. What are the enabling factors for 4IR-T adoption to drive competitive advantage in beverage manufacturing organisations?	To determine potential factors that enable adoption of 4IR-T in beverage manufacturing organisations to drive their competitive advantage.
2. What are the barriers against 4IR-T adoption to drive competitive advantage in beverage manufacturing organisations?	To identify the barriers that influence the decision to adopt or not adopt 4IR-T towards driving competitive advantage.

3. What potential risks influence the decision to adopt 4IR-T in beverage manufacturing organisations?	To understand the potential risks that beverage manufacturing organisations perceive to influence their decision to adopt 4IR-T towards driving competitive advantage.

1.5 Research Strategy

Based on the aim of the study and research questions, a case study strategy using qualitative methods has been used in this research. The case study strategy was used, as this research required an empirical investigation of a particular phenomenon, namely 4IR-T driving competitive advantage, within its real-life context using multiple sources of evidence, namely the beverage manufacturing industry and the participants from the organisation. This research adopted a purposive sampling method to collect data and applied a combination of semi-structured interviews and a focus group in order to perform member checking, to gather in-depth data from a beverage manufacturing organisation in South Africa. A thematic analysis was applied to analyse the data and the emergent findings of the data were interpreted by drawing from the assumptions of the TOE framework.

1.6 Significance of the Research

This research contributes to the existing body of knowledge on how beverage manufacturing organisations in South Africa can identify factors that influence the uptake of 4IR-T and its impact on driving competitive advantage. In practice, the findings from the study will enable organisations within the supply chain of South Africa's beverage manufacturing FMCG industry to assess their needs to drive the implementation of 4IR-T. The theoretical contribution will be evident in the contextualisation of the TOE framework to investigate competitive advantage as driven by industry 4.0 technologies especially within the South African beverage manufacturing industry.

1.7 Ethical Considerations

This research followed the prescribed ethical concerns of the researcher-participant relationship which include obtaining informed consent from the organisation and participants, protecting their privacy, preventing physical and psychological harm, and ensuring full disclosure and engagement (Saunders *et al.*, 2007; Blumberg *et al.*, 2014; Hair & Brunsveld, 2019). The researcher ensured that the goal of the ethics in research are met by ensuring no one suffers adverse consequences from this research. Further to the ethical considerations, the research followed all guidelines set out by the University of South Africa research ethics committee, to which the research proposal was submitted, and has ensure compliance with the protection of the South Africa personal information act (POPIA).

1.8 Delineation of the study

This research will focus on a beverage manufacturing organisation and its value chain within SA in the Gauteng province. The organisation caters to the local, national, and African markets by providing a range of carbonated non-alcoholic beverages. The organisation chosen has under 1000 employees and forms part of the FMCG sector within SA and was selected due to the high potential for 4IR-T adoption. Other organisations within the FMCG industry such as wholesalers and retailers are not considered. This study will contribute to the existing body of knowledge on how beverage manufacturing organisations within SA can identify factors that influence adoption of 4IR-T and its impact on driving competitive advantage. The contextualisation of TOE framework to investigate competitive advantage by 4IR-T within the SA FMCG industry will add to the theoretical contribution.

1.9 Structure of the Research

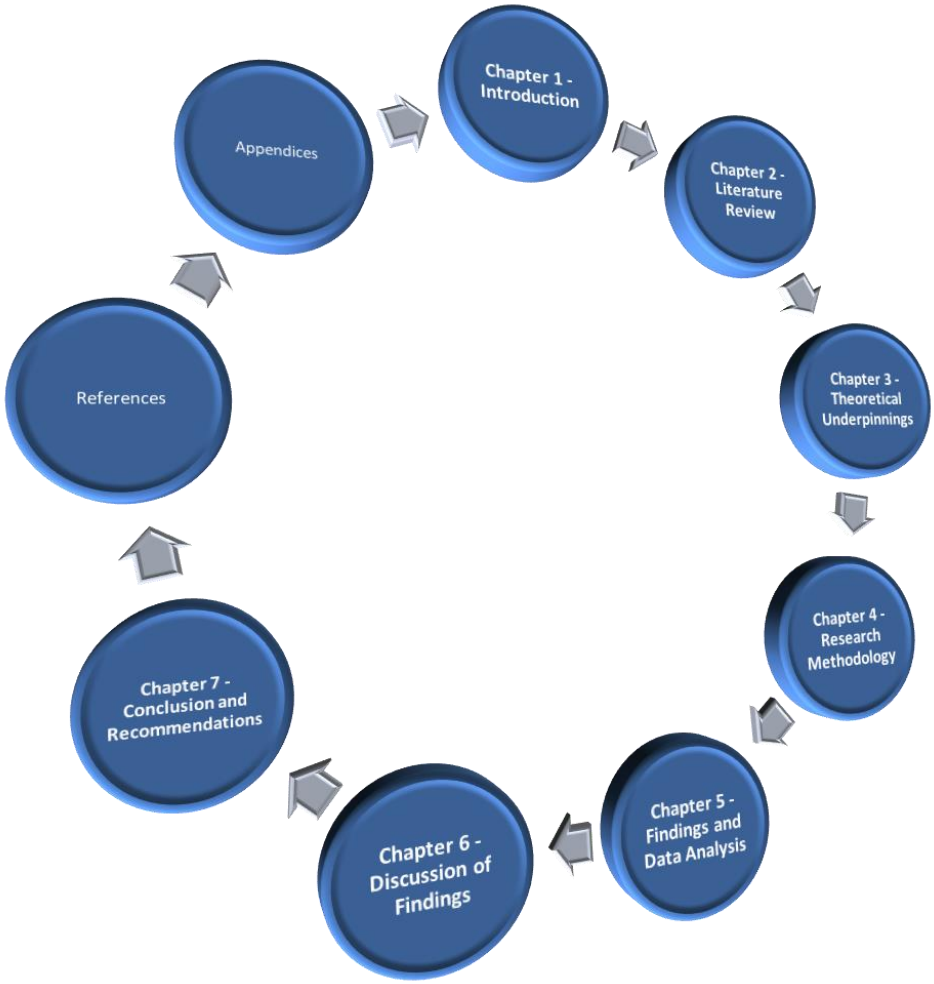

Figure 1: Structure of this study

Chapter 1 – provided the introduction for this research, background, problem statement and the rationale of why this research is being conducted and the significance. This chapter further outlines this research aim, objectives, questions that are relevant to the research while giving a brief introduction on the strategy and ethical considerations that will be used in this research.

Chapter 2 – presents a review of the existing literature on the topic. Various concepts are defined, and review of current literature conducted to identify gaps which informed the articulation of the research problem.

Chapter 3 – presents the theoretical framework that will be used in this research. A brief history of theories is given together with a definition of the different approaches to theory development. The chapter concludes with why the TOE framework was selected for use in this research.

Chapter 4 – provides the research methodology for this research. A research strategy, methods, and approach that this research will take as well as why these have been selected is presented. This chapter further defines the sampling techniques that will be used in this research, how data will be analysed and presents a data management plan as well as more descriptive ethical considerations as compared to chapter 1 summary ethical considerations.

Chapter 5 – presents the finding from the thematic data analysis that was completed after the semi-structured interviews and focus group was completed within the organisation. The findings will be presented in relation to the research questions and objectives of this research.

Chapter 6 - presents, discusses, compares, and contrast the findings which is done in relation to the existing literature presented in chapter 2. The practical implications and the contributions of this research are expanded and discussed in detail.

Chapter 7 – presents the conclusion and recommendations of this research. It further states the limitations and recommendations for future research.

1.10 Conclusion

This chapter has introduced the concept of digital technologies, 4IR-T, competitive advantage, Industry 4.0, supply chain and the FMCG Industry. The chapter has further provided a history of the various concepts mentioned and various studies have been noted that present the ideal situation of how 4IR-T can drive competitive advantage. For example, by implementing 4IR-T technologies beverage manufacturing industries can create superior value, or lower prices to their consumers thus creating a competitive advantage. The studies noted in this chapter have also found that 4IR-T can aid organisations in achieving cost reductions, productivity improvements, innovations, improve decision making and ensure the survival of these organisations by ensuring they stay competitive.

Beverage manufacturing organisations need to adopt 4IR-T in order to remain relevant, sustain competitive advantage and ensure their digital presence, however studies noted in this chapter have shown that beverage manufacturing organisations are slow to adopt 4IR-T and risk being left behind. The chapter has further presented the problem that was investigated, the research aim, objectives and questions that enabled for the exploration of the role of 4IR-T in driving competitive advantage with the beverage manufacturing organisations in the FMCG industry of SA.

Chapter 2 – Literature Review

2.1 Introduction

The aim of this study as noted in chapter 1 is to explore the role of 4IR-T in driving competitive advantage withing the beverage manufacturing organisations in the FMCG industry of SA. A particular focus of this research is to understand the factors that affect the adoption of 4IR-T in SA beverage manufacturing industry. To this end this chapter will present a review of literature on Industry 4.0 and 4th industrial revolution technologies (4IR-T) in section 2.2 and competitive advantage in section 2.3. Section 2.4 and 2.5 will review literature on Competitive advantage within the FMCG industry and ICT. A review of literature of 4IR-T and competitive advantage is presented in section 2.6, section 2.7 provides a conceptual framework and section 2.8 concludes this chapter.

2.2 Industry 4.0

The term "industrial revolution" was popularized by economist Arnold Toynbee when his lectures about the changes between 1790 and 1840 were published in 1884 (Klingenberg & Junior, 2017). During 1700s and late 1800s the world experienced the "First Industrial revolution" characterised by the substitution of water, coal and steam to power machines which replaced animal and human energy in manufacturing (Serumaga-Zake *et al.*, 2021; Poloz, 2021). The "Second industrial revolution" was experienced during the 1800s to the mid-1900s and this revolution was based on electricity to power machines and mass production (Klingenberg & Junior, 2017; Poloz, 2021). The "Third Industrial revolution" was between 1969s till date with the peak effect of this revolution taking place in the 1990s. This revolution saw the introduction of computer chips, electronics and, information and communication technologies (ICTs) to facilitate the manufacture and automation of machines (Klingenberg & Junior, 2017; Serumaga-Zake *et al.*, 2021).

Industry 4.0 or the 4th Industrial Revolution (4IR) is about the digitization of the global economy (Poloz, 2021). In the author's paper "Technological progress and monetary policy: Managing the fourth industrial revolution" described 4IR-T such as AI, machine learning and big data analytics as having the potential to improve all areas of economic activity. However, Poloz (2021) study focuses on implementing monetary policy in response to Industry 4.0. Nyagadza *et al* (2022) investigated the role of digital technologies, 4IR and global value chains (GVCs) nexus with emerging economies. The authors suggested that embracing 4IR organisations will increase productivity and innovations across various industries, and result in creations of new opportunities for emerging economies growth and development, quality of life will increase together with per capita income. The arguments by Nyagadza *et al* (2022) were based on existing literature but the current study focuses on the role of 4IR to drive competitive advantage especially in the FMCG industry.

4IR is not an extension of the third industrial revolution but a unique phase in terms of scope, velocity and systems impact due to the current industrial disruptive transformations (Klingenberg & Junior, 2017). Schwab, (2018) suggest that 4IR is evolving at an exponential rather than a linear pace when compiared to previous industrial revolutions, while disrupting almost every industry in every country. The breath and depth of the changes that 4IR brings can lead to the transformation of entire systems of production, management and governance. Nyagadza *et al.*, (2022) expands further and suggest that technology forces are increasing daily where a mega shift will be experienced in terms of how emerging economies businesses are operated, leading to the re-examination of the way resources are guarded.

A study conducted by Srivastava *et al* (2022) on the adoption of industry 4.0 by leveraging organisational factors suggested that Industry 4.0 allows flexible, smart, cost effective, environment friendly and socially responsible manufacturing ecosystem by leveraging 4IR-T. The study by Srivastava *et al* (2022) was conducted on India's technical educational institues and concluded that organisational factors of the TOE framwork was shown to be most important when looking to adopt 4IR-T. Maddikunta *et al* (2022) proposes that Industry 4.0 and 4IR-T is a motivator for "Industry 5.0" and could include applications such as intelligent healthcare, cloud manufacturing, supply chain management. However Wichmann, *et al* (2019) proposes that 4IR has not occurred which is supported by Poloz (2021) who proposes that we are in the early stages of 4IR.

Industry 4.0 has created a dynamic market with hyper-competition which is supported by Freund & Al-Majeed (2020). Freund and Al-Majeed (2020) suggests industrial production is driven by a hyper-competitive rivalry for market shares between industries which is caused by more global, digital, and interconnected environment using 4IR-T. Serumaga-Zake *et al* (2021) conducted a study to develop a framework to guide South African(SA) small, medium enterprises (SME's) into 4IR to gain increased productivity and reduce costs leading to competitive advantage and sustainable business performance. The authors concluded that the framework should be validated among SME's who are keen to embark on Industry 4.0 and 4IR-T.

Asides from SMEs, there are studies that have investigated the adoption of 4IR-T in different economic sectors of South Africa and the African continent. A study conducted by Van Dyk & Van Belle (2019) on the intention by SA Retail organisations to adopt 4IR-T found improved customer value and an agile innovative workforce as positive factors that drive competitive advantage. Another study conducted in the SA fabrication and construction industry by Karimulla (2020) on the assessment of adopting 4IR-T argued for the need to embrace 4IR-T to remain competitive. Bag *et al* (2020) investigated how big data analytics (BDA) can drive sustainable supply chain performance using an

operational excellence approach in the SA mining industry. The authors found that BDA capabilities have a strong effect on innovative product development and sustainable supply chain outcomes.

Wichmann, *et al* (2019) suggests that Industry 4.0 provides opportunities to thrive by embracing 4IR-T but concluded that failure to do might result in replacement by entirely new sectors and not just their competitors who have a higher competitive advantage.

2.2.1 4IR-Technologies

The background on which Industry 4.0 or the 4IR stands out is the new relationship that can be achieved between the physical world of human beings for example workers, consumers and the digital world for example computer sensors (Finotto *et al.*, 2019). Finotto *et al* (2019) further suggest that the merger of the physical and the digital world results in what is called Cyber-Physical Systems (CPS) which is one of the major 4IR-T of Industry 4.0. Rutten (2020) suggest that 4IR-T can be considered the new industrial paradigm of this age and is partly based on advanced manufacturing technologies. Buer *et al* (2021) proposes that in addition to CPS, other key technologies that drive industry 4.0 are Artificial Intelligence(AI), machine learning(ML), mobile, cloud computing, big data analytics and Internet of things(IOT). Buer *et al* (2021) further concludes that these 4IR-T promise to bring disruptive changes to manufacturing and organisations who don't adopt these technologies will fall behind and lose competitive advantage.

2.2.1.1 Cyber Physical System (CPS)

A CPS is a combination of ICT and production technologies which act as the enabling intelligence in a smart factory, a smart factory is a system of systems that receive data from various sources within and beyond the factory (Wichmann *et al.*, 2019). Wichmann *et al* (2019) further suggest that as productions systems become increasingly embedded with sensors, processing, and radio frequency identification (RFID) will allow production processes to become transparent and traceable and this is where CPS brings the greatest potential. While using a literature review in the study to identify trends of Industry 4.0 and effect on future manufacturing (Wichmann *et al*., 2019). Wichmann *et al* (2019) suggest that CPS will help organisations remain competitive by increasing the competitiveness of their factories in order to provide unique value to consumers and drive innovation.

A study conducted by Freund and Al-Majeed (2020) who proposed to present a conceptual framework for Industry 4.0 defined CPS as a new generation of systems that blend knowledge and physical artifacts together with engineered systems due to integrated computational and physical capabilities. The study further proposes that CPS are characterised by advanced connectivity which ensures real-time data acquisition from the physical world and information feedback from the cyber space and intelligent data management, analytics and computational capability that constructs the cyber space

(Freund and Al-Majeed, 2020). The researcher further suggest that these technology advances and 4IR-T hold the potential for organisations to achieve competitive advantage by driving superior, cost-effective production.

2.2.1.2 Artificial Intelligence (AI)

Artificial Intelligence (AI) refers to the ability of a digital computer, computer controlled robot or system to perform tasks commonly associated with intelligent beings (Van Dyk & Van Belle, 2019). For example, the ability to reason, discover meaning, generalize, or learn from past experience. McCarthy (1988) provided his opinion that AI is concerned with methods of achieving goals in situations where the information available has a certain complex character and the methods used to solve will be the same for a human or a computer program. Collins *et al* (2021) suggest that AI encompasses a broad range of ideas and practices and many forms of automation, machine learning and intelligent agents are labelled as AI. A study conducted by Wamba (2022) concluded that AI assimilation is an important predictor of firm performance, organisational and customer agility with varied intensity.

In the study Collins *et al* (2021) used a systematic literature review to understand characteristics of AI within the context of information systems. The authors discovered that AI supports business needs, for example process automation, gaining insight through data analysis and engagement with customers and employees, which can lead to competitive advantage. A study conducted by Serumaga-Zake *et al* (2021) further suggest that SA SMEs should be embracing 4IR-T such as AI and others in order to increase efficiency in delivery and production of quality goods and services. The application of AI and other 4IR-T will allow these processes to become more cost effective. Drydakis (2022) conducted a study on England SMEs to determine if AI applications are associated with reduced business risk. The authors highlighted that for SMEs to succeed and remain competitive, they should explore and exploit new opportunities by adopting technology enabling tools. Onu and Mbohwa (2021) further suggest that AI is a concept that facilitates machine learning.

2.2.1.3 Cloud Computing

Cloud computing is supported by virtualization technology, as it provides cloud computing with resource pooling, resource sharing, dynamic allocation, flexible extension and other capabilities (Koh *et al.*, 2019). Koh *et al* (2019) suggests that cloud computing can promote complex decision making where data can be stored in either the private cloud or public cloud servers by further enabling the modularization and service orientation in the field of manufacturing. Onu and Mbohwa (2021) suggest that cloud computing is a simple online information and data storage and retrieval platform using web based applications which requires no installation. Srivastava *et al* (2021) defines cloud computing as the system which deleivers different services throug the internet, requires minimal investment but

provides huge amounts of storage the resources of which include application like data storage, servers and database networking.

A study conducted by Finotto *et al* (2019) suggest that cloud computing is considered quite important to remain competitve in the beverage sector in Europe and Italy.However 32,6% of these organisations have not adopted 4IR-T and 79,1% have not adopted cloud computing. The authors concluded that ignoring 4IR-T will be a strategic mistake and cause these organisation to loose out on cost reduction in production, value addition to consumers and thus a loss in competitive advantage. A study conducted by Onu and Mbohwa (2021) explored opotunities of 4IR-T in sustainable manufacutirng. Cloud computing service was found to be at the core of techno innovation penetration. The authors concluded that cloud and other 4IR-T may serve as competitive solutions for future challenges.

2.2.1.4 Big Data Analytics

Big Data analytics (BDA) and technology can promote data collection from multiple sources, the ability to comprehensively analyse data and provide real time decision making based on the data analysis results (Koh *et al.*, 2019). Big data is a notion that applies to enormous, diversified and complicated data points that influence a choice and strategy as well as the organisational decision structure of the company's plan (Srivastava *et al.*, 2021). Onu and Mbohwa (2021) suggest that BDA is more focused on what will happen rather that what has happened and act as a prediction of the future possibilities or unknown events. Talwar *et al* (2021) proposes that BDA can assist organisations in improving operational performance by optimising supply chain costs, reduce logistics service costs, support information sharing and transparency in communication which could lead to competitive advantage.

Bagale *et al* (2021) within the study on SMEs in India suggest that BDA can assist in times of crisis management, for example BDA allowed for the COVID-19 pandemic to be monitored in real time. A study conducted by Nayak (2021) found that the potential of BDA and associated Industry 4.0 technologies which can assist in lowering operational cost and standardizing processes in the Health insurance firms would benefit these organisations. Drydakis (2022) further suggest that AI advances BDA collection and processing, analysis, drives conclusions and provides recommendations.

2.2.1.5 Internet of Things (IOT)

Internet of things (IOT) refers to a type of network that enables any device to connect to the internet based on stipulated protocols through information sensing equipment to conduct communication and information exchange (Van Dyk & Van Belle, 2019). Srivastava *et al* (2021) suggest that IOT enables physical devices to connect and exchange data with cloud application and other connected devices. Industrial IOT evolved after the combination of IOT, and internet of services resulted in the evolution of Industry 4.0 Srivastava *et al* (2021). IOT is an advancement that enables a system to communicate

autonomously to each other under a set of activities that creates big data for further analysis (Onu & Mbohwa, 2021). IOT has become a notable technology for digitizing the manufacturing supply chain management process (Onu & Mbohwa, 2021).

In their study Onu & Mbohwa explored 4IR-T to promote sustainable manufacturing concluded that IOT implementation can facilitate operational excellence and increase manufacturing quality. Serumaga-Zake *et al* (2021) in their article to develop a framework for SMEs in SA and the impact of 4IR. The authors suggest that with the implementation of IOT SMEs will be able to enable efficient delivery, produce quality goods, will become cost effective and will produce at a faster rate. A study conducted by (Kumar *et al.*, 2022) suggest that IoT can increase efficiency, productivity, convenience and response times in various logistics and warehouse operations, however the study concludes that there is a disconnect between IoT and warehouse logistics improvement plan.

2.3 Competitive Advantage

The term "competitive advantage" has a long standing history and tradition in the strategy management literature (Asad, 2012; Sigalas, 2015). Competitive advantage was first used in 1957 by Philip Selznick (Purbasari *et al.*, 2020). Ansoff (1965) was the first scholar who attempted to define competitive advantage as the particular characteristics or properties of individual product markets that give a firm a strong position against competitors. The characteristics or properties could be identified as superior products or services, superior value or resources compared to similar offers by competitors (Negulescu, 2019) and organisational agility (Wamba, 2022). The turning event that introduced competitive advantage in business strategy was Porter's (1985) book Competitive Advantage, creating and sustaining superior performance. Porter (1985) gives no explicit definition of competitive advantage but argues that competitive advantage is directly related to the value expected by the customer. If the value offered by an organisation is more in accordance with a customer's expectation, the organisation will have an advantage in one or more criteria of being more competitive. (Porter, 1985; Purbasari *et al.*, 2020).

Porter (1985) identified 5 forces referred to as the Five forces Framework that shape the intensity of competition based on an organisation's external environment. These five forces identified by Porter (1985) include industry rivalry, entry barriers, supplier power, buyer power, and substitute products. The forces are referred to as the Market Based View (MBV) or positioning view of competitive advantage (Asad, 2012; Sigalas, 2015; Purbasari *et al.*, 2020). The MBV argues that industry factors and external market orientation are the main determinants of firm performance (Purbasari *et al.*, 2020). Competitive advantage aims to find a position in an industry that can protect the organisation from the five forces that determine competition (Jobber & Ellis-Chadwick, 2020). Porter (1985)

proposes that an organisation can follow any of three generic strategies which include an overall cost leadership, product differentiation or meeting needs of certain consumers in order to achieve competitive advantage (Jobber & Ellis-Chadwick, 2020).

Another view of Competitive advantage is the Resource based view (RBV) which suggest a firm can earn sustainable profits if they have superior resources compared to their rivals (Grant, 1991). Barney (1991) suggest that an organisation's resources should be valuable, rare, inimitable, and non-substitutable (Serumaga-Zake *et al.*, 2021) to potentially create sustained competitive advantage. Valuable refers to the fit of the resource with the company goals and how it exploits opportunities and neutralizes competition while rare refers to how readily the resource may be acquired (Barney, 1991; Serumaga-Zake *et al.*, 2021). Barney (1991) further classifies inimitability as the dificulty involved in obtaining or copying a resource and non-substitutable as the degree to which an organisations resource can be substitued by its rivals. Heterogeneous and immobile are assumptions made in the RBV theory. Heterogeneous assumes that the mix of resources differ between organisations and immobile assumes that resources do not move from an organisation to another within a short period (Jobber & Ellis-Chadwick, 2020).

The difference between these two school of thoughts is that the MBV focuses on the industry of the organisation while the RBV pays more attention to individual company and its resources (Jobber & Ellis-Chadwick, 2020). Purbasari *et al* (2020) conducted a study within the Indonesian digital industry to understand the development of the digital industry to increase competitive advantage. The study found that the competitive power of this industry lies in digital content and application. A study conducted by Otieno and Angira (2021) was aimed at establishing the agility strategies employed by Coca Cola Beverages Africa- Kenya (CCBA-K) using the RBV. Business flexibility and organisational control over key resources has a direct influence on competitive advantage. Serumaga-Zake *et al* (2021) conducted a study to develop a framework to help SA SME's gain competitive advantage using the RBV theory. The framework proposed that tangible and intangible resources, capabilities, and experience of human capital can lead to sustained competitive advantage.

The studies mentioned have relevance to the current study of how competitive advantage can be driven by 4IR-T. 4IR-T can be used to create superior products, increase perceived use value, create superior resources, drive business leadership, and reduce costs. However, the studies reviewed do not focus on the South African beverage manufacturing industry or use a different research strategy in conducting the research.

2.4 Competitive advantage in the FMCG industry

Nainaar and Masson (2018) classify fast moving consumer goods (FMCG) as goods retailed at constant periods where prices are moderately less, and profits are made up through volume of sales. FMCG are relatively low priced goods with a short shelf life which are purchased frequently by customers (Mathu, 2021). These products usually have shelf life of less than a year, non-durable and bought frequently with recurring income (Rutten, 2020). Benfratello (2021) notes that FMCG products include food, beverages, cosmetics, detergents and over the counter drugs. Within SA, suppliers of processed products are food and beverage organisations, healthcare, and personal care products firms as well as suppliers of perishables such as vegetables, dairy, beef and grocery SME's (Mathu, 2021). Grocery SME's provide one of the leading distribution channels of FMCG's (Mathu, 2021). If FMCG organisations intend to remain competitive, increase sales and reduce waste, they need to be at the forefront of adopting modern day technology such as 4IR-T.

A study conducted in the food and beverage industry in Indonesia by Saryatmo and Sukhotu (2021) to investigate the influence of digital supply chain on operational performance found that a digital supply chain positively influences quality, productivity and cost reduction leading to market competitiveness. Another study in the food sector by Demartini *et al* (2018) using a literature review and focus groups to help food organisations toward digitalization. The study focused on design and manufacturing processes by developing a framework, concluded that the area requires further investigation and tests to improve the framework (Demartini *et al.*, 2018). A study conducted by Iliashenko *et al* (2019) on consumer goods companies in Russia investigated the use of Radio frequency(RF) tags to digitally transform logistics process. The findings show that the main advantage of RF tags was the ability to fully automate warehouse processes and maintain competitiveness by automating the logistics process, preventing halts in production, and reducing customer penalties.

A study conducted by Srivastava *et al* (2021) where L'Oréal east Africa and Unilever were one of the case studies found that 4IR-T such as robots, drones, big data are used in numerous production processes. This has allowed these organisations to strengthen their business strategy and gain competitive advantage. From a SA perspective Nainaar and Masson, (2018) conducted a study to investigate how technology management can create sustainable competitive advantage in FMCG beverage industry. The authors concluded that with the adoption of technology management principles and practices they can achieve improved product quality, reduce cost, and differentiate their products to drive competitive advantage. A study conducted by Mathu (2021) on how the application of supply chain management (SCM) process in SA FMCG SME's enhanced competitive advantage. The findings showed that SCM improved cost effectiveness, improved customer service, enhanced supplier customer relationships leading to competitive advantage

A study conducted within the SA manufacturing industry on factors that inhibit adoption of Industry 4.0 using a small-scale interview based qualitative descriptive study (Maisiri *et al.*, 2021). The study found that the SA manufacturing industry should consider balancing competitiveness aspects and meeting SA requirements of inclusiveness and equality. Maisiri *et al* (2021) concluded that factors such as resistance to change, unemployment, skills shortage and inadequate supporting ICT infrastructure are barriers to Industry 4.0 adoption. A study conducted by Rajkumar (2021) within Massbuild which is a retail organisation in SA. The study found that a conducive environment is needed for business to adopt new technology to achieve competitive advantage and some challenges in SA such as connectivity costs, lack of legal and policy frameworks and investments limit technology adoption. However, the study did not focus on the FMCG business of Massmart such as Masscash, Masswarehouses, and Massdiscounters.

The literature review of Competitive advantage and the FMCG industry are relevant to the study, studies noted in this section show how 4IR-T can drive down costs, increase value, create superior products, and drive business leadership. However limited studies have been conducted specifically in the FMCG beverage manufacturing environment in SA.

2.5 Competitive Advantage and ICT

Information and communication technology (ICT) refers to technology that supports activities involving the creation, storage, manipulation and communication of information and their associated methods, management and application (Akintelu *et al.*, 2016). Igwe *et al* (2020) further defines ICT as the infrastructure, people, skills, rules, procedure, and components that enable modern computing and communication and is generally accepted to mean all devices, networking components, applications and systems which allow people and organisations to interact with the digital world when combined. ICT encompasses both internet-enabled, and mobile devices powered by wireless networks, however the term also includes legacy ICT such as landlines telephones, radio and television broadcasting all of which are used in conjunction with 4IR-T (Igwe *et al.*, 2020). Rutten (2020) characterises ICT as part of the third industrial revolution. ICT has changed the way in which organisations work, socialize, create and share information. Amukanga and Otuya (2021) suggest that ICT implementation within SCM activities can result in competitive advantage or be a competitive weapon in his study on ICT and supply chain management performance.

Tiwari (2020) performed an analysis of the impact on ICT on the logistics industry in India. ICT adoption among logistics companies in India led to increased flexibility, speed, accuracy, and readily available information which would achieve competitive advantage. Another study by Ikhwana and Dianti (2022) explained interactions between ICT and SCM on competitive advantage. The authors concluded that

ICT and SCM have a strong unidirectional relationship effect on competitive advantage. Ihuoma (2018) performed a study in the Nigerian banking industry and the effect ICT has on their performance. The author concluded that Nigerian banks should invest more in ICT to achieve sustainable growth and competitive advantage. A study conducted by Igwe *et al* (2020) to investigate the relationship between technology adoption and sales performance of manufacturing SME's in Nigeria. The authors found ICT adoption positively influences sales and business performance and concluded that owners should encourage technology adoption geared toward competitive advantage.

Pillay (2016) conducted a study within the SMEs manufacturing sector to investigate the barriers to ICT adoption. The author found that implementing ICT in these organisations could offer possible improvement in their competitiveness for example new market opportunities and specialised information services. A study conducted in the South African construction industry to access the benefits of using ICT tools within SA construction organisations found that ICT implementation can provide competitive advantage within this industry by improving productivity and efficiency of construction work (Tanga *et al.*, 2021).

Motheogane and Pretorius (2021) conducted a study on a SA parastatal to investigate the factors that influence the alignment of ICT with strategic business objectives. The authors found that ICT remains valuable in enhancing competitiveness of the economy of a country and concluded that organisations should align their ICT Strategy with their Business strategy. Classen *et al* (2021) conducted a study on influencing factors on adoption of DT within SA SMEs using the TOE framework. The authors found that fear of losing to competitors from the environmental factors usually lead to the adoption of technology in order to maintain their competitive advantage.

While the above literature review on Competitive Advantage and ICT is relevant to the study, the technologies associated with ICT form part of the third industrial revolution. However, the current study will focus on Industry 4.0 and these enabling technologies in driving competitive advantage in the SA beverage manufacturing industry.

2.6 4IR-T and Competitive advantage

4IR-T are changing the way in which FMCG organisations function today due to readily availability of information. Organisations in the SA beverage manufacturing industry are able to use 4IR-T to their advantage by innovating new product variants, developing new markets and improving quality (Nainaar & Masson, 2018). With increasing competition in the digital industry companies are required to do various activities differently in order to survive and prosper while their competitive advantage constantly improved to succeed in global competition (Purbasari *et al.*, 2020). Firms in emerging economies like SA have struggled to create competitive advantage using traditional ways of

competitive positioning and in the digital era firms must look for fresh perspectives to frame its business and create value for customers (Nayak *et al.*, 2021). Previous studies have shown that 4IR-T implementation can enable organisations to gain competitive advantage and ensure their survival (Nainaar & Masson, 2018; Purbasari *et al.*, 2020; Nayak *et al.*, 2021; Felsberger *et al.*, 2022).

Nayak *et al.*, (2021) conducted a study in India's health insurance firms to explore how emerging technologies can augment competitive advantage found that 4IR-T need to be adopted, implemented, and managed in order for these firms to gain competitive advantage. Buer *et al* (2021) conducted a study to investigate impact of production environment by digitalization of manufacturing in Norway firms. The authors argued that 4IR-T promise to bring disruptive changes to manufacturing and organisations not capable of reaping these benefits will fall behind and lose competitive advantage. A study conducted by Ikhwana and Dianti (2022) on Indonesian SMMEs on the influence of technology and SCM on competitive advantage concluded that the higher the utilization of technology or the application of SCM the higher the achievement of competitive advantage. A study conducted by Felsberger *et al* (2022) within European manufacturing industry to investigate the impact of 4IR-T found that 4IR-T paved the way for competitiveness in these organisations within the European manufacturing industry.

A study conducted by Igwe *et al* (2020) within manufacturing SMEs in Nigeria to investigate the relationship between technology adoption and sales performance concluded that manufacturing SMEs in Nigeria should invest and encourage full adoption of 4IR-T to ensure they sustain competitive advantage. Eze *et al* (2020) conducted a study in the Nigerian service oriented micro-business on factors influencing adoption of digital marketing devices (DMD). The authors concluded that DMD adoption would enhance the value chain through information sharing and leads to product and process innovation, reduced costs, and competitiveness. A study conducted by Amukanga and Otuya (2021) on Kenya's public sector organisations to understand how 4IR-T impacts SCM found that competitive edge within the industry are achieved through performing supply chains. Otieno and Angira (2021) conducted a study on CCBA-K to establish agility strategies used by CCBA-K to sustain their competitive advantage. The authors found that CCBA-K has embraced technology to improve efficiencies, effective order fulfilment times and customer service to sustain their competitive advantage.

A study conducted by Bosch and Rossouw (2021) in the motorcycle manufacturing industry to establish a strategic position suitable for the 4IR to gain competitive advantage by increasing quality of products and developing superior resources by upskilling employees. The study concluded that it was necessary for the manufacturers to continuously adapt and modify strategies to ensure competitive advantage. Mofokeng and Mokoena (2021) conducted a study on the impact of 4IR in the

modern SA banking industry. The study found that benefits such as increased competitive advantage, profits, process efficiencies with the implementation of 4IR-T, however some perceived impacts were retrenchments at the banks. A study conducted by Rajkumar (2021) on 4IR-T influence on retailer Massbuild SA found that to achieve a competitive stance, adoption of 4IR-T is needed to derive profits, reduce costs and allow the organisation to gain competitive edge.

Studies conducted within the SA environment have shown that adoption of 4IR-T can lead to competitive advantage. A study conducted by Van Den Berg and Van Der Lingen (2019) on factors that affect mobile enterprise application (MEA) adoption found productivity, reduced cost and sustained competitive advantage. Maisiri *et al* (2021) conducted a study on factors that inhibit sustainable adoption of 4IR-T in SA manufacturing industry. The authors concluded that successful adoption of 4IR-T goes beyond development of technological capabilities and that sustainable adoption entails balancing competitiveness in ways that achieve goals. Mathu, (2021) conducted a study within SA SMEs to explore how the application of SCM provided competitive advantage. The authors found that technology use and information sharing improved supply chain collaboration between FMCGs, 3rd party logistics suppliers and grocery SMEs. A study conducted by Tanga *et al* (2021) on digitalisation of the SA construction industry found that 4IR-T can help organisations enhance competitiveness, innovation and expand opportunities.

While the above articles explore how 4IR-T have driven competitive advantage from an international, an African, a South African perspective and within various industries, the current study will focus on how 4IR-T can drive competitive advantage within the SA beverage manufacturing environment. In this study, variables of competitive advantage based on existing literature includes superior beverage products or services, value-added in beverage products, technology-driven business leadership peculiar to the beverage industry and enhanced performance of beverage manufacturing processes.

2.7 Conceptual Framework

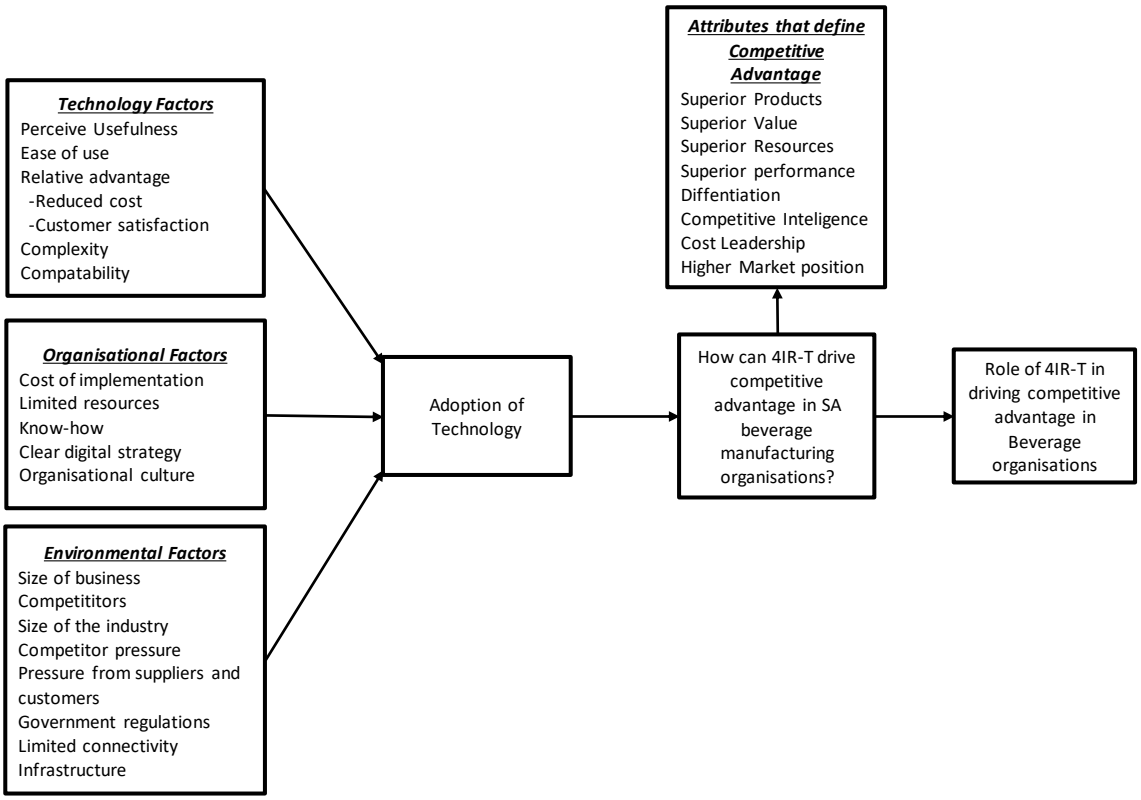

Figure 2: Conceptual Framework of this Study

A conceptual framework can be considered a structure which a researcher believes can best explain the natural progression of the phenomenon to be studied (Adom *et al.*, 2018). Figure 2 represents a conceptual framework based on the review of the literature and the objectives of the study. The above conceptual framework suggests that TOE factors will affect beverage organisations adoption decision of 4IR-T. The outputs of the framework will provide the researcher answers to the main research question of how 4IR-T can drive competitive advantage within SA beverage manufacturing organisations.

2.8 Conclusion

This chapter has presented a review of existing literature related to this research topic. The studies reviewed show the relevance of 4IR-T in driving organisations to produce superior products or services, drive business leadership, reduce costs and increase efficiency in production thus driving competitive advantage. This chapter has also presented the advantages of implementing third industrial revolution technologies such as ICT's that can drive competitive advantage and has further discussed studies from an international, African and South Africa perspective together with studies

from various industries. The aim of this study is to explore the role of 4IR-T in driving competitive advantage within the beverage manufacturing industry.

While various studies have been noted throughout the literature review, that focus on 4IR-T driving competitive advantage, ICT's driving competitive advantage from different countries and industries. There have been limited studies completed within the SA beverage manufacturing industry and the role of 4IR-T in driving competitive advantage withing these organisations.

Chapter 3 – Theoretical Underpinnings

3.1 Introduction

Latterly to the literature review, this chapter presents the theoretical underpinning and stance in order to simplify the investigation, contextualize the research phenomenon and aid the analysis of the phenomenon being investigated. This chapter with further present a suitable theory and motivates its selection for use in this research. This chapter will be structured into four sections, following the introduction section in 3.1, section 3.2 will give a reflection of the definition of a theory and the different types of theories used in research, section 3.3 will present the framework and motivation for the selected theory/framework, that will be used in this research and section 3.4 concludes the chapter.

3.2 Uses of Theory in Research

Saunders *et al* (2007) defines a theory as a formulation regarding cause and effect relationships between two or more variables which may or may not have been tested. Cooper and Schindler (2014) further defines a theory as a set of systematically interrelated concepts, definitions and propositions that are advanced to explain and predict phenomenon. The degree to which theories are sound and fit the situation will allow successful explanations and predictions (Cooper & Schindler, 2014). Saunders *et al* (2007) research onion proposes that the approach to theory development include deduction, induction and abduction which can be used in research.

3.2.1 Deductive approach to theory application in research

In deductive research, the logic is referred to reasoning moving from a general rule to a specific law like inference and is usually used for theory testing (Melnikovas, 2018) as is the case with this research being conducted. Saunders *et al* (2007) notes that the deductive approach to research involves the development of a theory that is subject to rigorous tests. Laws present the basis of explanation, allow the anticipation of the phenomena, predict the occurrence, and therefor permit them to be controlled. Okoli (2021) proposes that deductive theorizing is theorizing that starts with a proposed or supported theory, which should ideally result in a new proposed theory, a supported theory, or an enhanced theory. The TOE theory/framework was applied within this research as a lens through which the role of 4IR-T in driving competitive advantage with the SA beverage manufacturing industry was determined.

3.2.2 Inductive approach to theory application in research

The inductive approach to research involves building a theory and starts with specific observation on the basis of which a general rule is formulated and is mainly associated with intuitive techniques (Melnikovas, 2018). Cooper and Schindler (2014) suggest that induction differs from deduction in that conclusions from one or more particular facts or pieces of evidence will be drawn. Saunders *et al* (2007) further suggest that the purpose of inductive research is to get a feel for what is going on, so as to better understand the nature of the problem. Data collected will be analysed where the result of the analysis would be the formulation of a theory. Okoli (2021) proposes that inductive theorizing is theorizing that starts off with a non-theoretical empirical phenomenon which should ideally result in a proposed or supported theory.

3.2.3 Abductive approach to theory application in research

Melnikovas (2018) suggest that the abductive approach to research is a form of inference that starts with observation of clue-like signs, which provide the basic notion for further research. Abductive inference is a best guess or conclusion based on available evidence. Abductive approaches focus on the discovery of weak signals which are the first symptoms of change and is mainly applied to draw a conclusion from low knowledge. The abductive approach aims to identify structures, connections, contexts, constraints and involves the use of cognitive argumentation (Melnikovas, 2018). Okoli (2021) proposes that inductive theorizing is theorizing that starts off with rudimentary theory or theory in progress, which should ideally result in a proposed or support theory.

3.3 Technology Organisational Environment (TOE) Framework used in this Research

3.3.1 TOE Framework

The Technology-Organisational-Environmental (TOE) framework is an organisational level theory developed by Tornatzky and Fleischer (1990) to explain the elements that influence technology adoption within a firm context (Van Den Berg & Van Der Lingen, 2019). Van Dyk and Van Belle (2019) further states that the TOE framework represents how different elements of an organisation (TOE) affect technological innovations. Van Dyk and Van Belle (2019) suggests that this framework is suitable for research as it has flexibility for variance of the factors or measures.

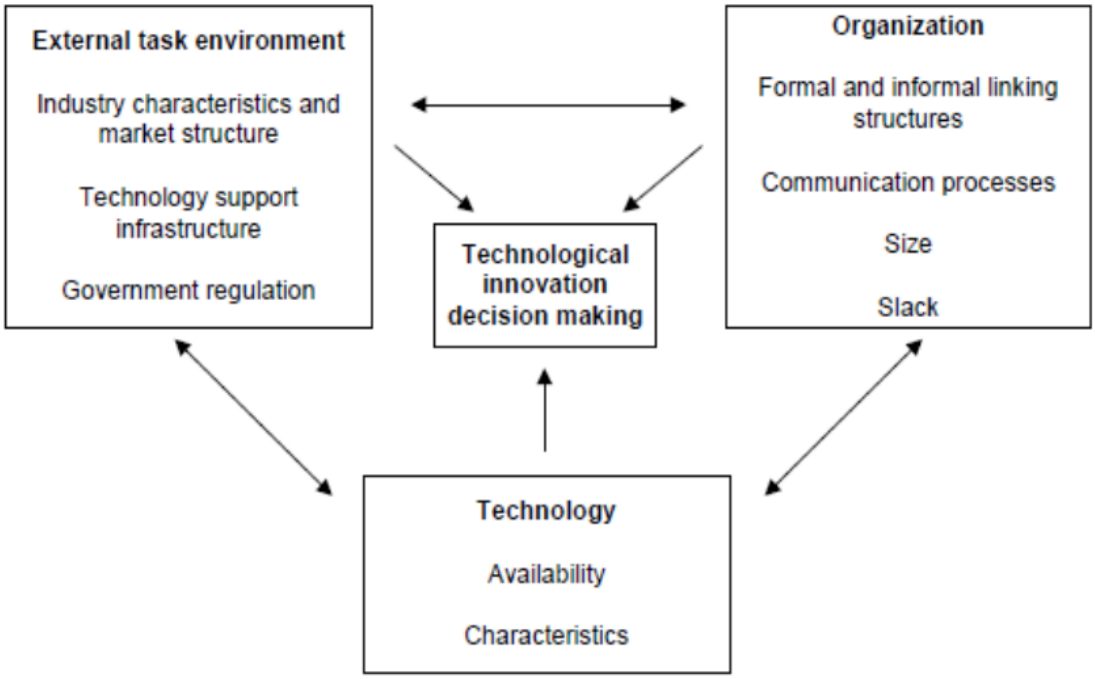

Figure 3: Technology-Organisational-Environment (TOE) Framework (Van Dyk & Van Belle 2019)

The TOE framework can be used to explain the readiness of organisations to adopt technological innovations (Igwe *et al.*, 2020). Eze *et al* (2020) further classifies the TOE framework as a conceptual framework used by organisations to examine what IT applications are more likely to improve their services by accepting and implementing such technological inventions which are shaped by TOE factors. Classen *et al* (2021) suggest that TOE frameworks strength lies in its ability to look at multiple dimensions of variables and this framework is recommended when there are external factors that need to be considered that affect technology adoption.

The technology aspect of the TOE framework refers to how technological features can affect a firms decision to adopt these technologies (Rajkumar, 2021). Rajkumar (2021) suggest that these features could include perceived benefits or advantages, obstacles, usability, perceived risk, compliance, and testability. Classen *et al* (2021) further proposes that relative advantage, compatibility, and the complexity can be considered technology factors that would influence an organisations technology adoption decision and process. For example the study conducted by Classen *et al* (2021) found that complexity also referred to as perceived ease of use influenced technology adoption, easy to use technologies such as social media were more likely to be adopted than technologies that were perceived as complicated.

Organisation factors of the TOE framework can include organisation size, top management support and prior technology experience which influence an organisations technology adoption process (Classen, Garbutt and Njenga, 2021). Igwe *et al* (2020) further classifies organisational capabilities, scope of business operation, size of the market coverage and suggest that limited resources in terms of financial, time, personnel affect an organisations decision to adopt technologies. The study conducted by Igwe *et al* (2020) found that organisational capabilities directly influence usage and adoption of technology to improve sales performance. A study conducted by Classen *et al* (2021) further found that top management support is essential when adopting technology as approval and resource allocation should be driven from top management. Classen *et al* (2021) concludes that and organisations is more likely to adopt technology if top management and employees are familiar with the technology.

Eze *et al* (2020) suggest that environment factors that affect an organisations decision to adopt technologies include competitors, macroeconomic perspective, and the regulatory background. Rajkumar (2021) and Classen *et al* (2021) further suggest that government regulations, customer pressure and competition are further environmental factors that affect technology adoption. For example the study conducted by Classen *et al* (2021) found that the fear of losing to competitors arises from the external environment and usually leads to organisations adopting technology to maintain their competitiveness. A study conducted by Van Dyk and Van Belle (2019) further suggest that limited infrastructure and connectivity could inhibit the adoption of technologies by organisations.

3.3.2 Application of the TOE Framework in previous studies

Various studies have been conducted using the TOE framework to establish the factors that affect the adoption of technology (Van Dyk & Van Belle, 2019; Van Den Berg &Van Der Lingen, 2019; Igwe *et al.*, 2020; Eze *et al.*, 2020; Classen *et al.*, 2021; Rajkumar, 2021; Mohamed & Jokonya, 2021; Srivastava *et al.*, 2022). For example Srivastava *et al* (2022) study used the TOE framework to establish adoption of Industry 4.0 by leveraging organisational factors. Mohamed and Jokonya (2021) study used the TOE framework to identify factors effecting the adoption of technologies to improve fleet safety management.

While the above studies are relevant, limited studies have been conducted in the SA beverage manufacturing industry. Srivastava *et al* (2022) study was conduted within India's technical educational institues. Both Igwe *et al* (2020) and Eze *et al* (2020) studies where conducted within the Nigerian SME and service oriented micro business respectively. The studies conducted by Van Dyk and Van Belle (2019) and Rajkumar (2021) was conducted within the SA retail industry. Van Den Berg and Van Der Lingen (2019) study was on SA organisations in general while Classen *et al* (2021) focused on

SA SMME's. Lastly the study conducted by Mohamed and Jokonya (2021) was conducted within the SA logistics industry.

3.3.3 Motivation for the TOE Framework for this Research

The TOE framework can be seen as a component of the innovation phase which refers to how a company adopts or does not adopt technologies. The TOE framework represents how the different elements of an organisation, namely technology, organisational and environment, affect technological innovations and that this framework has the flexibility for variance of the factors or measures. The TOE framework has been selected for use in this study as it is ideally suited to meet the research aim and objective by focusing on three different elements of the case study company which is the technology, organisational and environmental factors. The TOE framework is used as a lens to determine the role of 4IR-T in driving competitive advantage within beverage manufacturing organisations in SA.

3.4 Conclusion

This chapter has presented the theoretical underpinning for the research being conducted. An overview of the various types of research theories namely deductive, inductive, and abductive that can be used was discussed. Due to the deductive approach followed within this research, this research will not seek to develop a new theory but use an existing theory namely the TOE Framework to explore the role of 4IR-T in driving competitive advantage within the beverage manufacturing industry. The TOE framework has strength in its ability to look at multiple dimensions of variables and is recommended when external factors need to be considered that affect technology adoption, therefore this chapter has presented why it will be used in this study. A history of this framework, the various similar studies on the adoption of 4IR-T where this framework has been used and a further motivation as to why this framework was selected for use in this study has been presented in this chapter.

Chapter 4 – Research Methodology

4.1 Introduction

Research methodology is a general research strategy or guideline which describes the way in which scientific investigations should be conducted. A methodology includes philosophical assumptions which shape the understanding of the research question and underpin the choice of research methods (Melnikovas, 2018). Saunders *et al* (2007) proposed a theoretical concept referred to as the "Research Onion" to construct a research methodology. The research onion consists of 6 layers which include research philosophy, strategy, time horizon, methods, approach and techniques and procedures (Saunders *et al.*, 2007).

Saunders *et al's* (2007) research onion proposes that either positivism or interpretivism can be selected within the philosophy layer. Positivism refers mainly to the position of a natural scientist, and the study would seek to observe social reality where the end findings would be law-like generalisations similar to those produced by natural scientist (Melnikovas, 2018). Interpretivism research is more concerned with gathering right insights into subjective meanings, the study would focus on social phenomena in their natural environment and research among people rather than objects (Saunders *et al.*, 2007; Saunders & Tosey, 2012; Melnikovas, 2018).

The subsequent subsections highlight the research methodology that was used by the researcher to select a strategy in section 4.2, the research methods in section 4.3, research approach in section 4.4. Section 4.5 presents the sampling methods, ethics in section 4.6, data collection and analysis techniques in section 4.7 to investigate how 4IR-T can drive competitive advantage in the SA FMCG beverage manufacturing industry. Section 4.8 presents that data management plan and section 4.9 concludes the chapter.

4.2 Research Strategy

Melnikovas (2018) suggest that a research strategy can be referred to as a general way which helps researchers choose their main data collection methods or sets of methods in order to answer the research question and meet the research objectives. Saunders *et al* (2007) proposes that research strategies that can be selected include case study, experiments, surveys, action research, grounded theory, ethnography, and archival research, which form the research strategy layer of the research onion. The researcher used a case study research strategy to conduct this research.

Saunders *et al* (2007) defines a case study as a strategy which involves an empirical investigation of a particular contemporary phenomenon within is real life context using multiple sources of evidence.

This research aimed to explore how 4IR-T can drive competitive advantage in the FMCG beverage manufacturing organisations where 4IR-T driving competitive advantage would be the contemporary phenomenon. Beverage manufacturing organisations was the real-life context while information gathered from various participants formed the multiple sources of evidence. The researcher has engaged personnel within the beverage manufacturing organisation to identify factors that influence 4IR-T to drive competitive advantage in these organisations.

Yin (2009) further suggests that within a case study the boundaries between the phenomenon and context are not clearly evident, and the investigator has little control over events. This was the case within this research as 4IR-T driving competitive advantage in beverage manufacturing organisations is not clearly evident. The case study strategy was chosen as an ideal methodology by the researcher due to the study requiring a holistic, in-depth investigation of how 4IR can drive competitive advantage within beverage manufacturing organisations. Other research strategies proposed by Saunders *et al* (2007) research onion have not been chosen as these strategies would not have assist the researcher as effectively as the case study strategy in achieving the research aims, questions and objectives.

The organisation that formed the case study for this research is a SA beverage manufacturing organisation that was formed in 2018 out of an acquisition between two previous separate beverage organisations. The merger of the two organisations brings over 66 years of experience into the new formed organisation. The organisation manufactures high quality and value carbonated soft drinks, energy drinks, mixers and still beverages for the SA market. The organisation manufactures 10 different brands and further does private label manufacturing for various retail organisations. Due to the merger between two organisations, the current organisation has various legacy systems that are currently in use. While the organisation has implemented third industrial revolution technologies such as ICT's the organisation is slow to adopt 4IR-T in order for the organisation to compete with larger international companies and create competitive advantage within the local and international market. The organisation will be referred to as FMCG_B throughout this research.

An experiment strategy is used to study causal links in a controlled environment, to establish if a change in one independent variable causes a change in another dependant variable (Saunders *et al*, 2007). However, this strategy was not selected as the research does not seek to test causal relationship between 4IR-T and competitive advantage. Further to this the researcher had no control of the variables 4IR-T and competitive advantage as the research was conducted in a non-controlled environment namely the beverage manufacturing industry. A survey strategy, allows the collection of a large amount of data from a sizable population in a highly economical way Saunders *et al* (2007). However, this strategy lacks the ability to explore and understand the context which is limited by the

number of variables for which data can be collected. This research had a focus on bringing out viewpoints from participants using multiple sources of data on factors influencing the adoption of 4IR-T to drive competitive advantage.

Action strategy which encompasses a researcher working with practitioners to bring about organisational change, combines both data gathering and facilitation of changes (Saunders *et al.*, 2007; Saunders & Tosey, 2012). However, this research aimed to investigate how 4IR-T can drive competitive advantage in the beverage manufacturing industry and did not apply 4IR-T or monitor their implementation to drive competitive advantage. Grounded theory would be useful in research to predict and explain behaviour with an emphasis on building theory (Saunders *et al.*, 2007; Saunders & Tosey, 2012). However, this research did not seek to explain any behaviour or develop theories and focused more on understanding how 4IR-T can drive competitive advantage within the beverage manufacturing industry.

An ethnography strategy is used to describe and explain the social world research subjects inhabit and the way in which they would describe and explain it (Saunders *et al.*, 2007). For example, a researcher dwelling amongst a community for a period of time, to learn their ways. The researcher has noted that this strategy is not applicable to the research being conducted. Lastly an archival strategy or systematic literature review makes use of administrative records and documents as the principal source of data (Saunders *et al.*, 2007). In this study, the researcher continuously consulted the existing body of literature and engaged with personnel within the beverage manufacturing industry to identify the factors the influence adoption of 4IR-T to drive competitive advantage. Similar studies have also used a case study strategy (Demartini *et al.*, 2018; Van Dyk and Van Belle, 2019; Otieno and Angira, 2021; Rajkumar, 2021; Felsberger *et al.*, 2022).

The time horizon layer from Saunders *et al* (2007) research onion suggest that research can be cross-sectional or longitudinal, however this research followed the cross-sectional horizon. Cross section time horizon is referred to the study being done at a particular point or a snapshot(Saunders, Lewis and Thornhill, 2007) in time of how 4IR-T can drive competitive advantage within the beverage manufacturing organisations. The researcher gained information from personnel at beverage manufacturing organisations to investigate the contemporary phenomenon of 4IR-T in driving competitive advantage which was at a given point in time. A longitudinal study seeks to observe people or events over time. However, this study did not observe or measure personnel or events over a prolonged period within the beverage manufacturing industry hence the selection of the cross-section time horizon.

4.3 Research Methods

Saunders *et al* (2007) methodological layer of his research onion suggest that quantitative, qualitative, and mixed methods can be selected as a research method. Quantitative methods are predominantly used for data collection technique or data analysis procedure that generates or uses numerical data. Qualitative is used predominantly as a data collection technique that generates or uses non-numeric data (Saunders *et al.*, 2007). Mixed method is a general term for the use of both quantitative and qualitative data collection techniques and analysis procedures.

Taherdoost (2022) provides a definition of quantitative research as a method of employing numerical values derived from observations to explain and describe the phenomena that the observations can reflect on them. Numerical data collected in this method is analysed using mathematical methods and some of the strategies that are used in this method include surveys, experiments and causal-comparative research (Taherdoost, 2022).

Rajkumar (2021) defines qualitative research as an investigation adopted to examine and explain how an individual or groups of human actors assign interpretations to a social or perceptive phenomenon. This method aims to collect primary, first hand textual data and analyse is using specific interpretive methods and is useful in studying a phenomenon with limited accessible information (Taherdoost, 2022). Various empirical material such as case studies, life experiences and stories that show the routines and problems that are being faced though focusing on in-depth meaning and motivations which cannot be defined by numbers (Taherdoost, 2022).

The researcher used qualitative methods to identify the factors that influence adoption of 4IR-T to drive competitive advantage in beverage manufacturing organisations. The researcher engaged personnel within the beverage manufacturing industry and used interviews and a focus group. An interview can be classified as a purposeful discussion between two or more people, while a focus group refers to a group interview where a topic is clearly defined which enables interactive discussion between participants (Saunders *et al.*, 2007; Blumberg *et al.*, 2014). These methods were used due to the exploratory, qualitative research being conducted; this has allowed the researcher to gain valuable and reliable data that is relevant to the research questions and objectives. These techniques align with the researcher's case study strategy, as the qualitative methods has enabled the researcher to gain an in-depth understanding from the beverage industry on how they perceive 4IR-T to be driving competitive advantage.

4.4 Research Approach

Deduction, induction and abduction form the approach layer of Saunders *et al* (2007) research onion. A deduction approach involves testing of a theory while induction is more concerned with formulation

of a theory by analysing and making sense of collected data (Saunders *et al.*, 2007). Melnikovas (2018) suggest that abductive reasoning is a form of inference, starting with observation of clue-like signs, which provide the basic notion for further research, thus this approach is a best guess or conclusion based on available evidence.

Inductive reasoning is a way of building theory from specific observation on the basis of which a general rule is formulated. The approach is aimed at controlling information, and involves the use of structural and categorization argumentation. Rajkumar (2021) suggest that an inductive approach allows research results to arise from the frequent dominant themes inherent in the raw data without constraints imposed by formal methodologies. Saunders *et al* (2007) suggest that the emphasises of this approach is to gain understanding of meanings humans attach to events, less concern with the need to generalise and a more flexible structure to permit changes of research emphasis as the research progresses. Since the researcher did not seek to build a theory, an inductive approach is not suitable for this study. Hence, a deductive approach was used.

Deductive approach is referred to reasoning moving from a general rule to a specific law-like inference and is usually used for theory testing (Melnikovas, 2018). Rajkumar (2021) suggest that this approach aims to test an existing theory and often argues about its theoretical significance, it further implies deducing a hypothesis based on previous literature about a situation and theoretical models concerning the situation. Okoli (2021) further suggest that deductive theorizing starts off with a proposed theory and should ideally result in a new proposed theory, a supported theory or and enhanced theory. A deductive approach is similar to empiricism, which stresses the rational, proof of the theory and application of the theory to the evidence acquired (Rajkumar, 2021). Saunders *et al* (2007) suggest that a deductive approach is moving from theory to data, the necessity to select samples to reach conclusions and the operationalisation of concepts to ensure clarity of definition.

The research used a deductive research approach to conduct this study within the beverage manufacturing industry to identify factors that influence the adoption of 4IR-T to dive competitive advantage. The TOE framework has been used throughout the study and applied deductively as a lens to interpret the assessment of factors that the beverage organisations perceive to influence their decision to adopt or not to adopt 4IR-T.

4.5 Sampling Technique

Data is essential for business research irrespective of whether an investigation is quantitative or qualitative in nature (Hair & Brunsveld, 2019). A researcher collects data from a population under investigation, referred to as a census (Saunders *et al.*, 2007; Hair & Brunsveld, 2019). However in most situations this is not feasible due to restrictions in time, funding and sometime access therefor a small

subset of the populations is drawn and referred to as a sample (Saunders *et al.*, 2007; Hair & Brunsveld, 2019). Hair and Brunsveld (2019) suggest two types of sampling techniques namely probability and non-probability. Probability sampling refers to a process of randomly selecting participants from within a research population while non-probability sampling refers to the inclusion or exclusion in a sample based on a researcher's discretion. The common sampling techniques for probability sampling include, simple random, systematic, cluster and multistage while non-probability include convenience, judgemental, purposive and snowballling.

The researcher used a purposive sampling method in conducting this research on exploring the role of 4IR-T in driving competitive advantage in the beverage manufacturing industry. Purposive sampling is also refered to as judgement sampling (Hair & Brunsveld, 2019). Saunders *et al* (2007) notes that this form of sample is often used in small studies such as case study research and where there is a need to select cases that are particularly informative. Hair and Brunsveld (2019) further suggest that a sample size is choosen because the researcher believes they represent the target groups but not necessarily representative of the research population, and the advantages of this method are convenience, speed and low cost. The researcher selected particpants based on their expertise, weath of experience and knowledge within FMCG_B, who hold management roles and have decision making power on the adoption of technology to support business management processes.

The researcher used a case study research strategy that was conducted using qualitative research methods and a deductive approach. Due to the research aim, objectives and questions, information was sought from various level of employees whithin the beverage manufacturing industry who provided indepth informtion on their perceptions on 4IR-T to drive competitive advatage within the organisation. A sample size of twelve participants was selected to include executive and senior managers due to their higher level strategic knowledge of the organisation and employees to understand varied perceptions about the potential use of 4IR-T to drive competitive advantage.

4.6 Ethics

Blumberg *et al* (2014) defines ethics as norms or standards of behaviour that guide moral choices about our behaviour and relationship with others. Ethics in the context of research refers to the appropriateness of behaviour in relation to the rights of those who become the subject of the work, or are effected by the research being conducted (Saunders *et al.*, 2007). Hair and Brunsveld (2019) refer to Business ethics and suggest that this concept addresses the application of moral principles and ethical standards to human actions in the exchange process. The goal of ethics in research is to ensure that no one is suffers adverse consequences from research activities (Blumberg *et al.*, 2014).

The ethical dimensions of the researcher-participant relationship include, informed consent, protecting privacy, preventing harm and disclosure and engagement (Saunders *et al.*, 2007; Blumberg *et al.*, 2014; Hair & Brunsveld, 2019). In securing informed consent from participants, the researcher has disclosed the procedures of the proposed study before requesting permission to proceed. The participants have the right to privacy, the findings from the data collection have been used only for the intended purpose while individual responses were kept confidential. The participants were informed of the choice to withdraw at any time if they perceive any physical or psychological harm.

The participants could face potential risks for example data provided by an employee could be disclosed to management which would cause risk to the employee. However, participants were not required to submit their names during participation. The benefits of participants being included in this study has been the outcome of their organisation gaining knowledge on factors that influence adoption of 4IR-T in order to drive competitive advantage and adapt accordingly.

The researcher has followed the above guidelines during the research design, gaining access, collection of data, storing of data, data analysis and reporting phases of the research study. Informed consent was obtained from the Beverage organisation that were part of the study, all participants were also requested to complete a consent from confirming their participation in the study. The researcher received ethical clearance from the research ethics committee of University of South Africa School of business and leadership before the data collection process commenced.

4.7 Data Analysis

Data analysis can be defined as the process of interpreting text by the researcher to gain a deeper understanding of the data collected (Rajkumar, 2021). This analysis of data usually involves reducing accumulated data to a manageable size, summaries, looking for patterns and applying statistical techniques (Blumberg *et al.*, 2014). Saunders *et al* (2007) suggest that qualitative data analysis procedures help the researcher understand meanings while allowing theory to be developed from the data. Qualitative data analysis includes both the deductive and inductive approaches and range from the simple categorisation of responses to processes for identifying relationships between categories (Saunders *et al.*, 2007). The goal of qualitative data analysis is to identify, compare and interpret patterns and themes.

A widely used data analysis technique in qualitative research is thematic analysis (Nowell *et al.*, 2017). Thematic analysis involves the identification of recurring patterns that are presented by researchers as overarching statements or themes (Lochmiller, 2021). Lochmiller (2021) further suggest that the aim of a thematic analysis is to consider how the reported information addresses a specific research question or invites a new conceptual or theoretical understanding. A thematic analysis can produce

trustworthy and insightful findings, which provides a highly flexible approach that can be modified for the needs of a study providing detailed yet complex amounts of data(Nowell *et al.*, 2017).

Data gathered for this research has been sorted through a coding process that identified the needs of beverage manufacturing organisations, characteristics of 4IR-T, and its implementation drivers, barriers, and risks. The researcher performed the coding manually using categories and themes that emerged from the data. Coding units were selected to ensure data is linked with topics themes and concepts which allowed the researcher to sort, organise, and categorize the data. The analysis enabled the researcher to identify patterns and correlations in assessment of how 4IR-T can be implemented to drive competitive advantage in beverage manufacturing organisations within the FMCG industry. Subsequently, the researcher has drawn from the assumptions of the TOE framework to interpret the emergent findings from the data analysis.

4.8 Data Management plan

The Protection of Personal information Act (POPIA) commenced in SA on the 01st July 2020, organisations where given a year to comply with this act which ended on 30 June 2021 (Gazzette, 2013). The act seeks to protect the constitutional right to privacy by safeguarding personal information, the integrity and sensitivity by a responsible party (Gazzette, 2013). The researcher conducted this research within the limits of the POPIA act and recommendations.

The researcher has collected data from employees and managers within the beverage manufacturing industry organisations with their consent. The data gathered by the researcher was used to conduct this research on the role of 4IR-T in driving competitive advantage in the SA beverage manufacturing industry. The researcher stored the gathered data on a personal computer and has ensure the data is used for the intended use of this study only. Privacy of the respondents has been protected, data safeguarded in a password-protected folder accessible to only the researcher and not third parties.

The POPIA act and the recommendations from the university research ethics committee has guided the researcher in the process of conducting this research and has informed the data management plan to ensure the researcher stayed within the limits of ethical research.

4.9 Conclusion

This chapter has presented the research methodology that was used in this research. A background and history to the various research methodologies has been presented in this chapter together with the research selections that have been used. A case study research strategy, qualitative methods and a deductive approach was used in this research. A purposive sampling method and a thematic analysis of the data was applied. Ethical considerations and the process to be followed to ensure this research

was conducted according to ethical guidelines was also discussed. A data management plan was elaborated on and notes how this research has managed, retained, and destroyed data to be compliant with the ethical guidelines from the UNISA ethics review committee and the POPIA act.

Chapter 5 – Findings and Data Analysis

5.1 Introduction

This chapter presents the findings of this research. The research methodology detailed in chapter 4 was followed and qualitative data gathered by means of interviews was analysed using thematic analysis. The findings on how 4IR-T can drive competitive advantage within beverage manufacturing organisations are presented, analysed to draw conclusions to answer the main research question and objective as presented in chapter 1. The subsequent sections will provide the context of the study in section 5.2, the data analysis process used will be discussed in section 5.3, the thematic analysis of interview will be presented in 5.4 and 5.5 presents an analysis of the Focus Group conducted which looked to perform member checking. Section 5.6 provides a presentation of the findings, a summary of findings from the interviews and focus group is presented in section 5.7 and section 5.8 concludes this chapter.

5.2 Context of the Study

FMCG_B is a local beverage manufacturing organisation within South Africa with regional centres in four provinces. The business currently has a staff count of approximately 1000 employees and currently uses various ICT's and third industrial revolution technologies within all aspects of their operation and environment. For FMCG_B to remain competitive, relevant, able to compete with their larger competitors and survive in the beverage manufacturing industry there is a need to ensure superior products value, performance or differentiate their products and organisation to increase their competitive advantage. The researcher recruited participants for this study from the Gauteng region specifically the organisations head office due to the vast majority of middle, senior and executive managers residing in this location.

The researcher selected executive, senior, and middle managers to understand varied perceptions about the potential adoption of 4IR-T to drive competitive advantage. Once ethical clearance was obtained from the University of South Africa Ethics Review Committee, participants were approached by the researcher via face-to-face request as an initial interaction, the second interaction was an email communication providing all participants with the information sheet and informed consent documents for this research. Once signed informed consent was received from participants, semi-structured interviews were conducted via Microsoft Teams application. Interviews with participants took an average of 30 minutes per participant and the profiles of the participants are reflected in Table 2 below.

Table 2: Interview Participant Profiles

Number	*Participant*	*Designation*	*Age Group*	*Management Level*
1	PAR01	CIO	>30	Senior Management
2	PAR02	Manufacturing Manager	>30	Middle Management
3	PAR03	Programme Manager	>30	Senior Management
4	PAR04	Regional Operations Manager	>30	Senior Management
5	PAR05	Head Of Organisational Effectiveness	>30	Senior Management
6	PAR06	Head Of Procurement	>30	Senior Management
7	PAR07	Head Of Supply Chain Planning	>30	Senior Management
8	PAR08	Regional Logistics Manager	>30	Middle Management
9	PAR09	Head Of People Services	>30	Senior Management
10	PAR10	Trade Marketing Manager	>30	Middle Management
11	PAR11	CEO	>30	Executive Management
12	PAR12	CFO	>30	Executive Management

The researcher performed a pilot interview with PAR01, the Chief Information Officer (CIO) at FMCG_B who has acquired broad experience in Information Technology within the beverage manufacturing industry. The pilot interview was conducted to test the interview guide questions and ensure their appropriateness to meet the research objectives, and to ensure the validity, trustworthiness, and accuracy of the qualitative data collection. Initially the researcher set out to conduct eighteen interviews within FMCG_B, however due to six participants not returning the signed informed consent document after several follow up with these participants, twelve interviews was conducted. After the ninth interview the saturation point was reached as no new themes emerged from the following three interviews conducted, and the sample size was considered sufficient as saturation point.

After all, twelve interviews were conducted, the researcher conducted a focus group with three participants as opposed to five due to time constraints and availability of the participants. While the researcher tried to accommodate all participants by rescheduling the focus group on four occasions, eventually on the last scheduled focus group three participants were available and the researcher decided to proceed with the focus group to respect the time of other willing participants. Table 3 presents a profile of Focus group respondents which were selected at random from the interview participants. The aim of the focus group was to perform member checking to verify the accuracy and validity of the emergent themes from the interview. Member checking can be considered the process of verifying the credibility by testing the findings and interpretations with the participants (Nowell *et al.*, 2017).

Table 3: Focus Group Participant Profiles

Number	*Participant*	*Designation*	*Age Group*	*Management Level*
1	PAR01	CIO	>30	Senior Management
2	PAR08	Regional Logistics Manager	>30	Middle Management
3	PAR10	Trade Marketing Manager	>30	Middle Management

5.3 Data Analysis Process

The Data analysis was driven by the main research question, how can fourth industrial revolution technologies (4IR-T) drive competitive advantage in the beverage manufacturing organisations? and the three sub-research questions (RQ) noted in chapter 1.

RQ1 - What are the enabling factors for 4IR-T adoption to drive competitive advantage in beverage manufacturing organisations?

RQ2 - What are the barriers against 4IR-T adoption to drive competitive advantage in beverage manufacturing organisations?

RQ3 - What potential risks influence the decision to adopt 4IR-T in beverage manufacturing organisations?

The researcher used the transcriptions from the interviews to analyse the data. The transcripts were iteratively read by the researcher and coded into categories and themes using thematic analysis. Code words were determined by sorting through the interview transcripts to identify where participants described, mentioned, inferred words or phrases that's implied in relation to the research questions. Codes were then redefined by grouping similar responses together to establish the themes in relation to the research questions and omitting responses that were not relevant to the research questions and topic. Final themes were then established, and the researcher ensured that the final themes aligned to the research questions.

Subsequently, emergent themes were presented to the focus group participants for comments and any revisions they needed to make in terms of their individual responses. This process allowed the researcher to identify patterns, correlations and verify the validity of the data in assessment of how 4IR-T can be implemented to drive competitive advantage in beverage manufacturing organisations within the FMCG industry.

5.4 Thematic Analysis of Interviews

The analysis of the data combined resources such as recordings, transcriptions obtained from the functionality on the Microsoft Teams application and notes made by the researcher during the

interview. The researcher performed the coding of the data manually on Microsoft word, by grouping responses and subjects that were similar in a logical manner. Through the thematic analysis and coding process the researcher was able to establish codes that implied the enabling factors of 4IR-T adoption, barriers against 4IR-T adoption and risks that influence 4IR-T adoption. For example, code words that were described in relation to the RQ1 were product, brands, lower cost, limit human intervention, size of the organisation which were grouped into the themes or current state of competitive advantage, relative advantage, perceived benefits, enablers, and characteristics which enable adoption of 4IR-T.

Code words that where implied in relation to RQ2 were capital investment, return on investment and resource skills to name a few which were grouped into the themes to identify barriers to adoption of 4IR-T. In relation to RQ3 the codes words that were inferred include loadshedding, labour regulations and supply chain disruptions that formed the themes to identify the risks that influence the adoption of 4IR-T within FMCG_B. Once coding for all interviews was completed the researcher moved the codes relevant to the research questions to Microsoft excel where these codes were grouped into themes as shown in Appendix F. A complete breakdown of the thematic analysis performed by the researcher can also be found in Appendix F.

5.5 Analysis of Focus Group

Once all individual interviews were completed, a focus group was setup with a random selection of five participants to conduct member checking. The researcher presented the themes that emerged from the interviews thematic data analysis and asked users to comment. The focus group was driven by the central concepts of the sub-research questions. The focus group revealed that participants agreed with the themes that were presented in relations to the potential for 4IR-T adoption, barriers, and risks to adoption of 4IR-T. No new themes or sub-themes emerged from the focus group and the researcher considered the themes and sub-themes valid and reliable.

Table 4: Sample Responses from the Focus Group

Objective No:	***Sample Responses***
Objective 1: To determine potential factors that enable adoption of 4IR-T in beverage manufacturing organisations to drive their competitive advantage.	***PAR01*** – "I was very pleased, with the themes that obviously came out." ***PAR08*** – "All good from my side"
Objective 2: To identify the barriers that influence the decision to adopt or not	***PAR10*** – "I'm very aligned to that and I think you know you kind of touch on it because

adopt 4IR-T towards driving competitive advantage.	they're on the far right. You say that job redundancy is a is a risk and you touch on it in internal barriers with when you say early adopters and change management." ***PAR01*** – "We can double down using some of these themes and barriers and see whether they really are, and how that might help us because it's benefiting for us"
Objective 3: To understand the potential risks that beverage manufacturing organisations perceive to influence their decision to adopt 4IR-T towards driving competitive advantage.	***PAR01*** – "…so you look at some of our investments that I've been very selective about what we can and can't invest in as a company from an IT perspective. You know if you're goanna invest in a in a computer or a piece of software it's gotta have a life span,"

5.6 Presentation of Findings

This section presents the perceptions of the interview participants in respect to the potential factors that enable adoption of 4IR-T to drive their competitive advantage and the perceived barriers and risks to adoption of 4IR-T. As reflected in Tables 5 to 7 the major themes and sub-themes in relation to the objectives of the study will be described below. The themes and sub-themes are supported by the literature review and conceptual framework the was conducted in chapter 2 of this research. The TOE framework that was discussed in chapter 3 was used as a lens to interpret the data and themes as well as sub-themes that emerged from the data analysis.

5.6.1 Enabling factors that influence adoption of 4IR-T to drive their competitive advantage

Nadal *et al.* (2019) suggest that adoption refers to a multi-phase process starting with deciding to accept, select, purchase, and commit to use, and ultimately achieving infusion towards enhancing performance and processes. The definition of adoption was used by the researcher to inform the coding of the transcripts and thematic analysis. Four major themes emerged from the data analysis in relation to this research objective. These were the current state of competitive advantage, the perceived benefits and relative advantage that 4IR-T adoption can bring to FMCG_B, the perceived

enablers of 4IR-T adoption and the characteristics of 4IR-T that would be needed when consideration for 4IR-T adoption is investigated by FMCG_B.

Table 5: Major Themes for potential factors that enable adoption of 4IR-T

Themes and Sub-Themes	*TOE Category*	*Frequency of Occurrence*
Current State of Competitive Advantage		
Brand Presence and Strength	Organisational	5
Affordable Price	Organisational	4
Quality Products	Organisational	2
Local Company with National Footprint	Organisational	2
Relative Advantage		
Reduce Cost	Technology	7
Increase efficiency	Technology	5
Increase Quality	Technology	3
Increase value perception	Technology	2
Perceived Benefits		
Reduce Human Intervention	Technology	7
Informed/Quick Decision Making	Technology	6
Perceived Enablers		
Size of Organisation	Organisational	12
Adequate Management Support	Organisational	9
Characteristics		
Limited Downtime when Implementing	Technology	1
Integration Capability	Technology	1
Remote Access	Technology	1
Real Time Information	Technology	1

5.6.1.1 Current State of Competitive advantage

Eleven out of the twelve participants showed a positive attitude towards FMCG_B having a competitive advantage in their current state while one participant perceived FMCG_B as not having a competitive advantage at all. The major sub-themes that emerged were brand presence and strength, affordable price, local company with a national footprint and quality products. The researcher asked, do you perceive your organisation as having a competitive advantage? Participants noted that the organisation has a competitive advantage in terms of brand presence and strength (PAR03, PAR04, PAR05, PAR11 & PAR12),

> *PAR03 – "…in the lower to mid range market segment, our products and brands are extremely, competitive."*
>
> *PAR11 – "…but as it stands today, we do have a competitive advantage due to us being able to offer quite a complex portfolio which we've been able to do."*

Four interview participants noted that FMCG_B provides an affordable price for their products leading to a competitive advantage (PAR03, PAR05, PAR06 & PAR09),

> *PAR05 - "…and we've also got a lot of great brands and investment behind that, that drives a quality product into trade at an affordable price"*
>
> *PAR06 – "You know we can dictate our margins and where we win versus where we lose allows us to be a lot more competitive on shelf from a pricing perspective as well versus."*

Two interview participants mentioned that the quality of the products gives the organisation a competitive advantage (PAR05 & PAR12), while two participants mentioned the business being local with a national footprint allows them to have less red tape compared to their larger international competitors (PAR06 & PAR07),

> *PAR12 – "100% I believe we do, but I believe it's more through traditional means, through distribution methodologies, quality of product and quality of brands."*
>
> *PAR06 – "Because we're a local company, We're obviously a lot nimbler than the likes of a Coca-Cola or a PepsiCo or any of the other multinational FMCG. So, I think our ability to adapt to change and our speed of execution gives us a competitive advantage. We're not bound by hierarchy and red tape, and you know tedious processes that the multinationals are faced with"*

While eleven participants perceived FMCG_B as having a competitive advantage in their current state in line with the attributes in the literature review such as superior products, value, and quality which is in line with Porter (1985) highlighted in Chapter 2, section 2.3 one participant had an opposing view to this question (PAR10),

> *PAR10 – "No, I don't really think, if you look at our competitors and the market out there, I don't think we're sharing something that really stands out. So, I would say no."*

Majority of participants perceived FMCG_B as not having a competitive advantage in terms of 4IR-T and the competitive advantage attributes that can be achieved if FMCG_B leveraged 4IR-T within their organisation,

> *PAR03 – "I don't think it's competitive. I think that a lot of our build hardware and software from an organizational perspective is not where it should be in order for it to be competitive."*
>
> *PAR08 – "No, FMCG_B is far behind its competitors even from a 3IR perspective. Being on the bleeding edge of 4IR is a far cry"*

This finding shows that while FMCG_B percieves that the organisation has a competitive advantage in terms of brand presence and strenth, affordable prices, quality prices and being a local company, FMCG_B is not leveraging 4IR-T to increase their competitive advantage. The current state of competitive advantage at FMCG_B is an enabler to 4IR-T adoption to drive supperior performace, resources and diffrentiate their organisation from competitors.

5.6.1.2 Relative Advantage

Majority of the participants had a positive attitude to the adoption of 4IR-T within FMCG_B and noted that the organisation could achieve a further competitive advantage with the implementation of 4IR-T. The sub-themes that emerged from the data analysis include, reduced costs, increases in efficiency, quality of products and value perception. The researcher asked participants how they perceive 4IR-T in driving competitive advantage attributes like price, product value and customer satisfaction. Seven participants noted reduced cost (PAR03, PAR04, PAR05, PAR06, PAR08, PAR09 & PAR12),

> *PAR03 – "Making sure that you only plan what is necessary based on demand that already starts moving you to a concept called just in time. It shows that you have less working capital, you're getting efficient from an organization perspective, which is going to reduce your operational costs and then it migrates towards really true world class manufacturing."*
>
> *PAR08 – "Adopting 4IR-T will inevitably decrease our cost of sales and cost of manufacturing in the long run. This mean offering our current portfolio at cheaper prices, thus increasing our competitiveness in the market."*

Five participants, noted that the adoption of 4IR-T can increase efficiency within FMCG_B (PAR05, PAR06, PAR09, PAR10 & PAR11),

> *PAR06 – "I think if you have a quality a product that is consistent in terms of quality your end user your consumers and customers will be satisfied. I think where one adopts 4IR technology to replace human labour, allows you to have consistency and not be affected by things such as strikes and you know and union disputes and all of that, so I think you're able to be consistent"*
>
> *PAR10 – "I would imagine you know when you talk about things like big data and artificial intelligence and all of that, I would imagine it gives you the ability to make informed decisions much quicker, and which will obviously help you to be more efficient with all of those things, whether it's price, product, your customer satisfaction…"*

Participants noted a relative advantage that can be achieved with 4IR-T is an increase in quality (PAR02, PAR06 & PAR09) while two participants noted increase in value perception can be achieved (PAR04 & PAR08),

PAR09 – "I definitely think that those technologies would help to create or to improve the benchmark from a quality perspective, if you don't have to take an entire bottle off of a line to test the quality…"

PAR04 – "I think the perception of value in the high-end sector is about how we present ourselves and some elements of that, if you incorporate 4IR technologies this gives an element of attraction or a perception of value, so the way we communicate with the media that we or would use to communicate I think potentially could add lots of value."

From the participants' responses, it can be inferred that the perceptions at FMCG_B are that adoption of 4IR-T can assist to reduce their costs, increase efficiency, quality and value. Therefore, releative advantage is an enbling factor that promotes the adoption of 4IR-T to drive the organisations competitive advantage.

5.6.1.3 Perceived Benefits of 4IR-T

Various participants perceived that with the adoption of 4IR-T, benefits such as reduction in human intervention and informed quick decision making could be achieved. Seven participants perceived that 4IR-T adoption will benefit FMCG_B by reducing human intervention (PAR03, PAR04, PAR05, PAR06, PAR08, PAR09 & PAR12),

PAR05 – "…there are a lot of human routine processes that can be automated and artificial intelligence can process that information a lot quicker and make informed decisions with that data"

PAR06 - "I think if you have a quality a product that is consistent in terms of quality your end user your consumers and customers will be satisfied. I think where one adopts 4IR technology to replace human labour, allows you to have consistency and not be affected by things such as strikes and you know and union disputes and all of that, so I think you're able to be consistent"

Six participants mentioned that 4IR-T can lead to informed and quick decision making (PAR02, PAR03, PAR04, PAR05, PAR10 & PAR12),

PAR02 – "…which would help with fast decision making, so If it could link to other systems in the business where it could drive that speedy decision making in terms of ordering material or getting their rates fairs and the like, then that then would really give the organization the advantage."

PAR03 – "one of the main outputs that that comes from an industry standard four perspective is being able to make informed decisions by evaluating data"

PAR11 – "…because I think the there's the users of data and information now use such a significant quantum of data for such a short period of time that unless you be able to, you're able to interact with them when they're doing that, I think you'll you delusional relevance in the market"

The findings above align with section 2.6 of the literature review conducted in chapter 2 on the benefits 4IR-T adoption to drive competitive advantage. The finding shows that perceived benefits of 4IR-T to FMCG_B can enable quicker adoption.

5.6.1.4 Perceived Enablers of 4IR-T adoption

The major sub-themes that emerged were the size of the organisation and adequate management support. All of the participants noted that the size of the organisation is an enabler to the adoption of 4IR-T within FMCG_B. The second major sub-theme was the adequate management support. Nine participants perceived management support as an enabler of 4IR-T adoption while three participants perceived this sub-theme as a barrier. The researcher asked, in terms of your organisation size, would it be viable to adopt 4IR-T? all participants perceived this to be an enabler,

PAR02 – "Yes, just looking at, people wise, off peak, I've got about 60 people, In peak, it's about 104. You run a line with about 7 operators, processes mainly closed and your warehousing, there's opportunities then to improve and get some technology there."

PAR11 – "Absolutely, we are growing organization and we will continue to grow if we continue to apply all the right disciplines, but process improvements and 4IR technologies is critical for growing organizations to ensure that you've got future control of your business as well."

To gauge if management promotes the adoption of 4IR-T within FMCG_B, the researcher asked, does top management promote the adoption of technology?. Except for PAR07, PAR08 and PAR10, all other particpants percieved this to be an enabler of 4IR-T adoption,

PAR01 – "I think top management have been extremely supportive of all the initiatives we have taken over the last two, to three years, probably over the last two years. For the most part I think they've been, there's been very little resistance to moving the dial on our IT infrastructure and roadmap."

PAR06 – "They do so. We're always looking at new technologies. You know faster lines. Faster labellers, faster Packers. You know, so I mean, the simple answer. Is yes, I mean whenever we procure. We try to procure the latest technology equipment…"

This finding shows that majority of the participants perceived size of the organisation and management support as enablers to 4IR-T adoption which is in line with the conceptual framwork

noted in section 2.7 of chapert 2 and can influence the drive for supperior resources and value and cost reduction.

5.6.1.5 Characteristics of 4IR-T that enable adoption

During the thematic analysis, participants noted certain characteristics of 4IR-T, which would be required when looking to adopt 4IR-T. The sub-themes noted were ability to have limited downtime during implementation, ability to integrate with other systems, remote access ability and real time information.

> *PAR10 – "you know when we implemented things like SAP for example, there's always some downtime that comes into play with it. So, I suppose the implementation or the adoption of four 4IR technologies come with downtime because obviously that's something that companies can't really afford."*
>
> *PAR10 – "I think the only thing that would affect it quite heavily is that a lot of our systems need to speak to those of our customers such as an applicant page, ShopRite, etcetera. So, I think it would be important not a regulation, but it would be a requirement that our technology speaks to their technology."*
>
> *PAR02 – "…if it's just a nice system that incorporates everything and all of us use just that one system where you can see how the lines are performing real time, how, where materials is doing real time, how your order management and customers stuff is real time which will give you that advantage."*

Participants perceived that if 4IR-T could offer, integration capability, limited downtime, remote access, and real time information when being implemented or used these characteristics would enable and positively influence their adoption of 4IR-T which would improve performance during 4IR-T implementation. Further to improved performance, better engagement with customers and improved decision making will be seen which can give the organisation a competitive advantage.

5.6.2 Barriers to adoption of 4IR-T to drive their competitive advantage

A barrier can be referred to as an obstacle, challenge, or problem that inhibits a course of action (Orzes *et al.*, 2019). This definition has been used in the thematic analysis to determine the barriers to adoption of 4IR-T. While majority of the participants showed a positive perception towards 4IR-T in terms of the perceived benefits, the enablers of 4IR-T adoption and the characteristics that 4IR-T should have to be considered for adoption within FMCG_B, a number of perceived barriers were observed during the interviews and data analysis. The data analysis revealed that all participants perceived various barriers that effect their adoption of 4IR-T to drive competitive advantage. Barriers

identified include insufficient capital investment/cost of implementation, inadequate skills capacity, lack of timely return on investment, lack of early adoption, Inadequate legacy system and process migration, inadequate management support, lack of digital strategy and change management.

Other barriers revealed, include insufficient infrastructure and skills capacity from an environmental perspective. The data analysis revealed that a high number of barriers were perceived by participants as reflected in table 6 below. These themes were noted by participants throughout the interview and through various questions asked. The researcher asked has your organisation considered implementing 4IR-T? These themes were also noted during the questions, are there any internal organisational factors that could influence your decision to adopt 4IR-T? and are there any limitations within your organisation that could influence your decision to adopt 4IR-T'?

Table 6: Major Themes for barriers that influence adoption of 4IR-T

Themes	***TOE Category***	***Frequency of Occurrence***
Insufficient Capital Investment	Organisational	12
Inadequate Skills Capacity	Organisational	10
Lack of timely Return on Investment	Technology	7
Lack of early adoption	Organisational	6
Insufficient Infrastructure	Environmental	5
Inadequate legacy system and process migration	Organisational	4
Inadequate Management Support	Organisational	3
Lack of digital Strategy	Organisational	3
Lack of change Management	Organisational	2
Insufficient Skills Capacity	Environmental	1

5.6.2.1 Insufficient Capital Investment

The main theme that emerged from the perceived barriers was insufficient capital investment needed for the adoption of 4IR-T which also led to participants noting that the high cost of implementation and return on investment are major internal barriers to the adoption of 4IR-T. All participants mentioned insufficient capital investment and the high cost of 4IR-T as a major barrier to the adoption of 4IR-T.

> *PAR05 – "I think the next implication would be the budget required to implement these solutions. Another one would most likely be the physical infrastructure. So, a lot of our works deals with specific machinery. And they would be a Capex requirement there, which again is a cost. And again, if our competitive advantages to deliver it at the most affordable price within the short term to take on a Capex requirement doesn't serve that, it starts creating a cost requirement"*

PAR10 – "The first thing that the company will consider is obviously the cost, so I would imagine that if you moved to artificial intelligence and things like that, there would be significant Investment required in infrastructure, and I think that would be a big part of it. So, I'm not sure exactly what the requirements would be, but you know, if it's expensive, then obviously it will be a no."

The lack of timely return on investment was further noted by seven particpants who perceived this as a barrier (PAR01, PAR03, PAR04, PAR05, PAR07, PAR11 & PAR12).

PAR04 – "I qualify that with a you know it's gotta have a bang for Buck, there has to be an element of return on investment. But like any other investment that the company would undergo, there would be very specific requirements and benefits that would be well laid out ahead of time because we don't really have the funding right now to explore."

PAR12 – "Yeah, the Return on investment is there, but it would a five year return on investment instead of a three-year and I think our shareholders, as they stand that's too far out."

The cost of 4IR-T implementation serves as a major barrier together with the length of time in which a return on investment would be seen. These barriers would influence the opportunity of driving superior performance, value, products and competitive advantage.

5.6.2.2 Inadequate Skills Capacity

The next most acknowledged barrier is inadequate skills capacity needed for the adoption of 4IR-T. Ten participants except PAR05 and PAR08 perceived skills capacity as a barrier to 4IR-T adoption from and organisational perspective while one participant perceived skills capacity from an environmental perspective.

PAR07 – "But the other thing is, I think resources because AI and 4IR would make our lives much easier. Problem is, do your people really understand once you've got the information? What must they do with it? Because you and I will understand and maybe a few on Exco. But the ones that should really benefit are probably not going to understand it's a capability is definitely an issue."

PAR09 – "We don't have the infrastructure for it, from a people resourcing perspective as in you know, centres of excellence that are driving these projects and I'm speaking specifically in my space…. I think that would be a gap because we don't know what we need from an infrastructure perspective because there's nobody who's qualified to make that assessment"

PAR11 – "I think the one thing I need to remain conscious of is that the ability and the calibre of your people also at all levels in the organization."

This finding showed that particpants perceived that they do not have the required skills from an organisational and environmental perspective to adopt 4IR-T. This barrier would inhibit FMCG_B's drive for superior resources and competitive advantage.

5.6.2.3 Lack of early adoption

Six participants felt that FMCG_B is not early adopters of technology and the organisation prefers to be followers which is was perceived as a barrier to 4IR-T adoption (PAR04, PAR07, PAR08, PAR10, PAR11 & PAR12).

> *PAR07 – "You have to 1st buy it and then you have to go and amend it to suit the industry and to suit you, I would let somebody else do that bleeding."*
>
> *PAR08 – "Unfortunately, "FMCG_B" hasn't proven itself as being in the business of take technological leaps in innovation."*
>
> *PAR11 – "…efficiency and the way we organized does give us a portfolio advantage to some degree versus our main competitors and which also brings a level of complexity to the organization and it makes it a little bit slower to adapt to new trends unfortunately."*

The lack of early adoption by FMCG_B will lead to the loss of first mover advantage in driving superior products, performance, value, diffrentiation of their products and business, and loss of market share which would inhibit the organisation from obtaining a competitive advantage.

5.6.2.4 Insufficient Infrastructure

Insufficient infrastructure from and environmental perspective was noted by five participants as a barrier to 4IR-T adoption (PAR03, PAR04, PAR05, PAR07 & PAR09). The researcher asked, are there any infrastructure requirements that influence your decision in adopting 4IR-T?,

> *PAR03 – "We don't have the infrastructure, the technology, the power generation, the skills in this country."*
>
> *PAR04 – "and the infrastructure is to an extent decaying so, I think there's an element of having to say, do we want to invest in something separately ourselves that doesn't require external architecture?"*

The participants perceived that South Africa's infrastructure is in a state of decline and may not adequately support 4IR-T. This could lead to FMCG_B being hesitant to adopt 4IR-T which could influence the organisations in terms achieving superior performance, value, and products to drive competitive advantage.

5.6.2.5 Inadequate legacy system and process migration

Four participants percieved that FMCG_B is to set in thier legacy systems and processes and this has been a barrier to 4IR-T adoption (PAR03, PAR07, PAR08 & PAR10).

> *PAR03 – "I think that our systems and processes are very traditional, and we decided to stick with that in a competitive market right now. I think just being able to manage our cost outputs, actually right now the bigger picture with actually using technology to advantage hasn't necessarily been explored because again, it wouldn't be the burning platform"*
>
> *PAR08 – "We are still we are still managing stock using excel now as much as Excel made might be a great tool for a number of things, It isn't really the most secure tool as far as managing inventory now from a cost of manufacturing perspective we manage about 30 or the million rands worth of stock."*

The lack of leagcy system migration will influence the organisation's ability in terms of driving cost redcution and performance should FMCG_B continue to operate with legacy system and lower their chances of gaining competitive advantage.

5.6.2.6 Inadequate Management Support/Lack of Digital Strategy and Change Management

While nine participants percived management support as adequate, noted in section 5.6.1.4, three particpants had an oposing view and percieved management support as inadequate and a barrier to the adoption of 4IR-T (PAR07, PAR08 & PAR10),

> *PAR08 – "Top Management and their lack of understanding of all the benefits of the 4IR. As it stands, we are trailing behind our biggest competitors."*
>
> *PAR10 – "…I think that they promote the use of technology, but generally only technology that they are accustomed to, that they've seen in action before. So I don't think they are really."*

Three participants percieved that FMCG_B's lack of digital strategy is another internal barrier that inhibits the adoption of 4IR-T (PAR02, PAR03 & PAR04),

> *PAR02 – "…Yes, it isn't part of the strategy. So I can say yes, but, you know, it's still far fetched."*
>
> *PAR03 – "…, it's not really built into our business strategy, vision, and portfolio. I think that the industry even though it is possibly very applicable to supply chain as well and, I guess all departments marketing and sales also could benefit as well."*

The last theme that emerged was a percieved lack of change management by two particpants as a barrier to 4IR-T adoption within FMCG_B (PAR04 & PAR09),

PAR04 – "A current ongoing constraint within the company is the lack of change management."

There is a perception that management supports technology that they are familiar with and avoids technology that is unfamiliar. Without adequate management support there will be no clearly defined digital strategy and technology will not be incorporated into the organisations business strategy. With the lack of change management policies and procedures to ensure ease of implementation of 4IR-T, the implementation might fail and be met with resistance. These findings would influence the opportunity to drive competitive advantage by enabling superior products, performance and value with the implementation of 4IR-T.

The findings revealed various barriers percieved by the particpants inhibit 4IR-T adoption which limits the chances of FMCG_B attaining a competitive advantage. For example reducing costs, increasing performance, value and providing superior products. These findings align to the findings as noted in the section 2.4 and 2.5 of the literture review on Competitive advantage in the FMCG industry and Competitive advantage and ICT respectively in chapter 2.

5.6.3 Risks to adoption of 4IR-T to drive their competitive advantage

Risk refers to uncertainty about and severity of events, objectives, and consequences of an activity (Šotić & Rajić, 2015). The researcher used this as a conceptualization in the thematic analysis to identify risks to adoption of 4IR-T. The major themes that emerged from the data analysis, on the risks to adoption of 4IR-T were risks from an environmental and technology perspective. The themes include South Africa's "Loadshedding", labour regulations, inadequate 3rd Industrial technology and support, systems, and job redundancy. Participants also noted various supply chain disruptions that have been recently experienced.

Table 7: Major Theme for risk that influence adoption of 4IR-T

Themes and Sub-Themes	***TOE Category***	***Frequency of Occurrence***
Loadshedding	Environmental	7
Labour Regulations	Environmental	4
Inadequate 3rd Industrial Technology and Support	Environmental	3
System Redundancy	Technology	2
Job Redundancy	Environmental	2
Supply Chain Disruptions	Environmental	18

5.6.3.1 Loadshedding

The researcher asked, if there are any risks that might influence the decision to not adopt 4IR-T. Loadshedding emerged as a South African phenomenon (PAR01, PAR02, PAR03, PAR04, PAR05, PAR06 & PAR07).

> *PAR01 – "Obviously with loadshedding I think we'd be very unfortunate as a business because the difficulty with the supply chain in manufacturing is we don't have factories that are fully power redundant."*
>
> *PAR05 – "The other risk would be their reliance on technology in an economy where Eskom is not reliable. So, power supply is interrupted frequently, which means that without power you're not able to run those processes, rendering technologies effectively redundant and there's no manual contingency to those processes, so it, kind of just blocks the process."*

Power supply is not relaible in South Africa and would negatively influence the adoption of 4IR-T. The negative influence of this risk could cause FMCG_B to increase their costs and lose out on diffrentiating their organisation thorugh 4IR-T and gaining market share, driving excellence in everyday performance and increasing value.

5.6.3.2 Labour Regulations

When the researcher asked about external regulations that may influence the decision to adopt 4IR-T, four participants percieved that labour regulations from a govermental persepctive would be a risk. They mentioned that due to 4IR-T which eliminates the need for human intervention and could lead to job losses (PAR01, PAR02, PAR05 & PAR06).

> *PAR02 – "perhaps, pushback from the Union might be the one that comes to mind, because in some instances when you automate you do reduce people and the pushback there."*
>
> *PAR05 – "For example, from an implementation of a solution that results in a structure change or job redundancy. So that would be the Labour Relations Act, that would govern how we approach that. One of the reasons for such a change is technology, and this would be viewed as a technological change, and that would govern the process of implementation, but I don't think it would be something that prohibits us from implementing"*

The finding is that union pushback and the labour regulations act of South Africa would negatively impact FMCG_B decision on adopting 4IR-T which would cause FMCG_B to forego driving superior resources and performance.

5.6.3.3 Inadequate 3rd Industrial Technology and Support

Three particpants noted that inadequate third industrial revolution technologies and support as a risk to 4IR-T adoption (PAR03, PAR11 & PAR12),

> *PAR11 – "One thing that I'm conscious of is that if you want to build a second story in our technology, you need to make sure your foundations and the lower house is well in order."*

> *PAR12 – "Which is like I said, you just can't see the guy running 100 meters and you only crawling and think that you can get there overnight. There's building blocks that have to be done that allow you organization to fully leverage the benefits of 4IR technologies."*

Particpants perceived that there is inadequate third industrial revolution technologie and would cause FMCG_B to miss out on the beneficial outcomes of competitive advantage for example, diffrentiation, cost leadership and superior value that 4IR-T can deliver.

5.6.3.4 System and Job Redundancy

Two particpants percieved system reducdancy as a risk to its adoption, as a system implemented today could be replaced in a year or two,

> *PAR05 – "You know, so you run the risk of having a system that is no longer supported in the future. So the longevity of the system."*

The last theme noted by particpants is job redundancy which links in to the labour regulations act. Two particpants noted that this is a risk which will be faced by the organisation with the adoption of 4IR-T (PAR05 & PAR10),

> *PAR05 – "You can imagine a big business has responsibility to create jobs. So if there was a massive implementation of 4IR technology, so we automated the whole warehouse, you've got about 300 jobs, probably on the line, so I think there's a big social responsibility that organizations have to create work and the implication of that on jobs and livelihoods, I think is something that would be a risk."*

The finding higlights the constant update and advancement rate of technology, in the sense that a system that is implmented today for example might be outdated and redundent in the next year; jobs might become rudundant with 4IR-T implementation. The organisation would then have to implement newer technologies leading to increase in capital investment, costs and loss of social image and ultimately competitive advantage which is perceived as a risk that will negatively impact their decision to adopt 4IR-T.

5.6.3.5 Supply Chain Disruptions experienced by FMCG_B

The major sub-themes that emerged from the thematic data analysis was the War that is currently occurring in the Ukraine with Russia which has caused various issues such as shipping delays and shortages of raw materials. The researcher asked has your organisation experienced recent supply chain disruptions? Six participants noted the war in the Ukraine (PAR02, PAR04, PAR07, PAR09, PAR11 & PAR12),

> *PAR02 – "Because of the Ukraine Russia war, there were some challenges in getting some more material in terms of like flavours, flavours from overseas we get like from Monarch France for instance."*
>
> *PAR11 – "Answer is yes, and it's all because of that. I think the world struggling to adopt to the spike in the bond across many resources after COVID and then second tier to that was the emerging of the war in Eastern Europe."*

Participants perceived that due to the war in the Ukraine, this has caused FMCG_B to experience shipping delays and shortages in raw materials such as aluminium, and carbon dioxide (Co2). Two particpants noted shipping delays (PAR05 & PAR06), two particpants noted Co2 shortages (PAR02 & PAR04) and two noted aluminium shortages (PAR04 & PAR07) as recent disruptions to FMCG_B's supply chain

> *PAR05 – "*The shipping delays and logistics of product coming in, so raw material delays resulting in the arriving short dated and the implication on expired stock."
>
> *PAR02 – "For instance we would have a Co2 constraint and there were some board increases that would affect your flat sheets for instance."*
>
> *PAR07 – "But if we if we had 4IR technologies, this would have been visible to us and we would have been able to bid a plan on our aluminium procurement up to where we are now where we stand today."*

Four particpants, noted Covid 19 as a disruption to FMCG_B's supply chain (PAR05, PAR07, PAR11 & PAR12),

> *PAR07 – "When COVID hit nobody knew what on earth are we dealing with, we had no information had to have a look where previous countries had pandemics How did it change shopper and consumer behaviour and we had to learn from it."*
>
> *PAR11 – "…that also caused supply disruptions there along with COVID and in the continuous Chinese COVID disruptions taking place with these euro covered policy, there's all that influence in the world."*

Lastly participants percieved that the water restrictions which South Africa is experiecing is causing supply chain disrutions for FMCG_B (PAR04 & PAR05).

> *PAR04 – "…we had some problems more locally, it's more of sort of municipality problem where we have issues with water supply and one of the factories or like Isando, where the infrastructure is declining, we have relatively regular either breakages on the line or leaks or inabilities to supply."*

Risks specific to FMCG_B have been identified. The risk of supply chain disruption has a positive influence on FMCG_B's decision to adopt due to 4IR-T being able to deliever superior performance in all aspects of the organisations value chain to enable competitive advantage.

5.7 Summary of Findings

The aim of the study was to explore the role of 4IR-T in driving competitive advantage withing the beverage manufacturing organisations in the FMCG industry of SA. Hence, the findings from the semi structured interviews and a focus group was used to address the sub-research questions. Section 5.7.1 indicates how the research objectives have been answered with the themes that emerged presented in Table 8. The findings relevant to each sub-research questions as stated in section 1.4.2 is presented in the following sections 5.7.1.1 – 5.7.1.3.

5.7.1 Findings from Interviews and Focus Group

Table 8: Findings from Interviews and Focus Group to Support Objectives

Research Objectives	***Findings***
To determine enabling factors that influence adoption of 4IR-T in beverage manufacturing organisations to drive their competitive advantage.	• FMCG_B's current State of competitive advantage would be an enabling factor for the organisation to adopt 4IR-T to drive superior performance, resources and differentiate their organisation. • With the relative advantage that can be achieved with the adoption of 4IR-T, such as reduce cost, increased efficiency, quality, and value, this is a factor that enables 4IR-T adoption.

	• The perceived benefits that 4IR-T can offer, for example, reduced human intervention and quick informed decision making, is a factor the enables 4IR-T adoption and drives competitive advantage. • The Size of FMCG_B and adequate management support are factors that enable 4IR-T adoption in FMCG_B that can influence the drive superior resources, value, and cost reduction. • FMCG_B requires specific needed characteristics of 4IR-T to enable adoption to drive improved performance, better customer engagement, and improve decision making.
To identify the barriers that influence the decision to adopt or not adopt 4IR-T towards driving competitive advantage.	• Cost and timeline for return on investment inhibit 4IR adoption and influence the opportunity of driving superior performance, value, and products. • Skills capacity from both an organisational and environmental perspective is insufficient to adopt 4IR-T and inhibits the drive for superior resources and competitive advantage. • The lack of early adoption leads to the loss of first mover advantage in driving superior products performance, value, differentiation of products, business, and loss of market share.

	• Perception that there is insufficient infrastructure to support 4IR-T and that infrastructure is decaying, inhibits adoption to drive superior performance, value, and products. • Due to the lack of legacy system and process migration, FMCG_B is hesitant to adopt 4IR-T to drive cost reduction and performance. • Inadequate management support and lack of digital strategy as well as change management inhibits adoption to drive superior performance products and value.
To understand the potential risks that beverage manufacturing organisations perceive to influence their decision to adopt 4IR-T towards driving competitive advantage.	• With power supply not being reliable in South Africa, this negatively influences the decision to adopt 4IR-T to drive cost reduction, differentiation and increase in market share. • Risk of labour regulations and push back from unions negatively impacts FMCG_B 4IR-T adoption decision to drive superior resources and performance. • Inadequate third industrial revolution technologies to support 4IR-T negatively impact the 4IR-T adoption decision to drive differentiation and superior value. • System and job redundancy negatively impact the decision to adopt 4IR-T to drive reduced investment, costs, and loss of social image due to lifespan of technology and social responsibility.

	• Risk of supply chain disruptions positively influences the decision to adopt 4IR-T to drive superior performance in all aspects of FMCG_B's value chain and limit disruptions.

5.7.1.1 Potential for 4IR-T adoption in beverage manufacturing organisations

The research findings indicate participants felt that they had a competitive advantage in terms of brand presence and strength, affordable prices, quality products and the fact that FMCG_B is a local organisation with a national footprint in South Africa. While most participants felt that FMCG_B has a competitive advantage in their current state, majority of the participants perceived the organisations as not having a competitive advantage due to the lack of 4IR-T usage. The findings also revealed that all participants have a positive attitude towards 4IR-T and the benefits that can be achieved with the implementation of 4IR-T. The perceived benefits include relative advantage and increases in quality, efficiency, and value perception with decreases in human intervention and enabling quick and informed decision making.

Furthermore, the findings reveal that participants perceived that their organisation size is an enabler of 4IR-T adoption. Adequate management support to technologies adoption within FMCG_B was also indicated as an enabler by the majority of participants. Findings further revealed that certain 4IR-T characteristics are needed for 4IR-T to be considered such as limited downtime during implementation, remote access, real time information and integration capability. All of these themes enable the adoption of 4IR-T adoption within FMCG-B.

5.7.1.2 Barriers to 4IR-T adoption in beverage manufacturing organisations

Majority of participants had a positive attitude toward 4IR-T adoption. However, the research found that participants perceived various barriers that prevent FMCG_B from adopting 4IR-T. The barriers from an organisational perspective include insufficient capital investment needed and the cost of 4IR-T implementation, inadequate skills capacity within the organisation, lack of timely return on investment, the lack of early adoption. Inadequate legacy system and process migration, lack of digital strategy and change management processes where further found as barriers within FMCG_B. Some of the participants perceived management as non-supportive of technology adoption. The findings also revealed environmental barriers with insufficient infrastructure in South Africa and insufficient Skills capacity as barriers to 4IR-T adoption. These findings influence FMCG_B's decision to adopt 4IR-T and to drive the competitive advantage in terms of cost reduction, superior performance, value, products and resources, differentiation of their products and business.

5.7.1.3 Potential risks that influence beverage manufacturing organisations decision to adopt 4IR-T

Risks such as South Africa's loadshedding, the labour regulations act, inadequate third industrial revolution technology and the perception that jobs will become redundant are perceived by the participants to negatively affect FMCG_B's decision to adopt 4IR-T. Also, supply chain disruptions positively affect the decision by FMCG_B to adopt 4IR-T. The organisation has experienced various supply chain disruptions recently which include the war in Ukraine causing shipping delays, and shortages in aluminium and carbon dioxide (Co2), COVID-19 pandemic and South Africa's water restrictions. These disruptions can positively drive the potential for 4IR-T adoption at FMCG_B. The risks found will influence FMCG_B drive for reduced cost, differentiation, increasing market share, superior resources, value and social image and ultimately competitive advantage.

5.8 Conclusion

This chapter has presented the findings of this research from the interviews and focus group that was conducted in line with the ethics recommendations from the University of South Africa Ethics review committee and the research methodology as discussed in chapter 4. The context of the study was discussed and gave insight on how the researcher approached the interview participants, provided the demographics of the participants and information on the interviews conducted. The data analysis process followed by the researcher was discussed which was driven by the three research questions as noted in chapter 1. Twelve participants took part in this research and a focus group was conducted after interviews to perform member checking with three participants. The thematic data analysis and themes that emerged from the data analysis was discussed, further discussion on the process followed during the thematic analysis and focus group was provided with evidence.

A description of themes that emerged from the thematic analysis in relation to the research objectives which are, enabling factors, barriers and potential risks that influence adoption of 4IR-T in beverage manufacturing organisations to drive their competitive advantage. This chapter concludes with a summary of the findings in relation to how the themes have answered the research objectives.

Chapter 6 – Discussion of Findings

6.1 Introduction

The aim of this study was to explore the role of 4IR-T in driving competitive advantage within the beverage manufacturing organisations in the FMCG industry of SA specifically in terms of potential, barriers, and risks. This chapter presents a discussion of the findings from chapter 5 in relation to the literature review conducted in chapter 2. The Technology-Organisation-Environment (TOE) theory as discussed in chapter 3 serves as a lens to interpret the data. Section 6.2 will present the discussion on the technology aspect of the findings; the organisation characteristics is discussed in section 6.3 while the environment considerations is discussed in section 6.4. Section 6.5 concludes this chapter.

6.2 Technology Factors that influence 4IR-T adoption

The TOE framework that was discussed in chapter 3 noted that various technology factors, for example relative advantage, perceived barriers and benefits influenced an organisations decision to adopt 4IR-T (Van Dyk & Van Belle, 2019; Igwe *et al.*, 2020; Classen *et al.*, 2021). The findings from the data analysis highlights that FMCG_B's decision to adopt 4IR-T is enabled by the perceived benefits, relative advantage, and 4IR-T characteristics. However, the timeline for return on investment and potential for system redundancy are major technology barriers against FMCG_B 4IR-T adoption decision. The findings revealed more positive technology factors that influence adoption with only two negative technology factors or barriers that affect FMCG_B decision to adopt 4IR-T.

6.2.1 Benefits

The perceived benefit finding infers that with the adoption of 4IR-T, the organisation can achieve benefits such as reduced human intervention and the ability to make informed, quick decisions. Thus, it can be implied that these perceived benefits can enable adoption of 4IR-T at FMCG_B to drive a reduction in errors due to lack of human intervention in processes and with readily available information the potential to drive quick decision making and competitive advantage. This finding is in line with previous studies which suggest benefits that 4IR-T can offer (Koh *et al.*, 2019; Bag *et al.*, 2020; Purbasari *et al.*, 2020; Serumaga-Zake *et al.*, 2021). For example, Purbasari *et al* (2020) and Serumaga-Zake *et al* (2021) found that 4IR-T could enable organisations in the beverage industry to automate various value chain activities and limit human intervention. According to Koh et al (2019) Big Data analytics (BDA) and technology can promote data collection from multiple sources, the ability to comprehensively analyse data and provide real time decision making based on the data analysis results.

The findings show that participants perceived that with the adoption of 4IR-T they could achieve relative advantage. Thus, it can be inferred that with 4IR-T adoption FMCG_B could achieve reduced cost and increases in efficiency, quality, and value perception. This finding supports previous studies which found that relative advantage can enable 4IR-T adoption (Nainaar & Masson, 2018; Van Den Berg & Van Der Lingen, 2019; Martínez-Caro *et al.*, 2020; Serumaga-Zake *et al.*, 2021; Rajkumar, 2021; Saryatmo & Sukhotu, 2021). For example, Nainaar and Masson, (2018) argued that with the adoption of technology management principles and practices organisations can achieve improved product quality, reduce cost in business processes and enhanced revenue growth.

Serumaga-Zake et al (2021) suggested that SA SMEs should be embracing 4IR-T such as AI and others in order to increase efficiency in delivery and production of quality goods and services. Studies by Van Den Berg and Van Der Lingen (2019), Martínez-Caro et al (2020) and Saryatmo and Sukhotu (2021) concluded that the adoption of 4IR-T within the FMCG more specifically, the food and beverage industry can aid organisations to create considerable value added, monetary gain and competitive advantage.

6.2.2 Characteristics

The findings revealed that participants required certain 4IR-T characteristics that will be needed for the 4IR-T adoption to be considered. It can be inferred that should 4IR-T have the ability to provide integration with systems including internal and customer systems, limited downtime during the implementation, provide real time information and offer remote access this will enable 4IR-T adoption. However, a study by Nainaar and Masson (2018) argued that automation and integration between systems would allow organizations to streamline processes in their value chain. Streamlining the value chain with the adoption of 4IR-T would enable value chains to be localised, more cooperative and create sustainability benefits to the customers and organisations.

Martínez-Caro et al (2020) further stated that from the consumer of FMCG products perspective, the implementation of 4IR-T by organisations would ensure direct access to the organisations, thereby improving communication and customer relations and competitive advantage. Bongomin *et al.*, (2020) stated that augmented reality can be applied to provide the ability for remote access for example training purposes and robotics could be applied to achieve remote control systems. Ngai *et al.*, (2021) further found that a system should lead to little or no disruption to increase users' acceptance of a new system and systems should be integrated to limit difficulties for users in their study on chatbots.

6.2.3 Barriers

Technology barriers that were perceived by the participants where the return on investment and system redundancy. Participants felt that the adoption of 4IR-T would not yield a return on investment

and implied that the return on investment would be seen in the long term with foregoing the short-term returns. This finding supports previous work by Pillay (2016) and Eze et al (2020) who found that 4IR-T fail to generate an immediate return on investments and that the return on investment together with increases in market share may wind up in no distant time. Participants further felt that with the rapid advancement of technology system can become redundant and outdated within a shorter period which would increase their investment costs by having to implement updated or new systems. Limited studies have been conducted on the redundancy of systems and this finding would add to the existing body of knowledge on technology factors that affect or influence the adoption of 4IR-T.

With 4IR-T adoption FMCG_B can drive superior performance, value, and differentiation by reducing costs, increasing efficiency, quality, and value perception. However, technology factors such as lack of timely return on investment negatively influence FMCG_B decision to adopt 4IR-T. Limited studies have been conducted on system redundancy in relation to 4IR-T driving competitive advantage and this finding would add to the existing body of knowledge specific to FMCG_B.

6.3 Organisation Characteristics enabling 4IR-T adoption

The organisational factors from the TOE framework include size of the organisation, top management support and prior technology experience to name a few (Igwe *et al.*, 2020). The finding from the data analysis revealed a large number of organisational barriers faced by FMCG_B with two organisational enablers of 4IR-T adoption. The current state of competitive advantage at FMCG_B was also found to be an enabler of 4IR-T adoption due to the implied state of competitive advantage by participants.

The organisational factors were implied by the participants to be barriers that inhibit the adoption of 4IR-T. The highest noted finding by participants was the cost of implementation and the capital investment required for the adoption of 4IR-T with all participants noting this theme. This finding is in line with previous studies (Akintelu *et al.*, 2016; Pillay, 2016; Mulaudzi, 2017; Sarı *et al.*, 2020; Bagale *et al.*, 2021; Serumaga-Zake *et al.*, 2021). All of these studies concluded that at the forefront of organisational factors is cost of implementation and capital investment in 4IR-T. Studies by Akintelu *et al* (2016) and Sarı *et al* (2020) further stated that with South Africa being a developing country, FMCG organizations lack the needed capital and managerial know-how to adopt and implement 4IR-T within their environments. This barrier would cause FMCG_B to forego the chance to drive superior performance, value and performance as supported by Porter (1985) and Barney (1991).

A large number of participants inferred that the organisation does not have the required skills capacity to implement 4IR-T or a workforce that will be able to use this technology. It can be implied that this will affect the decision to adopt 4IR-T within FMCG_B. This finding supports findings from previous studies (Van Dyk & Van Belle, 2019; Maisiri *et al.*, 2021). For example, Van Dyk & Van Belle (2019)

found that perceived barriers such as infrastructure impact, security risks and lack of talent – technical skills impact 4IR-T adoption. Maisiri *et al* (2021) further concluded that factors such as resistance to change, unemployment, skills shortage and inadequate supporting ICT infrastructure are barriers to 4IR-T adoption. This would inhibit the drive for superior resources and competitive advantage which is supported by Barney (1991) and Serumaga-Zake et al (2021). For example, Barney (1991) proposes that possession of superior skills and resources has been viewed as the traditional recipe for a firm to gain competitive advantage.

The next highly noted organisational finding was the perception that FMCG_B was not early adopters of technology, which implied that FMCG_B will lose out on first mover advantage. This would cause the organisation to forego the opportunity to drive superior performance, value resources and differentiation. This finding is supported by (Van Den Berg & Van Der Lingen, 2019; Poloz, 2021; Felsberger *et al.*, 2022). For example, Poloz (2021) stated that early adopters of a new technology may be well-placed to reap the lion's share of the benefits in the early going. Participants further inferred that FMCG_B is to set in their ways and there is a lack of legacy systems and process migration which implied a barrier to 4IR-T adoption. This finding is supported by Nainaar and Masson, (2018) who found that legacy technologies have the potential to negatively impact these organisations through, manufacturing processes, inefficiencies and breakdowns whereas new technologies have added advantages in terms of cost reduction and increasing productivity and competitive advantage.

The findings on inadequate management support, lack of digital strategy and change management are closely linked. It can be inferred that without management support, there will be no clearly defined digital strategy, and this leads to lack of change management processes. These findings are supported by Nainaar and Masson (2018) and Van Dyk and Van Belle (2019). For example, Van Dyk and Van Belle (2019) concluded that a lack of a clear digital strategy to drive transformation, a lack of leadership that steers the direction and company culture to a digital mindset are barriers to the adoption of 4IR-T. Nainaar and Masson (2018) noted It is essential for management to provide support and change processes to technical employees if they intend to successfully implement and manage technologies in an effective manner. According to Wamba (2022) 4IR-T can be used to achieve deep market engagement, support and create value to a firm's operations towards superior product value and enhanced performance.

6.3.1 Enablers

From and organisational perspective the findings from the data analysis revealed a limited number of factors that enable the adoption of 4IR-T. Further to this, participants had a split view on the finding in terms of management support with majority of participants implying that top management is

supportive of technology adoption. This finding supports pervious findings that top management support is essential when adopting technology as approval and resource allocation should be driven from top management (Classen *et al.*, 2021). Srivastava *et al* (2022) further argued that top management support is critical and affects the adoption of 4IR-T and should be involved throughout the process of adoption. All participants perceived that their organisation size enables 4IR-T adoption, and it can be inferred that even though FMCG_B is smaller than its competitors there is still a need for 4IR-T adoption. This finding is in line with Classen *et al* (2021) who concludes the organisation size is a significant factor in influencing technology adoption and competitive advantage.

The current state of competitive advantage at FMCG_B revealed that as an organisation there are limited competitive advantage attributes that the participants perceived. Thus, it can be inferred that the organisation can leverage 4IR-T to drive further competitive advantage, for example superior performance, resources, increase the value of their products as perceived by consumers, differentiate their products and organisation from their competitors. This finding is supported by Porter (1985) conceptualization of competitive advantage together with Barney (1991) view of competitive advantage from a resource's perspective. Previous studies have shown that with 4IR-T adoption organisation can achieve these attributes of competitive advantage (Nainaar & Masson, 2018; Serumaga-Zake *et al.*, 2021; Onu & Mbohwa, 2021; Saryatmo & Sukhotu, 2021). For example, Serumaga-Zake *et al* (2021) stated that with the implementation of IoT, SMEs will be able to enable efficient delivery, produce quality goods, will become cost effective and will produce at a faster rate thus driving competitive advantage.

The findings as discussed align with the conceptual framework presented in chapter 2, which suggests that organisational factors can influence positively or negatively, the decision to adopt 4IR-T. From the discussion it can be deduced that the perception by participants is that the FMCG_B is faced with a high number of organisational barriers and limited enabling factors that can enable 4IR-T adoption. The organisational barriers will inhibit the organisation from adopting 4IR-T and thus driving superior performance, resources, value differentiation and increasing their market share. With the low number of enabling organisational factors that promote 4IR-T adoption this could be a further inhibitor to driving competitive advantage.

6.4 Environment Considerations for 4IR-T adoption

Environmental factors from the TOE framework include size of the industry, government regulations, competitive pressure and external pressure from customers and suppliers which can influence the adoption of 4IR-T (Igwe et al., 2020). Findings from the data analysis revealed that FMCG_B perceives a large number of risks that negatively influence their decision to adopt 4IR-T from an environmental

perspective. FMCG_B also perceived that the risk of supply chain disruption positively influences their decision on 4IR-T adoption.

6.4.1 Infrastructure, cost, and skills capacity

The most noted theme from an environmental perspective was load shedding, which is unique at the current time to South Africa. This finding could have emerged due to the cross-sectional study being done within a time that South Africa is under constant loadshedding by the national power supplier. Participants inferred that a constant power supply is needed for 4IR-T, with the power supply not being constant this is seen as a risk that will influence their decision to adopt 4IR-T. This finding is in line with Tulinayo *et al.*, (2018) who noted that unstable electricity power is a challenge when using digital tools, however there have been limited further studies on the electricity component of 4IR-T and how this could be a risk to its adoptions. Due to the additional investment needed to cater for loadshedding FMCG-B would increase costs, leading to loss of short-term superior value and competitive advantage.

The risk of labour regulations and fear of job losses was implied by participants to influence their decision to adopt 4IR-T. South African labour regulations exist to preserve jobs and ensure employees are treated fairly, however the perception was that with the adoption of 4IR-T, certain jobs would become redundant and lead to job losses within FMCG_B. Participants perceived pushback from unions that would negatively impact the decision on 4IR-T adoption. This finding is supported by previous studies (Classen *et al.*, 2021; Maisiri *et al.*, 2021; Maddikunta *et al.*, 2022). For example, Maisiri *et al.* (2021) found that 4IR-T adoption could potentially reduce or even remove certain low-skilled and semi-skilled jobs, which stakeholders such as labour unions fear. Maddikunta *et al* (2022) further concluded that while 4IR-T has improved the manufacturing cost, it has ignored the human cost through process optimization. This inadvertently leads to the backward push of employment and will raise resistance from labour unions thereby affecting the full adoption of 4IR-T.

(Drydakis, 2022) stated that certain 4IR-T such as AI, may make job positions redundant as work performed traditionally by employees might be substituted by computers. However, this finding contradicts a study performed by Bosch and Rossouw (2021) who suggest that with training employees' positions will not become redundant. Since FMCG_B has a social responsibility to the community it serves by preserving and creating jobs, the organisation risks losing social image, driving superior resources, value, performance, and competitive advantage.

Participants were under the impression that South Africa has inadequate third industrial revolution technologies and support to adopt 4IR-T. Further to this, the findings inferred those participants felt that there is insufficient infrastructure from an environmental perspective in terms of for example

connectivity, power and in order to adopt 4IR-T, further investments would be needed by the FMCG_B which they considered risks. These findings are in line with findings from previous studies, Van Dyk and Van Belle (2019) suggest that limited infrastructure and connectivity could inhibit the adoption of technologies by organisations. Malomane *et al* (2022) further noted that risks such the unavailability of specialists, lack of education, lack of access to wireless connectivity, lack of interest and insufficient electricity are risks faced by organisations when looking to adopt 4IR-T but to a lesser extent. Due to the perception that additional investment would be needed, this would further increase costs and lead to loss of superior value and competitive advantage.

The last finding noted from an environmental perspective was inadequate skills capacity, this finding was noted by one participant who felt that while the organisation has inadequate skills capacity internally, this is also the case with the external resource pool. This finding is supported by previous studies by Maisiri *et al* (2021) and Malomane *et al* (2022). For example, Malomane *et al* (2022) found that unavailability of training capacities and lack of adequate skills are the main threats to implementing 4IR-T. The perception with both this environmental factor together with the organisational factor was the risk that 4IR-T implementation could fail without correct skills and the correct skills will not be available from the resource pool to recruit from. This risk would inhibit FMCG_B ability to drive superior resources or attain these superior resources in terms of people and the drive for competitive advantage.

6.4.2 Effects of Supply Chain Disruptions

The data analysis revealed six risk specific to supply chain disruptions and FMCG_B which have been experienced recently. These included war in the Ukraine, Covid 19, and shipping delays which lead to shortage in carbon dioxide and aluminium. Supply chain disruptions experienced by FMCG_B were identified as risks to the decision to adopt 4IR-T by FMCG_B. However, the perceptions were that the adoption of 4IR-T could lower the risk of supply chain disruptions by reducing delays, shortages and by being able to use 4IR-T to plan in advance. This has positively influenced FMCG_B decision to adopt 4IR-T. While these risks are specific to FMCG_B, there are studies that support this finding. Bagale *et al* (2021) for example found that the use of Big Data Analytics had allowed for the Covid 19 pandemic to be monitored in real time. Rajkumar (2021) further noted that big data has become a widely accepted concept in supply chain, especially when leveraging data to optimise supply chain distribution and ordering processes, which improves operational efficiencies and reduces ordering and distribution costs, which can drive competitive advantage.

The finding as discussed from an environmental perspective align to the conceptual framework in chapter 2. These findings support previous studies, however, contradicts a study concerning the job

redundancy. While the risks will negatively influence FMCG_B decision to adopt 4IR-T, supply chain disruptions would have a positive influence on this decision. With the perception that these risks will negatively influence 4IR-T adoption within FMCG_B, the organisation will forego the opportunity to drive superior performance, value, products, and competitive advantage. However, the risk of supply chain disruptions would have the opposite effect.

6.5 Conclusion

This chapter has presented a discussion of the findings. The findings are discussed using the TOE framework as a lens to address the research aim. The discussion notes that majority of the technology factors influence the adoption of 4IR-T positively with a limited number of factors that have a negative influence. The organisational factors are barriers to FMCG_B adoption of 4IR-T with two factors namely, the organisation size and management support being seen as enablers 4IR-T adoption. Various risks from an environmental perspective negatively influences the decision to adopt 4IR-T within FMCG_B however, supply chain disruption has a positive influence. Overall, the positive influences will allow FMCG_B to drive superior value, performance, products, differentiate their organisation, be seen as a member of the community they serve and drive competitive advantage. With the negative influences of 4IR-T adoption leading to FMCG_B not adopting 4IR-T, the organisation will struggle to improve on the competitive advantage attributes.

Chapter 7 – Conclusions and Recommendation

7.1 Introduction

This chapter will present the conclusion and recommendations to address the research aim and problem presented in chapter 1. The findings from data analysis presented in chapter 5 and discussion of the findings presented in chapter 6 informed the conclusion and recommendations. Section 7.2 will conclude how this study has addressed the research problem and the research aim the while section 7.3 will provide the limitations of this research. Section 7.4 will provide the research contributions from a practical, methodological, and theoretical stance and section 7.5 will provide actionable recommendations to the practice and industry community. Section 7.6 concludes this chapter and provides further research suggestions.

7.2 Addressing the Research Aim

As a reflection of the chapters is completed, chapter 1 presented the introduction to this research and the current situation within beverage manufacturing organisations highlighting the capabilities and applications of 4IR-T that can drive competitive advantage. A background to this research which presented the ideal situation of how 4IR-T can drive competitive advantage within beverage manufacturing organisations was presented. This led the researcher to the research problem that indicated with the benefits that 4IR-T can offer such as cost containment, increase in value, productivity, differentiation, and competitive advantage the adoption rate in beverage organisations is slow which will hinder organisations' ability to remain competitive and ensure survival. The aim of the research was then formulated together with the research objective to address the research problem. The research objective expanded into sub research questions and objectives to determine the potential, barriers, and risks to 4IR-T adoption to drive competitive advantage in the FMCG industry and beverage-manufacturing organisations.

In order for the researcher to meet the objective and sub-objectives of this study it was imperative to explore what previous studies have been completed in terms of 4IR-T driving competitive advantage. Chapter 2 presented a literature review of existing studies within this field of research, which presented various studies completed on Industry 4.0, 4IR-T, ICT, competitive advantage and the FMCG industry. The studies reviewed discussed how 4IR-T adoption can enable organisations to achieve competitive advantage by driving superior performance, value, resources, differentiation of products and organisations. However, the literature review identified a gap where limited studies have been conducted within the South African beverage manufacturing industry specifically on 4IR-T driving competitive advantage within this industry. Chapter 3 presented the theoretical underpinnings for this

research and the TOE framework used as a lens due to its strength in being able to look at multiple dimensions of variables, refers to how an organisation adopts or does not adopt technologies and the deductive nature of this research.

Once the literature review and theoretical underpinning identified the clear gap, the research methodology was formulated for the collection of data and the analysis that would be conducted to answer the sub-research objectives. The research methodology was discussed in chapter 4, the case study strategy using qualitative methods, a deductive approach using the TOE framework and a purposive sampling method using a cross-sectional time horizon was selected. The researcher used interviews and a focus group to gather data, a thematic analysis of the data was performed to achieve the research objective. This methodology was selected due to the suitability within this research and the ability to bring the researcher closer to achieving the aim and objective of this study. Chapter 4 further presented the ethical considerations and data management plan that was adhered to during the data collection process.

In order to address the aim and objective of this research, it was imperative that sub questions and objectives be developed which aimed to explore the potential factors that enable 4IR-T adoption, barriers, and risks to adoption to drive competitive advantage. Chapter 5 presented the findings from the thematic analysis conducted in relation to the research sub-objectives. The researcher deemed it necessary to present a discussion of the findings in chapter 6 which was informed by the TOE framework where the researcher compared and contrast the findings in relation to the literature review that was conducted. Chapters 5 and 6 lead to the successful achievement of the sub-research objectives and the overall aim of the study. The researcher was able to gain information on the potential factors that enable 4IR-T adoption, the barriers to 4IR-T adoption and risk that influence the decision to adopt 4IR-T to drive competitive advantage within beverage manufacturing organisations.

What was discovered is that there is major potential for 4IR-T adoption within beverage manufacturing organisations, potential factors such as perceived benefits, relative advantage, size of the organisation, management support and 4IR-T characteristics enable 4IR-T adoption. With the current state of competitive advantage beverage organisations can leverage 4IR-T to drive superior products, value, resources, differentiation to increase their competitive advantage compared to competitors. However, beverage manufacturing organisation face various barriers for example insufficient capital investment, cost of implementation and lack of timely return on investment which inhibits their adoption of 4IR-T which would inhibit increasing competitive advantage. Beverage organisations perceived various risks mostly from an environmental perspective that influence their decision to adopt 4IR-T and risks for example loadshedding, job redundancy and labour regulations

negatively impact their decision and the drive for competitive advantage. However, the risk of supply chain disruption has a positive influence on the adoption decision for 4IR-T.

From the achievement of the sub research objectives, the researcher was able to achieve the aim of the study which was to explore the role of 4IR-T in driving competitive advantage within beverage manufacturing organisations. By identifying the potential enabling factors, the barriers and risks to 4IR-T adoption faced by beverage organisations it was evident that 4IR-T can provide beverage organisations with the ability to drive superior products, performance, value, resources, and differentiation. This has also led to the research addressing the research problem in that, with the benefits that 4IR-T can enable, the barriers and risks experienced by beverage organisation contribute to the slow adoption of 4IR-T and limit the beverage organisation's ability to remain competitive.

7.3 Limitations of this Research

Using a case study strategy, cross-sectional time horizon, qualitative methods with a deductive approach and TOE framework to explore the role of 4IR-T in driving competitive advantage within beverage manufacturing organisations in the FMCG industry of SA, there were limitations to the study.

The case study organisation is a smaller non-alcoholic beverage-manufacturing organisation compared to its competitors and the study was conducted in the Gauteng region of SA. The findings can therefore not be generalised to include all beverage-manufacturing organisation. Next the study used a cross-sectional time horizon which would have influenced the perception of the participants at the point where the study was conducted, as noted in finding on risk, for example loadshedding. Research conducted at a different point in time could have provided different perceptions from participants.

As noted in chapter 5 the informed consent form was sent to eighteen participants, however only twelve participants returned the signed informed consent form, to be in line with ethical recommendations only twelve participants were interviewed. Due to time constraints and availability of participants a focus group was conducted with three participants to respect time of willing participants. Although the sample size was well suited to the research methodology and aim of the study, it could be considered small and a limitation of this research due to the perception and opinions of the research participants within the case study organisation. The findings can then not be generalised to the whole beverage manufacturing industry.

7.4 Research Contributions

The gap in the literature found in chapter 2 noted that limited studies have been conducted within the beverage manufacturing industry of South Africa. This research contributes practically by adding

to the existing body of knowledge on the potential enabling factors of 4IR-T adoption. This research further contributes by providing the perceived barriers to 4IR-T adoption and the perceived risks that influence South Africa beverage manufacturing organisations decision in adopting 4IR-T. This knowledge can be used by South Africa beverage manufacturing organisations to drive their digital transformation journey and adoption of 4IR-T. The research can further provide future research insights on the role of 4IR-T in driving competitive advantage with South African organisations.

Various existing literature has used a case study strategy, qualitative methods, and a deductive approach to their research. However limited studies have been conducted within the South African beverage manufacturing industry on 4IR-T driving competitive advantage. The methodological contribution of the research is evident in the use of a combination of a literature review and collection of qualitative data. A validation of the findings was completed with a focus group to verify the accuracy and validity of the emergent themes from the interview by performing member checking.

This study used the TOE framework deductively to explore the role of 4IR-T driving competitive advantage within South African beverage manufacturing organisations. Literature shows that various previous studies have used this framework due to its ability to explain the elements that influence technology adoption within a firm context. New factors specific to the SA beverage manufacturing industry were discovered for example South African “Loadshedding” from an environmental perspective, being a local company with national footprint in terms of organisational and system redundancy from a technology perspective. The findings from this research add theoretically to the existing body of knowledge on TOE factors that can influence South African beverage manufacturing organisations decision to adopt 4IR-T.

7.5 Recommendations

Recommendations relative to the data collection and analysis that address the research problem of the slow adoption of 4IR-T within beverage manufacturing organisation in South Africa will be put forward in this section. The recommendations will assist beverage manufacturing organisations in proceeding to adopt 4IR-T at a faster rate which will ultimately provide these organisations with a competitive advantage within the industry of South Africa.

The first recommendation is that beverage organisations should adopt 4IR-T to leverage the benefits and relative advantage that 4IR-T can offer at an increased rate. These organisations should look to digitally transform and move away from legacy systems and traditional ways of doing business by being first movers to technology adoption. This would allow for the organisations to drive improvements in all aspects of their business such as cost reduction, superior products, performance,

value and differentiate their organisation thus leading to competitive advantage and first mover advantage from a 4IR-T adoption point of view.

The second recommendation is that beverage organisations should take a long-term view of 4IR-T adoption and the benefits that can be achieved. An investment made in 4IR-T today could take time to show a return on investment; however, the organisation should acknowledge short-term gains that lead up to strengthening their competitive advantage. By further investing, to overcome risks, for example in power redundancy, this will not only benefit 4IR-T adoption but the organisations as a whole by limiting downtime. 4IR-T adopted now could allow the organisation to be innovative and drive competitive advantage in the future by reducing costs, improving performance over a period which would lead to long term competitive advantage.

The third recommendation is upskilling and training of employees through courses and further education on 4IR-T. Beverage organisations need to ensure that through this training employees' knowledge, skills and education on 4IR-T is increased which would ensure that employees can be enablers to the adoption of 4IR-T and their fear of job redundancy would be reduced. Upskilling employees will also address the risks of labour regulations and union pushbacks as employees could move into different roles. This would enable the organisation to achieve easier adoption of 4IR-T and allow the organisation to drive superior resources and competitive advantage.

The fourth recommendation is that top management promote and support adoption of 4IR-T, by firstly ensuring that a digital strategy is developed or by making technology apart of the business strategy. Secondly, ensuring that the developed strategy is driven top-down within the organisation by communication and regular discussion on 4IR-T. This would ultimately lead to proper change management procedures being implemented to enable 4IR-T adoption and the migration from legacy systems. This would enable the organisation to be innovative, drive the adoption of 4IR-T and competitive advantage.

Lastly beverage organisations need to look to 4IR-T such as big data analytics, cloud solutions, AI, mobile solutions to prevent supply chain disruptions as seen in the recent years. This would enable beverage organisations to overcome supply chain disruptions and drive superior performance, value, products, and competitive advantage by being able to plan in advance and the ability of certain employees working from anywhere.

Table 9: Summary of Recommendations in Relation to Findings

Findings	***Recommendations***
• FMCG_B's current State of competitive advantage would be an enabling factor for	• Beverage organisation should adopt 4IR-T to digitally transform in order to leverage the

the organisation to adopt 4IR-T to drive superior performance, resources and differentiate their organisation. • With the relative advantage that can be achieved with the adoption of 4IR-T, such as reduce cost, increased efficiency, quality, and value, this is a factor that enables 4IR-T adoption. • The perceived benefits that 4IR-T can offer, for example, reduced human intervention and quick informed decision making, is a factor the enables 4IR-T adoption and drives competitive advantage. • The Size of FMCG_B and adequate management support are factors that enable 4IR-T adoption in FMCG_B that can influence the drive superior resources, value, and cost reduction. • FMCG_B requires specific needed characteristics of 4IR-T to enable adoption to drive improved performance, better customer engagement, and improve decision making.	benefits, relative advantage, and competitive advantage that 4IR-T can offer.
• Cost and timeline for return on investment inhibit 4IR adoption and influence the opportunity of driving superior performance, value, and products. • Skills capacity from both an organisational and environmental perspective is	• Investments in 4IR-T should with completed with a long-term view of the return that can be achieved. Beverage organisations should not look to gain short term returns by sacrificing long term competitive advantage.

insufficient to adopt 4IR-T and inhibits the drive for superior resources and competitive advantage. • The lack of early adoption leads to the loss of first mover advantage in driving superior products performance, value, differentiation of products, business, and loss of market share. • Perception that there is insufficient infrastructure to support 4IR-T and that infrastructure is decaying, inhibits adoption to drive superior performance, value, and products. • Due to the lack of legacy system and process migration, FMCG_B is hesitant to adopt 4IR-T to drive cost reduction and performance. • Inadequate management support and lack of digital strategy as well as change management inhibits adoption to drive superior performance products and value.	• Upskilling and training employees on 4IR-T should be implemented, this would ensure employees are enablers of 4IR-T adoption and reduce their fear of job redundancy which would drive superior resources and competitive advantage. • Recommendation one further recommends that beverage organisation become first movers to attain first mover advantage. • Top management needs to support and drive 4IR-T adoption by ensuring a digital strategy is developed and driven top down. In doing this, barriers such as lack of legacy system migration will be overcome, and adoption of 4IR-T will be increased. Thus, driving superior resources, performance value and competitive advantage.
• With power supply not being reliable in South Africa, this negatively influences the decision to adopt 4IR-T to drive cost reduction, differentiation and increase in market share. • Risk of labour regulations and push back from unions negatively impacts FMCG_B 4IR-T adoption decision to drive superior resources and performance.	• Recommendation one further recommends that investments be made to overcome risks, for example investment in power redundancy, again with a long-term view of the competitive advantage that can be achieved. • Recommendation two further recommends that by upskilling and educating employees on 4IR-T, this would alleviate the risk that was found on labour regulations and reduce

• Inadequate third industrial revolution technologies to support 4IR-T negatively impact the 4IR-T adoption decision to drive differentiation and superior value. • System and job redundancy negatively impact the decision to adopt 4IR-T to drive reduced investment, costs, and loss of social image due to lifespan of technology and social responsibility. • Risk of supply chain disruptions positively influences the decision to adopt 4IR-T to drive superior performance in all aspects of FMCG_B's value chain and limit disruptions.	the fear of job redundancy thereby ensuring organisation drive superior resources performance and competitive advantage. • Beverage organisations should look to 4IR-T like big data, AI, mobile and cloud to avert risks such as supply chain disruptions which could inhibit the organisation from achieving innovation and competitive advantage.

7.6 Conclusion and Future Research

This chapter has presented the conclusion to this research by performing a reflection of the preceding chapters, which discussed how these chapters have enabled the researcher in achieving the aim of this research and addressing the research problem. This chapter further presented the limitations of this research and the contributions this research has made in terms of practical, methodological, and theoretical perspective to the industry. Recommendation to the practice and industry where presented which detailed what steps can be taken by beverage manufacturing organisations in order to increase the speed of 4IR-T adoption and overcoming barriers and risks that were found to slow down 4IR-T adoption. A summary of the recommendations in relation to the findings as found in chapter 5 was also presented in Table 9 which concluded this chapter and the research.

Future research should be conducted within the FMCG industry to include a larger sample of beverage manufacturing organisations and a larger sample size of participants to gain various perceptions and opinions to gain prescriptive knowledge on 4IR-T. Furthermore, it is suggested that research be completed at another point in time as findings might be different compared to this research. In addition, further investigation should evaluate how adopted 4IR-T within beverage manufacturing organisations has enabled them to drive competitive advantage.

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Appendix A – Turnitin Report

Thesis Keagean Govender 45005427 Final December 2022

ORIGINALITY REPORT

21%	16%	10%	8%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	uir.unisa.ac.za Internet Source	2%
2	researchspace.ukzn.ac.za Internet Source	1%
3	Submitted to University of South Africa Student Paper	1%
4	pdfs.semanticscholar.org Internet Source	1%
5	www.researchgate.net Internet Source	1%
6	hdl.handle.net Internet Source	1%
7	vital.seals.ac.za:8080 Internet Source	<1%
8	aisel.aisnet.org Internet Source	<1%
9	ujcontent.uj.ac.za Internet Source	<1%

Appendix B – Ethical Clearance

Graduate School of Business Leadership, University of South Africa, PO Box 392, Unisa, 0003, South Africa
Cnr Janadel and Alexandra Avenues, Midrand, 1685, Tel: +27 11 652 0000, Fax: +27 11 652 0299
E-mail: sbl@unisa.ac.za Website: www.unisa.ac.za/sbl

SCHOOL OF BUSINESS LEADERSHIP

RESEARCH ETHICS REVIEW COMMITTEE (GSBL CRERC)

19 September 2022

Ref #: 2022_SBL_MBA_056_FA
Name of applicant: Mr K Govender
Student #: 45005427

Dear Mr K Govender

Decision: Ethics Approval

Student: Mr K Govender (45005427@mylife.unisa.ac.za, 084 6777588)

Supervisor: Dr Oluwamayowa Ogundaini (ogundoo@unisa.ac.za, 073 598 9341)

Project Title: The role of 4th industrial revolution technologies in driving competitive advantage in the South African beverage manufacturing industry.

Qualification: Master in Business Administration (MBA)

Expiry Date: December 2023

Thank you for applying for research ethics clearance, SBL Research Ethics Review Committee reviewed your application in compliance with the Unisa Policy on Research Ethics.

Outcome of the SBL Research Committee: Approval is granted until December 2023

The application was reviewed in compliance with the Unisa Policy on Research Ethics by the SBL Research Ethics Review Committee on the 16/09/2022

The proposed research may now commence with the proviso that:

1) The researcher will ensure that the research project adheres to the relevant guidelines set out in the Unisa Covid-19 position statement on research ethics attached
2) The researcher/s will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
3) Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study, as well as changes in the methodology, should be communicated in writing to the SBL Research Ethics Review Committee.
4) An amended application could be requested if there are substantial changes from the existing proposal, especially if those changes affect any of the study-related risks for the research participants.
5) The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study.

45 years Building leaders who go beyond

SBL GRADUATE SCHOOL OF BUSINESS LEADERSHIP UNISA

Graduate School of Business Leadership, University of South Africa, PO Box 392, Unisa, 0003, South Africa
Cnr Janadel and Alexandra Avenues, Midrand, 1685, Tel: +27 11 652 0000, Fax: +27 11 652 0299
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Kind regards,

NBW Mlitwa

Prof N Mlitwa

Chairperson: SBL Research Ethics Committee

011 - 652 0381/ wiltonk@unisa.ac.za

ANobatyi

pp.

Prof P Msweli

Executive Dean: Graduate School of Business Leadership

011- 652 0256/mswelp@unisa.ac.za

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SBL
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UNISA

Appendix C – Supervisor Consent

MBLREP / MBL5913 / MBA5929

CONSENT TO SUBMIT RESEARCH REPORT FOR EXAMINATION 2022

Consent is hereby given to:

Student name: Keagean Govender

Student number: 45005427 to submit his research report in its final form.

Supervisor Signature: ..... Date: 6th December 2022

Supervisor Name: Dr. Oluwamayowa Ogundaini

The student acknowledges that sufficient feedback was provided by the supervisor and that s/he took the responsibility to attend to the feedback in a way that satisfies the requirements for a research dissertation on the MBA and MBL level.

Student signature: Date: 04 December 2022

Appendix D – Institution Permission

[redacted]

GRANTING OF INSTITUTIONAL PERMISSION FOR RESEARCH

Dear Keagean Govender

I, Wesley Nidd the Chief Financial Officer of this company grant permission to collect data at this site for your research project titled "The role of 4th industrial revolution technologies in driving competitive advantage in the South African beverage manufacturing industry.

I grant this permission as the authorized person to so in this company and am aware of the following:

1. The study is conducted as a UNISA researcher and remains the property of UNISA
2. You {can use}, {not use} the name of the company in your research project
3. All data and information collected will be solely in the procession of the researcher
4. I will {require}, {not require} feedback of the research.
5. The research may be published in the public domain under the supervision of the supervisor.

I wish the best and success in this research.

Wesley Nidd
Chief Financial Officer

Email: Wesley.nidd@thebevco.co.za

[redacted]

Appendix E – Interview Guide

Introduction

I am Keagean Govender and currently performing research in partial fulfilment of a Master of Business administration Degree at the UNISA SBL. I have received your signed consent and consent from your organisation to conduct this research and ethical clearance from the UNISA SBL ERC.

Aim of the Study

The aim of this study is to explore the role of fourth industrial revolution technologies (4IR-T) in driving competitive advantage within beverage manufacturing organizations in the FMCG industry of South Africa.

I am conducting this research to find out how can fourth industrial revolution technologies (4IR-T) drive competitive advantage in the beverage manufacturing organizations?

4IR-T and Problem

4IR-T include Cyber Physical systems (CPS) Artificial Intelligence (AI), Machine Learning, Mobile, Cloud, Big Data Analytics, and Internet of Things (IoT) which can enable productivity improvements, cost reductions, and drive the potentials for competitive advantage, however the adoption rate is slow in South Africa compared to high income countries.

Main Research Question

How can fourth industrial revolution technologies (4IR-T) drive competitive advantage in the beverage manufacturing organisations?

Sub Research questions

What is the potential for adoption of 4IR-T in beverage manufacturing organisations?

> **Objective: To determine potential factors that influence adoption of 4IR-T in beverage manufacturing organisations to drive their competitive advantage.**

- Do you perceive your organisations as having a competitive advantage? How?
- Has your organisation considered implementing 4IR-T technologies, if yes or no why?
- Are the any infrastructure requirements that influence your decision in adopting 4IR-T?
- Are there any external regulations that influence your decision in adopting 4IR-T?

What are the barriers to 4IR-T adoption within beverage manufacturing organisations?

> **Objective: To identify the barriers that influence the decision to adopt or not adopt 4IR-T towards driving competitive advantage.**

- In terms of your organisation size, would it be viable to adopt 4IR-T?
- Does top management promote adoption of technology?
- Are there any other internal organisational factors that could influence your decision to adopt 4IR-Ts?
- Are there any limitations within your organisation that could influence your decision to adopt 4IR-T's?

What are the potential risks that influence beverage manufacturing organisations decision to adopt 4IR-T?

Objective: To understand the potential risks that beverage manufacturing organisations perceive to influence their decision to adopt 4IR-T towards driving competitive advantage.

- Has your organisation experienced recent supply chain disruptions, if yes How? If no, why?
- How do you perceive 4IR-T in driving competitive advantage attributes like price, product value and customer satisfaction?
- Are there any risks you foresee that might influence your decision to not adopt 4IR-T?

I would like to Thank you for providing your consent to participate in this research, attending this interview and the valuable insights you have provided.

Appendix F – Thematic Analysis

Objective No:	*Sample Responses*	*Codes*	*TOE Category*	*Themes*
Objective 1: To determine potential factors that influence adoption of 4IR-T in beverage manufacturing organisations to drive their competitive advantage.	***PAR03 –*** "…in the lower to mid-range market segment, our products and brands are extremely, competitive." ***PAR05*** – "…and we've also got a lot of great brands and investment behind that, that drives a quality product into trade at an affordable price" ***PAR11*** – "…but as it stands today, we do have a competitive advantage due to us being able to offer quite a complex portfolio which we've been able to do." ***PAR05*** - "…and we've also got a lot of great brands and investment behind that, that drives a quality product into trade at an affordable price" ***PAR06*** – "You know we can dictate our margins and where we win versus where we lose allows us to be a lot more competitive on shelf from a pricing perspective as well versus." ***PAR09*** – "…what the competitive advantage for us is from a price point perspective as an economic alternative in the market." ***PAR05*** - "…and we've also got a lot of great brands and investment behind that, that drives a quality product into trade at an affordable price" ***PAR12*** – "100% I believe we do, but I believe it's more through traditional means, through distribution methodologies, quality of product and quality of brands. ***PAR06*** – "Because we're a local company, We're obviously a lot nimbler than the likes of a Coca-Cola or a PepsiCo or any of the other multinational FMCG. So, I think our ability to adapt to change and our	• Brand Presence and strength • Affordable Price • Quality • Local Company • Lack of competitive advantage • Reduce Cost • Increase Efficiency • Value Perception • Increase quality • Human Intervention • Decision making • Management support • Size of organisation	• Organisational • Organisational • Organisational • Organisational • Technology • Technology • Technology • Technology • Technology • Technology • Organisational • Organisational • Characteristics	• Current State of Competitive advantage. • Perceived Benefits/ Relative Advantage • Perceived Enablers • 4IR-T characteristics

	speed of execution gives us a competitive advantage. We're not bound by hierarchy and red tape, and you know tedious processes that the multinationals are faced with" ***PAR07*** – "We are small. We don't have so much red tape as any other big businesses" ***PAR03*** – "I don't think it's competitive. I think that a lot of our build hardware and software from an organizational perspective is not where it should be in order for it to be competitive." ***PAR07*** – "…the one is no, we don't with the current systems that we have with us. But yes, absolutely with the systems where we are going towards so there's an appetite for improvement." ***PAR08*** – "No, TBO is far behind its competitors even from a 3IR perspective. Being on the bleeding edge of 4IR is a far cry" ***PAR03*** - *"*Making sure that you only plan what is necessary based on. Demand that already starts moving you to a concept called just in time, just in time shows that if you have less working capital, you're getting efficient from an organization, which is going to reduce your operational costs and then it migrates towards really true world class manufacturing." ***PAR06*** – *"*I think obviously, I would assume that your total fixed cost or people cost would go down, so you'd be able to be a lot more competitive on price." ***PAR09*** – "Yes, I do believe that's from a cost perspective. I think that you know the virtuous cycle, or the value chain of our business looks to reduce costs in the manufacturing and supply chain departments and redirect those cost saving towards marketing and sales initiatives."			

	PAR12 – "I think it could help us in our warehousing and distribution, better control, more cost efficient and more accurate methods of learning." ***PAR06*** – "I think if you have a quality a product that is consistent in terms of quality your end user your consumers and customers will be satisfied. I think where one adopts 4IR technology to replace human labour, allows you to have consistency and not be affected by things such as strikes and you know and union disputes and all of that, so I think you're able to be consistent" ***PAR10*** – "I would imagine you know when you talk about things like big data and artificial intelligence and all of that, I would imagine it gives you the ability to make informed decisions much quicker, and which will obviously help you to be more efficient with all of those things, whether it's price, product, your customer satisfaction…" ***PAR06*** – "…obviously you'll have a massive investment that one needs to put it, I think from a from a quality perspective, you'll have a lot more consistency." ***PAR09*** – "I definitely think that those technologies would help to create or to improve the benchmark from a quality perspective, if you don't have to take an entire bottle off of a line to test the quality…" ***PAR04*** – "I think the perception of value in the high-end sector is about how we present ourselves and some elements of that, if you incorporate 4IR technologies this gives an element of attraction or a perception of value, so the way we communicate with the media that we or would use to communicate I think potentially could add lots of value." ***PAR04*** – "The other side would be around minimizing the waste or the			

	loss that occurs as a consequence of the process, so having more interactive and up-to-date tracking of stocks of raw materials that don't rely on people going and counting, but the Stock automatically updates into set and it's an interactive process between the tracking mechanism" ***PAR05*** – "…there are a lot of human routine processes that can be automated, and artificial intelligence can process that information a lot quicker and make informed decisions with that data" ***PAR06*** - "I think if you have a quality a product that is consistent in terms of quality your end user your consumers and customers will be satisfied. I think where one adopts 4IR technology to replace human labour, allows you to have consistency and not be affected by things such as strikes and you know and union disputes and all of that, so I think you're able to be consistent" ***PAR02*** – "…which would help with fast decision making, so If it could link to other systems in the business where it could drive that speedy decision making in terms of ordering material or getting their rates fairs and the like, then that then would really give the organization the advantage." ***PAR03*** – "one of the main outputs that that comes from an industry standard four perspective is being able to make informed decisions by evaluating data" ***PAR11*** – "…because I think the there's the users of data and information now use such a significant quantum of data for such a short period of time that unless you be able to, you're able to interact with them when they're doing that, I think you'll have delusional relevance in the market"			

	PAR02 – "Yes, just looking at, people wise, off peak, I've got about 60 people, In peak, it's about 104. You run a line with about 7 operators, processes mainly closed and your warehousing, there's opportunities then to improve and get some technology there." ***PAR08*** – "Absolutely, this isn't a bubble, the 4IR technologies is here as the next obvious step in the technology journey. Not taking advantage only leaves us behind, and soon enough, out of business." ***PAR11*** – "Absolutely, we are growing organization and we will continue to grow if we continue to apply all the right disciplines, but process improvements and 4IR technologies is critical for growing organizations to ensure that you've got future control of your business as well." ***PAR01*** – "I think top management have been extremely supportive of all the initiatives we have taken over the last two, to three years, probably over the last two years. For the most part I think they've been, there's been very little resistance to moving the dial on our IT infrastructure and roadmap." ***PAR05*** – "Yes, I believe that they do and there is an appetite to introduce new technologies. We've seen that in the introduction of the MS Teams portfolio and different applications and processes that come within the Microsoft portfolio and the adoption thereof." ***PAR06*** – "They do so. We're always looking at new technologies. You know faster lines. Faster labellers, faster Packers. You know, so I mean, the simple answer. Is yes, I mean whenever we procure. We try to procure the latest technology equipment…" ***PAR10*** – "you know when we implemented things like SAP for example, there's always some downtime that comes into play with			

	it. So, I suppose the implementation or the adoption of four 4IR technologies come with downtime because obviously that's something that companies can't really afford." ***PAR10*** – "I think the only thing that would affect it quite heavily is that a lot of our systems need to speak to those of our customers such as an applicant page, ShopRite, etcetera. So, I think it would be important not a regulation, but it would be a requirement that our technology speaks to their technology." ***PAR02*** – "…but I don't have something like as simple as a remote access to my machinery and support, So I use SIPA equipment and if there's an issue, the technicians have to come here physically so there is downtime. ***PAR02*** – "…if it's just a nice system that incorporates everything and all of us use just that one system where you can see how the lines are performing real time, how, where materials is doing real time, how your order management and customers stuff is real time which will give you that advantage."			
Objective 2: To identify the barriers that influence the decision to adopt or not adopt 4IR-T towards driving competitive advantage.	***PAR02*** – "So, to move to robotics, that would involve some Investment and it would be a bit of an overkill considering the output that comes out there." ***PAR05*** – "I think the next implication would be the budget required to implement these solutions. Another one would most likely be the physical infrastructure. So, a lot of our works deals with specific machinery. And they would be a Capex requirement there, which again is a cost. And again, if our competitive advantages to deliver it at the most affordable price within the short term to take on a Capex requirement doesn't serve that, it starts creating a cost requirement"	• Investment/Cost • Return on investment • Resource skills • Early adoption • Infrastructure • Legacy systems • Management support • Digital strategy • Change management	• Organisational • Technology • Organisational • Organisational • Environmental • Organisational • Organisational • Organisational • Organisational	• Insufficient Capital Investment • Lack of timely return on investment • Inadequate Skills capacity • Lack of early adoption • Insufficient infrastructure • Inadequate legacy system and process migration • Inadequate management support • Lack of digital strategy

	PAR08 - TBO "tends to lean on financial restrictions as its number 1 reason for not adopting 4IR-T. However, with little investigation, one would realise that with an advancement in technology, so has been the decrease in the capital needed to tap into this space." ***PAR10*** – "The first thing that the company will consider is obviously the cost, so I would imagine that if you moved to artificial intelligence and things like that, there would be significant Investment required in infrastructure, and I think that would be a big part of it. So, I'm not sure exactly what the requirements would be, but you know, if it's expensive, then obviously it will be a no." ***PAR01*** – "It's got to be taken with a with a measure of what is your return on investment on these things." ***PAR04*** – "I qualify that with a you know it's gotta have a bang for Buck, there has to be an element of return on investment. But like any other investment that the company would undergo, there would be very specific requirements and benefits that would be well laid out ahead of time because we don't really have the funding right now to explore." ***PAR12*** – "Yeah, the Return on investment is there, but it would a five-year return on investment instead of a three-year and I think our shareholders, as they stand that's too far out." ***PAR07*** – "But the other thing is, I think resources because AI and four 4IR it would make our lives much easier. Problem is, do your people really understand once you've got the information? What must they do with it? Because you and I will understand and maybe a few on Exco. But the ones that should really benefit are probably not			• Lack of change management

	going to understand it's a capability is definitely an issue." ***PAR09*** – "We don't have the infrastructure for it, from a people resourcing perspective as in you know, centres of excellence that are driving these projects and I'm speaking specifically in my space…. I think that would be a gap because we don't know what we need from an infrastructure perspective because there's nobody who's qualified to make that assessment" ***PAR11*** – "I think the one thing I need to remain conscious of is that the ability and the calibre of your people also at all levels in the organization." ***PAR07*** – "You have to 1st buy it and then you have to go and amend it to suit the industry and to suit you, I would let somebody else do that bleeding. PAR08 – "Unfortunately, "TBO" hasn't proven itself as being in the business of take technological leaps in innovation." ***PAR03*** – "…. simply, that's what it comes down to the skill level within the country is already a limiting factor, because that is a limiting factor with one of the worst education systems in the world and if you look at the fact that We have very high inequality numbers, our socio-economic factors are very, very important." ***PAR11*** – "…efficiency and the way we organized does give us a portfolio advantage to some degree versus our main competitors and which also brings a level of complexity to the organization, and it makes it a little bit slower to adapt to new trends unfortunately." ***PAR03*** – "I think that our systems and processes are very traditional, and we decided to stick with that in a competitive market right now. I think just being able to manage our cost outputs, actually right now the			

	bigger picture with actually using technology to advantage hasn't necessarily been explored because again, it wouldn't be the burning platform" ***PAR08*** – "We are still we are still managing stock using excel now as much as Excel made might be a great tool for a number of things, It isn't really the most secure tool as far as managing inventory now from a cost of manufacturing perspective we manage about 30 or the million rands worth of stock." ***PAR03*** – "We don't have the infrastructure, the technology, the power generation, the skills in this country." ***PAR04*** – "and the infrastructure is to an extent decaying so, I think there's an element of having to say, do we want to invest in something separately ourselves that doesn't require external architecture?" ***PAR05*** – "So I think there is an issue accessing connectivity across the business in the grid, and another one would most likely be the physical infrastructure." ***PAR03*** – "I think that our systems and processes are very traditional, and we decided to stick with that in a competitive market right now. I think just being able to manage our cost outputs, actually right now the bigger picture with actually using technology to advantage hasn't necessarily been explored because again, it wouldn't be the burning platform" ***PAR08*** – "We are still we are still managing stock using excel now as much as Excel made might be a great tool for a number of things, it isn't really the most secure tool as far as managing inventory now from a cost of manufacturing perspective we manage about 30 or the million rands worth of stock."			

	PAR08 – "Top Management and their lack of understanding of all the benefits of the 4IR. As it stands, we are trailing behind our biggest competitors." ***PAR10*** – "…I think that they promote the use of technology, but generally only technology that they are accustomed to, that they've seen in action before. So, I don't think they are really." ***PAR02*** – "…Yes, it isn't part of the strategy. So, I can say yes, but, you know, it's still farfetched." ***PAR03*** – "…, it's not really built into our business strategy, vision, and portfolio. I think that the industry even though it is possibly very applicable to supply chain as well and, I guess all departments marketing and sales also could benefit as well." ***PAR04*** – "A current ongoing constraint within the company is the lack of change management."			
Objective 3: To understand the potential risks that beverage manufacturing organisations perceive to influence their decision to adopt 4IR-T towards driving competitive advantage.	***PAR01*** – "Obviously with loadshedding I think we'd be very unfortunate as a business because The difficulty with the supply chain in manufacturing is we don't have factories that are fully power redundant." ***PAR04*** – "But I think the broader picture of the company, we've got three of the plants that have been affected by the loadshedding." ***PAR05*** – "The other risk would be their reliance on technology in an economy where Eskom is not reliable. So, power supply is interrupted frequently, which means that without power you're not able to run those processes, rendering technologies effectively redundant and there's no manual contingency to those processes, so it's kind of just blocks the process."	• Power supply • Unions • Regulation • 3IR technology and support • System longevity • Loss of jobs • Disruptions	• Environmental • Environmental • Environmental • Technology • Organisational • Environmental	• Loadshedding • Labour regulations • Inadequate 3IR technology and support • System redundancy • Job Redundancy • Risk of supply chain disruptions

	PAR06 – "Yeah, another big influencer in our network is loadshedding." ***PAR02*** – "perhaps, pushback from the Union might be the one that comes to mind, because in some instances when you automate you do reduce people and the pushback there." ***PAR05*** – "For example, from an implementation of a solution that results in a structure change or job redundancy. So that would be the Labour Relations Act, that would govern how we approach that. One of the reasons for such a change is technology, and this would be viewed as a technological change, and that would govern the process of implementation, but I don't think it would be something that prohibits us from implementing" ***PAR11*** – "One thing that I'm conscious of is that if you want to build a second story in our technology, you need to make sure your foundations and the lower house is well in order." ***PAR12*** – "Which is like I said, you just can't see the guy running 100 meters and you only crawling and think that you can get there overnight. There are building blocks that have to be done that allow you organization to fully leverage the benefits of 4IR technologies." ***PAR05*** – "You know, so you run the risk of having a system that is no longer supported in the future. So, the longevity of the system." ***PAR05*** – "You can imagine a big business has responsibility to create jobs. So, if there was a massive implementation of 4IR technology, so we automated the whole warehouse, you've got about 300 jobs, probably on the line, so I think there's a big social responsibility that organizations have to create work and the implication of that on			

	jobs and livelihoods, I think is something that would be a risk." ***PAR02*** – "Because of the Ukraine Russia war, there were some challenges in getting some more material in terms of like flavours, flavours from overseas we get like from Monarch France for instance." ***PAR11*** – "Answer is yes, and it's all because of that. I think the world struggling to adopt to the spike in the bond across many resources after COVID and then second tier to that was the emerging of the war in Eastern Europe. ***PAR05*** – "The shipping delays and logistics of product coming in, so raw material delays resulting in the arriving short dated and the implication on expired stock." ***PAR02*** – "For instance we would have a Co2 constraint and there were some board increases that would affect your flat sheets for instance." ***PAR07*** – "But if we if we had 4IR technologies, this would have been visible to us, and we would have been able to bid a plan on our aluminium procurement up to where we are now where we stand today." ***PAR07*** – "When COVID hit nobody knew what on earth are we dealing with, we had no information had to have a look where previous countries had pandemics How did it change shopper and consumer behaviour and we had to learn from it." ***PAR11*** – "…that also caused supply disruptions there along with COVID and in the continuous Chinese COVID disruptions taking place with these euro covered policy, there's all that influence in the world." ***PAR04*** – "…we had some problems more locally, it's more of sort of municipality problem where we			

	have issues with water supply and one of the factories or like Isando, where the infrastructure is declining, we have relatively regular either breakages on the line or leaks or inabilities to supply.”			