BUSINESS MODELS AND INNOVATIVE TECHNOLOGIES FOR SMEs

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Business Models and Innovative Technologies for SMEs

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PREFACE

Small and medium-sized enterprises (SMEs) are the backbone of many developing countries, contributing to economic growth and job creation. However, SMEs in these countries face a myriad of challenges that hinder their success, including limited resources, poor infrastructure, and lack of access to financing and technology. In recent years, the convergence of data analytics and artificial intelligence has presented a new set of opportunities for SMEs to navigate these challenges and unlock their potential.

Studies have shown that technologies play a major role in alleviating most of the challenges SMEs face in most developing countries. Studies also indicated that SMEs have shown remarkable resilience and adaptability in navigating the rapidly changing the business landscape. In recent years, the proliferation of disruptive technologies such as, data analytics and artificial intelligence has presented both opportunities and challenges for SMEs in developing countries. While these technologies offer new ways of doing business, SMEs often struggle to navigate the complex landscape of business models and technology adoption.

This book, titled "**Business Models and Innovative Technologies for SMEs**" aims to provide a comprehensive overview of the challenges and opportunities presented by these disruptive technologies. The book draws on the latest research and real-world case studies to offer practical insights into how SMEs can successfully navigate the changing business landscape. Drawing from real-life case studies and expert insights, the book provides a detailed analysis of the key concepts and theories related to SME business models, data analytics, and artificial intelligence, as well as their practical applications in the context of SMEs in developing countries for promoting the adoption of data-driven strategies.

The book incorporates various SME Business Models, Data Analytics, and Artificial Intelligence in the context of developing countries. It draws its use cases and insights from diverse environment academics, researchers, policymakers, and business practitioners having a core interest in SME development and the intersection of business models, data analytics, and artificial intelligence, to name a few. To be more specific, the book aims to address issues that include the following:

- What are the potential benefits of innovative technologies for SMEs?
- What is the proposed strategy model that can be used to support mobile application development for Small and Medium Enterprises (SMEs) in response to disruptive innovation?
- What are the cybersecurity risks associated with the use of modern digital technologies during the processes of digital transformation and business model innovation in Small and Medium Enterprises (SMEs), and how can appropriate cybersecurity culture be developed to protect SMEs during and after these processes?
- How can innovating SMEs' business models unleash their full innovative potential beyond simply riding on the wave of digital technology?
- How does this study contribute to the field of business model innovation, particularly in the industries that are situated in the developing countries?

The book is written based on the joint efforts of the editor, authors, and reviewers. The book mainly features qualitative, quantitative, and analytic insight into diverse case studies on SME

business models, data analytics and artificial intelligence within the framework of the developing countries. The book is divided into seven chapters. This edited volume features the work of experts who bring both academic knowledge and real-world expertise to the table. Each author has made a unique contribution to this collection of writings based on their own studies and professional experiences.

The book is divided into seven chapters, each of which discusses the author's research methodologies and the context in which they were developed. The following provides a brief overview of each chapter.

Chapter 1: Business Model Innovation Mobile Application Development SMEs in Response to Disruptive Innovation

In this chapter, Dr. Francke explained Business model innovation for mobile application development for SMEs in response to disruptive innovation. This chapter proposes a multi-factorial strategy model to support mobile application development SMEs in response to disruptive innovation through business model innovation. The chapter explores the impact of artificial intelligence on various industries and suggests that SMEs in the mobile application sector should collaborate with each other to moderate their independent weaknesses. The research has developed the Disruptive Innovation State Response Model and the Disruptive Innovation Praxis Model, which can be used by development agencies, businesspersons, technologists, venture capitalists, etc. to determine the state of the business and make an appropriate response. The chapter highlights the value of the synergistic relationship of its principles.

Chapter 2: Cybersecurity Culture as a Critical Component of Digital Transformation and Business Model Innovation in SMEs

In this chapter, Prof. Zoran Mitrovic, Prof. Colin Thakur and Dr. Sudhika Palhad explain how Cybersecurity culture as a critical component of digital transformation and business model innovation in SMEs should be created in order to protect the inherent values of digital transformation. This chapter discusses how SMEs create jobs and generate tax revenue which is crucial to the economic growth of many developing countries. To keep up with the times, more and more small and medium-sized enterprises (SMEs) are adopting digital transformation (DT) and business model innovation (BMI) strategies. But if businesses do not take cybersecurity risks associated with new technology seriously, they might end up paying a high price for these inventive breakthroughs that could be disastrous. As a result, the cyber threats posed by the ICT used in DT and BMI procedures are investigated in this conceptual desktop research. It is proposed that SMEs be protected throughout and after the DT and BMI procedures by fostering a culture of adequate cybersecurity.

Chapter 3: Assessing SMEs' Business Model Innovation Readiness

In this chapter, Dr. Cecil Kgotiane carried out assessment of SME's business model innovation readiness before, during, and after the COVID-19 pandemic. This chapter titled "Assessing SMEs' business model innovation readiness", discusses two major difficulties faced by small and medium-sized enterprises (SMEs) before, during, and after the COVID-19 pandemic: their lack of preparedness to implement new business models and slow adoption of game-changing technologies like Intelligent Analytics (IA). The study focuses on a large number of SMEs in northern Gauteng, South Africa, using literature reviews, questionnaires, and on-site observations. While the study primarily focuses on Asian SMEs, the chapter concludes that the highlighted difficulties are not universal and apply to South African SMEs.

SMEs play a crucial role in society, and if they do not address these difficulties, innovation in service delivery will suffer.

The SME sector offers many possibilities for creative problem-solving, and reinventing business models is a good place to start. Simply riding the wave of digital technology may not be enough for SMEs to fully realize their potential, and they may benefit from innovating business models and adopting technologies like IA. SMEs also contribute to economic growth and need to constantly improve their strategies. Large corporations may also benefit from SMEs' novel business approaches. Improved service and product delivery have pushed society towards digitalization and disruptive technology, with IA being one such technology.

Chapter 4: Digital Transformation in SMEs: Developing Digital Business Model Innovations Based on Artificial Intelligence

In this chapter, Dr. Tlou Maggie Masenya examined the digital transformation in SMEs and developed digital business model innovations that are based on Artificial Intelligence. This chapter discusses how small and medium-sized enterprises (SMEs) are adopting modern technologies, including artificial intelligence (AI), to develop innovative business models and remain competitive in the era of digital transformation. The study reviewed literature on the impact of AI on business innovation and performance in SMEs and found that AI has the potential to revolutionize business processes, practices, and organizational performance. The article recommends that SME managers should find ways to support business innovation processes with AI and other advanced technologies to boost their dynamic capabilities, efficiency, and reduce operational risk. The major goal of every organizational strategy is to enhance the effectiveness and efficiency of operation, which could lead to organizational success. However, digital transformation presents challenges for SMEs, who need to maintain a high-performance work environment to remain competitive.

Chapter 5: Understanding the Affordances of Expert Systems in Improving the Competitiveness of South African Insurance SMEs

In this chapter, Dr. Stevens P. Mamorobela presented the role of expert systems in improving the competitiveness of South African insurance SMEs. Small and medium-sized businesses (SMEs) in South Africa's insurance market are seeking ways to improve their competitiveness. Expert systems, a newly developed technology, are expanding knowledge bases to help businesses offer insurance services more efficiently and with higher quality. However, the potential benefits of expert systems for SMEs in the insurance sector are not well understood in the literature on business model innovation. This chapter reviews the resource-based view model and proposes a model of the affordances of expert systems to help SMEs become more competitive. An explanatory mixed-method research strategy, including questionnaires and semi-structured interviews, was used to investigate the affordances of expert systems in SME insurance firms. The study found that treating the expert system as a valuable, rare, unique, low-cost, and low-risk resource can help SMEs enhance their competitiveness. This research has practical and theoretical implications for the field of business model innovation, particularly for SMEs in the insurance sector.

Chapter 6: Factors Affecting the Adoption of Data as a Service (DaaS) in Small, Medium, and Micro Enterprises (SMMEs)

In this chapter, Ms. Megan Morta and Prof. Osden Jokonya describe a research study that examined factors affecting the adoption of Data as a Service (DaaS) in Small, Medium, and Micro Enterprises (SMMEs). There has not been much research on the variables impacting the adoption of Data as a Service (DaaS) in SMMEs, despite the numerous advantages of

embracing cognitive analytics, business model innovation, and data science by SMMEs. Therefore, the purpose of this chapter is to investigate what influences SMMEs to embrace Data as a Service (DaaS). The research used a comprehensive literature review to investigate what influences Small, Medium, and Micro Enterprises (SMMEs) to use DaaS. This research used the Technology-Organization-Environment (TOE) Framework as a lens to investigate barriers to DaaS adoption in SMMEs. According to the findings, SMMEs cite technical factors including complexity, network capacity, and availability as the most significant barriers to using DaaS. Cost, support, and infrastructure demand were also cited as the most important organizational factors influencing DaaS adoption among SMMEs. Finally, the findings show that consumer demand was deemed the most important environmental element influencing DaaS adoption in SMMEs. Finally, the study's findings indicate that technical, organizational, and environmental factors all have a role in whether or not SMMEs embrace DaaS. The research adds to the existing body of knowledge on the variables that impact the adoption of DaaS in SMMEs, notwithstanding the constraints associated with easy sampling and non-empirical data. Empirical data may be used to address the issues in future investigations.

Chapter 7: Factors Affecting the Adoption of Emerging Technologies to Reduce Food Waste by SMEs in the Food Industry

Mr. Talent Muzondo and Prof. Osden Jokonya confirmed that food waste is a major issue in modern society, with one-third of the world's food supply being lost or squandered every year. This study focuses on small and medium-sized enterprises (SMEs) in the food sector and what influences their adoption of new technology to reduce food waste. The research uses the TOE framework to analyze the factors that affect SMEs' likelihood to use new technology to reduce food waste. The study finds that technical criteria such as complexity, security, usability, cost, and flexibility influence SMEs' decision to adopt new technologies to decrease food waste. The size of an organization and resistance to change are significant organizational factors that influence technology adoption in the food sector. Additionally, IT policy and law are significant environmental factors influencing technology adoption. The study provides insight into the barriers that prevent SMEs in the food sector from adopting new technology to reduce food waste and highlights the need for further research.

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CHAPTER 1

Business Model Innovation for Mobile Application Development for SMEs in Response to Disruptive Innovation

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Abstract: The central proposition of this chapter is that a multi-factorial strategy model can be evolved to support mobile application development for SMEs in response to disruptive innovation through business model innovation. Artificial Intelligence is often regarded as a significantly disruptive technology impacting many industries today. AI is penetrating many sectors and transforming the tasks performed by computers. This chapter rests on two principles: the discovery of business model innovation and the type of disruption of SMEs in the mobile application sector. The fieldwork for this chapter consists of four phases. The findings and interpretations presented in this chapter imply that the rise of disruptive innovation has sparked technological advancement, which will affect SMEs in South Africa. SMEs should transition to a progressive interdependent modality where they participate using their shared strengths, according to the concept of business model innovation. They could mitigate their weaknesses by working with other mobile app development SMEs. The value of the principles' synergistic relationship has finally been revealed in the chapter. The Disruptive Innovation State Response Model and the Disruptive Innovation Praxis Model were created by this research as responses to its main thesis. A development agency, businessperson, technologist, venture capitalist, *etc*. could use these models to determine the state that the business recognizes itself in and, employing its use, generate a response that is suitable according to the chapter's final proposition.

Keywords: Artificial Intelligence, Business Model, Business Model Innovation, Commercialization, Disruptive Innovation, Disruptive Technology, Mobile Computing, Multi-Factorial Strategy Model, Praxis Model, Small Business, Strategy, Technology Innovation.

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INTRODUCTION

Pirola *et al*. (2020) suggested that Small and Medium Enterprises (SMEs) need to be ready for the Fourth Industrial Revolution. The authors state that SMEs are mindful of it, but management seeks ideal strategies to approach this Fourth Industrial Revolution. Along with the rise of the Fourth Industrial Revolution, Summers (2019) suggests that there are inventive prospects for SMEs to succeed using artificial intelligence (AI), which is more prolific than ever. Chonsawat & Sopadang (2021) extend the views of Pirola *et al*. (2020) by suggesting that in the Fourth Industrial Revolution, SMEs require the technology and strategy to integrate their business processes throughout. However, knowledge about technological applications in business, production, and supply chains is lacking. Rane & Narvel (2021) argue that with the rise of disruptive innovation in the Fourth Industrial Revolution, businesses should redesign their business models for these innovations to enhance agility in their operations.

Christensen *et al*. (2015) regard disruptive innovations as those upon which a product or service has been created featuring a technology originally introduced in simple applications at a lesser market price. Roblek *et al*. (2021) state that disruptive innovations "are not breakthrough innovations or ambitious upgrades" of prevailing products or services causing a shift in business models. On the contrary, they simplify and reduce the price of these products and services. In so doing, these disruptive innovations can transform the relevant industry. The transformation of these industries has been made possible by developing new business platforms that acknowledge the inefficiency of traditional organisations' pipeline architectures, which create only one income stream and have a linear value chain. Instead, industries are moving toward a model where producers, consumers, and platforms generate new connections where customers and producers exchange, consume, and jointly create value (Agyei-Boapeah, Evans & Nisar, 2022).

Khan (2022) argues that a recent technological advancement is incorporating AI into mobile applications. Existing mobile applications lack the potential to include the artificial intelligence trend, which is rapidly gaining popularity. This kind of programming has a thriving market. One of the main motives for developing applications and adding artificial intelligence to them is for top-tier mobile application development companies to upgrade their skill sets.

It is apparent that business opportunities for SMEs have emerged from the mobile application (app) market. Okonkwo & Huisman (2019) regard mobile app development as one of the most prolific technological innovations internationally. This is attributable to the rise in popularity of mobile phones and their

assimilation into all aspects of society. A study conducted by Grand View Research (2020) supports the views of Okonkwo & Huisman (2019) by stating that largely because of the rise in popularity of mobile phones, coupled with the expansion of the internet and Fourth Industrial Revolution technologies, mobile apps are expected to grow in the coming years. The study states that the international mobile app market was valued at USD 154.05 billion in 2019 and is anticipated to expand at a compound annual growth rate of 11.5% from 2020 to 2027. These apps would include mobile gaming, music, health and fitness, social networking, e-commerce, *etc*.

RESEARCH PROBLEM

It appears that definite business opportunities for SMEs have arisen from the mobile app market. To ensure competitiveness and sustainability, mobile app development for SMEs needs important involvement from development agencies. The collaborative effects of disruptive innovation, business model innovation, and development agencies that support SMEs in mobile app development have received little attention in the literature. As a result, this research aims to investigate the advancement of a multi-factorial strategy model that will support the commercialisation of the mobile application development SME sector through business model innovation in response to disruptive innovation.

AIM

Based on an initial doctoral study relating to this field of research by the same author, this chapter proposes that SMEs in South Africa could exploit the potential of AI in this lucrative mobile app development market. The research aims to develop a multi-factorial strategy model to support mobile applications development for SMEs in response to disruptive innovation such as AI through business model innovation. In this chapter's perspective, a multi-factorial strategy model is considered a strategy emanating from various business inspirations describing the logic and key deliberations in establishing an SME's strategy. The management of the SME can use it to assess the company's situation and decide on the best method to innovate the business model in response to disruptive innovation.

OBJECTIVES

In striving to reach its main objective, which is to develop a multi-factorial strategy model to support mobile applications development for SMEs in response to disruptive innovation through business model innovation, this research rests on two principles:

CHAPTER 2

Cybersecurity Culture as a Critical Component of Digital Transformation and Business Model Innovation in SMEs

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Abstract: Small and medium enterprises (SMEs) are crucial to national and regional development and are significant drivers of job creation and income generation. To remain competitive, SMEs are increasingly adopting Digital Transformation (DT) and Business Model Innovation (BMI) to take advantage of modern digital technologies. However, these transformations can also pose serious cybersecurity risks if organisations do not prioritise cybersecurity threats associated with these modern technologies. Therefore, this conceptual desktop study examines the cybersecurity risks of information and communication technologies (ICT) utilised in DT and BMI processes and recommends fostering an appropriate cybersecurity culture to protect SMEs during and after these transformations.

Keywords: Business model innovation (BMI), Cybersecurity culture, Digital transformation (DT), Small and medium enterprises (SMEs).

INTRODUCTION

Small and medium enterprises (SMEs) are viewed as key drivers of both national and regional development in numerous countries and play a crucial role in generating employment opportunities and income (Demirguc-Kunt, 2007). Hence, they are seen as significant contributors to economic development (OECD, 2014). In South Africa, the country where the authors come from, SMEs contribute significantly to the economy, roughly 34% of South Africa's Gross Domestic Product (GDP) and play a vital role as drivers for reducing unemployment. Also, SMEs employ about 60% of the workforce in South Africa (IFC, 2021). However, South Africa is no exception as many developing economies are pursuing their growth by stabilising their SME sector (Masroor & Asim, 2019).

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Conversely, it is widely believed that SMEs are susceptible to a variety of social, economic, technological, cultural, environmental, and management-related factors that make them vulnerable. These challenges are viewed as competitive factors that contribute to the shorter lifespan and failure of SMEs (Prasanna *et al*., 2019). Thus, SMEs are advised to adopt information and communication technologies (ICT) as a way to address the competitive challenges they face (Nugroho *et al*., 2017). Embracing ICT leads to lower operational costs, better customer service, and enhanced responsiveness between SMEs, their customers, and suppliers. In addition, it enhances market intelligence and strengthens the relationship with trading partners. These benefits are the reason for the adoption of ICT by SMEs (Prasanna *et al*, 2019).

It is now well known that modern societies are driven by all-perversive ICT. The ongoing trend in digitalisation is continually transforming the business world and our society. There has been an ongoing discussion regarding how businesses of all sizes can incorporate new technologies into their innovation models to generate value. This trend of heavily relying on modern ICT to enhance business processes is referred to as Digital Transformation (DT) (Legner *et al*. 2017). Moreover, to keep up with technological advancements and the societal changes brought on by generations X, Y, and Z, businesses must address these challenges with innovative solutions and the use of various modern technologies. This is an essential practice for businesses to adopt if they aim to thrive in a global market that is continuously disrupted by rapid and unpredictable changes, where the modern customer is a collaborator in value creation (Ziółkowska, 2021).

However, DT frequently triggers significant transformations that take place at various levels, shaping how agents innovate by identifying, grasping, and modifying opportunities created by the new digital paradigm across all types of organisations (Appio *et al*., 2020). The potential disruptive impact of digital transformation on innovation and Business Model Innovation (BMI) is apparent (Bughin, 2017; Cozzolino *et al*., 2018). For instance, well-known digital innovations such as Uber, Airbnb, and Spotify challenge the existence of established companies and create significant systemic effects in markets and industries (Skog *et al*., 2018). Hence, to stay competitive, SMEs must innovate, changing themselves, amongst others, through innovating their business models.

However, many South African SMEs are yet to introduce appropriate digital transformation strategies and processes in their organisation. The research findings suggest that SMEs in South Africa have only adopted a limited number of digital transformation strategies, such as online selling, social media marketing, and web design. Other effective digital marketing techniques such as application development, video production, email marketing, search engine optimization and

marketing, branding, and content marketing are yet to be embraced by SMEs. According to Jeza and Lekhanya (2022), these marketing techniques have the potential to significantly expand the reach of SMEs and contribute to their growth.

To fully leverage the advantages of DT and BMI, it is crucial to prioritise the secure utilisation of modern ICT. Additionally, SMEs must effectively handle cyber risks as they transition to the digital realm and adopt new digital solutions (Huzaizi *et al*., 2021). Furthermore, SMEs will need to properly manage cyber risks as they connect to the digital world and progress towards new digital solutions (Huzaizi *et al*., 2021). The need for cybersecurity should not hinder anyone from engaging in business activities online (Ghernaouti & Wanner, 2018). This primarily requires capacitating humans as they are still the weakest link in cybersecurity (De Maggio *et al*., 2019). Extant literature suggests that a significant number of cyberattacks arise from people's non-compliant behaviour (Njoroge, 2020).

Since people can pose a threat and vulnerability to a company's informational resources, individuals need to take responsibility for promoting a secure and watchful culture at work (Ismail & Yusof, 2018). The evidence strongly indicates that developing and sustaining a culture of cybersecurity is crucial. This is because such a practice is increasingly acknowledged as an efficient way of addressing human factors in various types of organisations (ENISA, 2018). This highlights the need to promote a cybersecurity culture (Reegård *et al*., 2019; Leenen *et al*., 2020).

Despite an increase in cybersecurity awareness training programs, including those aimed at SMEs, and the implementation of security policies, procedures, and technical solutions, cybersecurity incidents still occur at a high frequency in businesses that provide such training (Georgiadou *et al*., 2020). Although reports indicate that many employees have claimed to understand their company's policies and procedures, knowing alone is not sufficient to eliminate harmful behaviour - SMEs must establish a cybersecurity culture (Huzaizi *et al*., 2021).

In the context of this study, change management is considered a crucial factor for bringing about the necessary changes required for the successful implementation of DT and BMI, as well as for establishing and sustaining a culture of cybersecurity (Nel & Drevin, 2019). Previous studies have not offered specific guidance on how to effect changes when the cybersecurity culture falls short of the required level for safeguarding information and systems (Uchendu *et al*., 2021). Hence, cybersecurity culture issues during DT and BMI are at the core matters of this conceptual study, which provides some guidelines for the application of cybersecurity culture in the DT and BMI transformations. Although

CHAPTER 3

Assessing SMEs' Business Model Innovation Readiness

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Abstract: This chapter assesses business model innovation readiness for South African SMEs. The assessment is based on the perspective of two challenges that SMEs went through pre-, during, and post-novel coronavirus disease of 2019 (COVID-19). The challenges are about the readiness to innovate the SMEs' business models and grip disruptive technologies such as Intelligent Analytics (IA). To investigate the challenges identified, the chapter expands on IA. In considering IA, four major areas of IA are synthesized. Importantly, IA is about smarter ways of doing business across different sectors. Society 5.0 and the fourth industrial revolution plus (4IR+) complement IA, as the chapter proposes. By and large, the novel COVID-19 accelerated the adoption of disruptive technologies. The chapter concludes by considering the role of the SMEs' owner-managers in embracing the technology.

Keywords: Business Model Innovation, Disruptive Technology, Growth, Industry 4.0, Intelligent Analytics, SMEs.

INTRODUCTION

The chapter looks into two challenges facing Small and Medium Enterprises (SMEs) pre-, during, and post-novel coronavirus disease of 2019 (COVID-19). Challenge 1 is about the SMEs' readiness or lack thereof, to innovate their business models. Challenge 2 concerns the SMEs' failure to embrace disruptive technology such as Intelligent Analytics (IA). The chapter looks into a systematic literature review, and surveys, and observes an infinite number of SMEs across northern Gauteng, South Africa. To a large extent, the systematic literature review focused on Asian SMEs. Though the chapter does not propose that the challenges facing SMEs are not unique to certain regions, there are instances wherein regions do matter. Therefore, the general feeling of the chapter is that the challenges identified can be better focused on South African SMEs.

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For instance, the challenge of the SMEs' failure to embrace disruptive technology, such as Society 5.0, cannot be about Asian SMEs. The world has been evolving so much that Society 5.0 has become a global phenomenon sparking the interest of both society and government. From a social point of view, SMEs come to fulfill a role that will ultimately benefit both society and the government. The SMEs' failure to respond to challenges 1 and 2 makes it almost impossible for society to benefit from innovative services.

Hence, there is a wealth of opportunities for innovation within the Small and Medium Enterprise (SME) industry. A good starting point, therefore, will almost invariably be innovating the SMEs' business models. Simply riding on the wave of digital technology does not seem to unleash the full innovative potential of SMEs. Innovating business models and riding on the wave of digital technology (Muller, 2019); specifically IA, seems to work in favor of SMEs.

SMEs contribute to economic development (Pucihar, Lenart, Borštnar, Vidmar, and Marolt, 2019). Hence their business model innovation is the key to economic growth. In the same vein, big businesses stand to benefit from the SMEs' value proposition through an innovative business model. The world has gravitated toward digitalization and disruptive technologies for improved service and product offerings. On this basis, IA has been fulfilling this role of disruptive technology for obvious reasons.

METHODS AND DISCUSSION

In line with Xiao and Watson (2019), the chapter employed a systematic literature review. In so doing, two scholarly online databases, namely Google Scholar and Scopus, were searched to respond to whether the SMEs were ready to innovate their business models and subsequently embrace disruptive technology. A nonfinite sample of SMEs across northern Gauteng, South Africa, was surveyed and observed on their business model innovation readiness during and after the novel coronavirus disease of 2019 (COVID-19). Some SMEs went out of business at the height of the novel COVID-19 or reinvented themselves. Speaking of reinvention, this indicates that SMEs can innovate their business models when backed in a tight corner.

In the same breath, some new SMEs started during the peak of the novel COVID-19. Some of these SMEs simply rode on the wave of popular business, such as Personal Protective Equipment (PPE) and courier/delivery services. Most of these SMEs' businesses involved exports since the demand for PPE was ever rising across the globe.

With a confidence level of 95% and an expected error level (alpha) of 5%, the formula for the nonfinite sample size (raw) used was, therefore,

$$\tilde{n} = \left(\frac{\sigma^2 n}{s^2}\right)^{-\hat{E}}$$

Where $\tilde{n}$ was an estimated (raw) sample size.

With the novel COVID-19 unprecedented, there were some inconsistencies regarding some of the indexed literature findings concerning the SMEs' readiness to innovate their business models, and embrace disruptive technology. Pre-COVID-19, some findings were that the SMEs were not ready to innovate their business models (Ain *et al*., 2019). By extension, the SMEs were not ready to take full advantage of disruptive technology for their smart operations.

Importantly, SMEs could hardly ever be ready to innovate their business models and embrace disruptive technology unless something drastic befell them. In this instance, the novel COVID-19 became an unexpected drastic measure that could not be ignored. Hence, post-COVID-19, there was a steady increase in the embrace of disruptive technology by SMEs toward innovating their business models.

OVERVIEW OF SMES AND THEIR IMPACT ON THE SOUTH AFRICAN ECONOMY

In line with Kgoetiane, Sibanda, and Mashau (2021), SMEs are the lifeblood of the economy. As such, SMEs contribute immensely toward job creation, economic development, and the country's Gross Domestic Product (GDP). Importantly, SMEs are the driving force behind innovation. Each country seems to have its own definition of SMEs. For instance, in the American context, an SME can consist of 1 to 500 employees. As far as South Africa is concerned, the Government Gazette (2003) and the South African National Small Business Act (1996:15-16) define an SME as follows:

A Small Enterprise is defined as an enterprise that consists of "less than 100 employees, formal and registered, has fixed business premises, and is owner-managed but has more complex management structure".

and

CHAPTER 4

Digital Transformation in SMEs: Developing Digital Business Model Innovations Based on Artificial Intelligence

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Abstract: The strategic goal of most organisations is to improve business operations for successful organisational performance. Digital transformation is a time of swift technological changes posing an ongoing challenge for Small and Medium Enterprises (SMEs) to establish high-performance work systems for organisational performance. Hence SMEs are exploring new technologies to stay competitive and develop innovative business models in the digital transformation era. Artificial Intelligence (AI) technologies may enable SMEs to enhance practices and improve their business model innovation strategies. This chapter examined the existing literature on the digital transformation of SMEs by implementing Artificial Intelligence. The goal was to emphasise how AI can significantly change business processes, practices, and overall organisational performance, ultimately supporting the development of digital business models in SMEs. The study's findings indicated that AI holds great potential for SMEs to enhance their business processes, practices, and overall performance, enabling them to better navigate their increasingly competitive environment. Therefore, it is recommended that managers of SMEs explore opportunities to incorporate AI and other advanced technologies into their business innovation processes. By doing so, SMEs can generate tangible value by strengthening their dynamic capabilities, improving efficiency, and mitigating operational risks.

Keywords: Artificial Intelligence, Business model innovation, Digital technologies, Digital transformation, Small and Medium-sized Enterprises.

INTRODUCTION

Digital transformation poses challenges for small and medium enterprises (SMEs) as digital transformation is drastically reshaping the business environment and creating new opportunities through integrating information, communication, and emerging connectivity technologies (Bharadwaj *et al*., 2013). The emerging disruptive technologies include artificial intelligence, the Internet of Things, and

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big data analytics, to name a few (Teffo, Motjolopane & Masenya, 2022). Globally, SMEs are increasingly adopting these innovative technologies to enhance business practices, improve business performance, deliver brand services, and develop new business innovation strategies. This technology-driven era is thus revolutionising SMEs globally and is an entrepreneurial process whereby SMEs are developing digital business models. Therefore, the digital transformation era is vital for SMEs to innovate and compete (Akpan, Soopramanien & Kwak, 2020). According to Peter, *et al*, (2019), the digital transformation's continuous interplay between business and technology has become incredibly clear as companies adapt to the new possibilities and difficulties by strategically digitising business operations. Digital transformation enhances efficiency throughout the value chain through technology, as stated by Stich and Hering (2015). Furthermore, as highlighted by Fettke, *et al*, (2014), each significant shift in industrial revolutions is accompanied by the introduction of novel technologies. Adapting and reshaping traditional business strategies with emerging new technologies is necessary in the digital transformation context. According to Peter *et al*. (2019), digital transformation requires SMEs to embrace and implement digital technologies such as business processes and practices. Thus, disruptive technologies such as big data analytics, Artificial Intelligence, and the Internet of Things radically shift how SMEs create and deliver customer value. In the digital transformation context, adapting and reshaping traditional business strategies with emerging new technologies is necessary. Integrating emerging technologies may lead to profound changes in value creation and business model innovation (Garzella, *et al*, 2021).

Wang, *et al*, (2022) describe business innovation as an organisation incorporating new procedures and services to influence the business positively. In addition, Vils *et al*. (2017) define business model innovation as the process by which companies create and acquire value through the organisation of internal processes and external relationships with customers and suppliers. Business model innovation may be linked to intelligent analytics in the digital transformation era. Sun and Stranieri (2021) described smart analytics as science and technology about collecting, organising and analysing big data to discover and visualise patterns through artificial intelligence systems.

As such, the impact of digital transformation and digitalisation demonstrates that digital technologies and intelligent analytics can no longer be regarded merely as a subordinate support function but as an integral part of the business and enterprises (El Sawy & Pereira, 2013).

PROBLEM STATEMENT

In a business environment facing digital transformation, SMEs face mounting pressure to maintain competitiveness, relevance and significance in society (Organization for Economic Co-operation and Development, 2017). Moreover, this underscores a need to adopt emerging digital technologies. However, SMEs face challenges in embracing emerging technologies from limited skills and funds and the lack of knowledge necessary to effectively utilise these advanced technologies without suitable business models for digital transformation. Hence Linde, *et al*, (2021) and Trischler and Li-Ying (2023) suggest that digital transformation often needs to catch up in numerous companies failing to realise the potential benefits of significant investments in emerging technologies. Furthermore, Travaly and Muvunyi (2020) indicate that a lack of relevant technical skills among young people is one of the significant threats and barriers to realising emerging technologies' full potential.

SMEs are more inclined to transform their existing business models, including their prime objectives and approaches to value creation. SMEs may benefit from the wealth of new technologies by basing their business models on artificial intelligent technologies, which creatively use existing services and protocols to develop more responsive and dynamic products. Artificial Intelligence can communicate directly with the user or other machines to offer a brand-new level of interaction in any environment. Therefore, in a digital transformation era, adopting emerging technologies such as Artificial Intelligence is a pressing need to support digital business models. To stay competitive within the dynamic and demanding digital business landscape, SMEs must focus on designing and developing digital business models (Schoemaker *et al*., 2018). This chapter thus examined the adoption of Artificial Intelligence for digital business model innovation in SMEs as a response to digital transformation.

OBJECTIVES

The research objectives which underpinned this chapter were to:

• Determine the impact of digital transformation on business processes and practices in SMEs.

• Determine the strategies for effective development of business model innovation within SMEs.

• Determine the adoption of Artificial Intelligence as a driver for business innovation models in SMEs.

CHAPTER 5

Understanding the Affordances of Expert Systems in Improving the Competitiveness of South African Insurance SMEs

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Abstract: Small and Medium Enterprises in the insurance industry of South Africa are increasingly seeking new ways to improve competitiveness. Recently, technologies like expert systems are evolving to provide new knowledge to enable organizations to deliver insurance services more effectively and efficiently. However, little information is presented in the studies of business model innovation about the affordances of expert systems in improving the competitiveness of the Small and Medium Enterprises in the insurance industry. Based on the literature review of the Resource-based view model, this chapter develops a model of the affordances of expert systems to guide Small and Medium Enterprises in the insurance industry in their effort to improve competitiveness. An explanatory mixed-method research approach was followed to collect relevant data using a questionnaire and semi-structured interviews to understand the affordances of expert systems in Small and Medium Enterprises in the insurance industry. The results of the study indicate that competitiveness can be improved if the Small and Medium Enterprises manage the expert system in five areas: (i) as a valuable resource; (ii) as a rare resource; (iii) as an inimitable resource; (iv) as a unique organizational resource; and (v) as a low-cost resource. Since the concept of business model innovation is centered on resources that generate value, this study has implications for theory and practice in the field of business model innovation, particularly in the Small and Medium Enterprises operating in the insurance industry.

Keywords: Business model innovation, Competitiveness, Competencies, Expert system, Insurance, Knowledge development, Resource-based view, Small and eedium enterprises, South africa, Valuable resources.

INTRODUCTION AND BACKGROUND

The Small to Medium Enterprises (SMEs) in South Africa are privately owned businesses that are generally characterized by a lack of access to capital and

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resources (Rajagopaul, Magwentshu & Kalidas, 2020). Notwithstanding their limitations, SMEs are very flexible and adaptable to changing demands and pressures. They are regarded as strategic partners for improving the economic status of the country due to their ability to innovate and create employment. In South Africa, the contribution made by SMEs in growing the economy is considerable, with over 50 present towards employment creation opportunities and 34 present towards the Gross Domestic Product (GDP) (Ayong & Naidoo, 2019). Indeed, South Africa is experiencing socio-economic challenges as a developing country, thus, the role of SMEs in growing the economy can never be overlooked. However, the competition for business is rife and SMEs have to compete with large organizations to strive for survival.

The rivalry among SME businesses of the same industries requires continued investment in innovative ways to improve competitiveness and business sustainability. Over the years, SME businesses have adopted technologies like artificial intelligence, big data, business intelligence, the Internet of Things, social media, cloud computing, and chatbots to improve their innovativeness and to compete in the industry (Arsawan *et al*, 2020). The nature of the SME business is flexible with dynamic capabilities to adopt the latest technologies to innovate their business models. Indeed, SMEs have flexible management structures that allow them to innovate. In today's business environments, digitization has become one of the main sources of innovation. The literature of business model innovation confirms that the transformation of business models accrues a lot of benefits from increased digitization (Motjolopane, Owolawi & Ruhode, 2023). Business model innovation comprises all processes and efforts for developing and enhancing business models (Motjolopane & Ruhode, 2021). Central to business model innovation is the ability to holistically describe the business model to identify and suggest areas that can benefit from the digitized innovation.

The benefits of digitization are also realized in the insurance industry where the core of the business is to manage volumes of data about the spread of risks, lasting investments, and financial stability (Olarewaju & Msomi, 2021). Since the COVID-19 pandemic struck the world, SMEs in the insurance industry have been inundated with many expectations from customers. Understandably, customers want a fast-paced insurance service that is accurate to respond to their demands. COVID-19 has triggered many uncertainties where people had to ask a lot of questions about the accuracy of insurance services and pricing thereof (Santoso, Prabowo, Warnars & Fajar, 2021). At the heart of the insurance business is the ability to determine accurate premiums which are largely influenced by the risk categorization of the objects under the insurance cover (Rawat *et al*., 2021). This tasks can be very complex and requires very unique and rare expertise.

The emergence of technologies like expert systems offers many opportunities to SMEs in the insurance industry to effectively and efficiently deliver insurance services (Santoso *et al*., 2021). Expert systems work at the highest level of expertise by simulating the decision making processes of humans using the knowledge that is well-defined. For example, during the process of assessing the risk profile of the customer, the expert system can facilitate communication processes between the insurance company and the customer by using the data about the claims made by the customer overtime and the knowledge of the underwriting process. This chapter presents a model for understanding the affordances of expert systems in improving the competitiveness of SMEs in the insurance industry. The structure of the chapter includes the introduction and background, research problem, purpose and objectives, research methodology, literature of the affordances of expert systems, the development of a model of the affordances of expert systems, discussions, limitations and future research direction, and conclusion.

RESEARCH PROBLEM

The ability of expert systems to solve complex problems in the insurance business processes implies that expert systems are valuable resources for organizations in the insurance industry with the potential to improve competitiveness. Evidently, expert systems contribute to the dimensions of innovation within the research of business model innovations. The inclusion of expert systems as innovations within the business models of the insurance organizations offers a lot of potential to enhance competitiveness. Indeed, business models enable the interlinks between innovative technologies and competitiveness (Baden-Fuller & Haefliger, 2013). In concurrence, Matt, Hess & Benlian, (2015) also add that business model innovation puts emphasis on value creation through innovation, a concept which is clearly interlinked with expert systems and their ability to solve complex problems using large volumes of data.

Although business model innovation research is rapidly evolving with conceptualizations and theorizations, it is still less well understood (Foss & Saebi, 2017). There are several dimensions of business model innovation research that warrant further investigation. For instance, it is not clear what could be the drivers, facilitators and hindrances of innovation within business model innovation research. Although studies of factors influencing business model innovation success are emerging (Motjolopane, & Ruhode, 2021), there is still a lack of literature that brings about an understanding of the inter-link between innovation factors and the components of the business model that are innovated. Furthermore, research into business model innovation and artificial intelligence reveals that artificial intelligence technologies are implemented practically in

CHAPTER 6

Factors Affecting the Adoption of Data as a Service (DaaS) in Small, Medium, and Micro Enterprises (SMMEs)

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Abstract: Although there are several benefits to the adoption of emerging technologies by Small, Medium, and Micro Enterprises (SMMEs), not many studies have been performed on inhibiting Data as a Service (DaaS) adoption factors in SMMEs. This study, therefore, explores Data as a Service (DaaS) adoption factors in Small, Medium, and Micro Enterprises (SMMEs). The study adopted a systematic literature review and TOE framework as a lens to explore the possible factors. The study results suggest that within the technological context, the complexity, network bandwidth, and availability were considered the most important factors that affected the adoption of DaaS in SMMEs. Furthermore, within the organizational context, cost, support, and infrastructure demand were considered the highest factors affecting DaaS adoption in SMMEs. Lastly, within the environmental context, the results indicate that customer demand was considered an environmental factor. In conclusion, the study results suggest that the adoption of DaaS in SMMEs is affected by several TOE factors. Despite limitations associated with convenient sampling and non-empirical data, the study contributes to the body of knowledge on DaaS adoption factors by SMMEs. Further studies may address the mentioned shortcomings by using empirical data.

Keywords: Big data, Data as a service (DaaS), Digital transformation, Everything as a service (XaaS), ICTs, SMMEs, TOE framework.

INTRODUCTION

Digital transformation has been around for nearly 30 years, becoming popular in the late 1990s and then gaining popularity again in the mid-2000s. Digital transformation is seen as an attempt to integrate emerging technologies into business processes for economic benefit. Developments in digital technologies have undoubtedly steered businesses in the direction of embracing the 4th

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industry technologies. These emerging technologies change businesses' operations, resulting in new digital transformation strategies (Verma & Bhattacharyya, 2017). Verma & Bhattacharyya, (2017) said "Digital technologies are rapidly changing, and enterprises adopting these emerging technologies can reduce costs, enhance efficiencies in their business processes, retain customers, and maintain a competitive advantage over their competitors". Although there are many benefits of emerging technologies for SMMEs in SA, within the era of 4IR, many organizations still need to be fully equipped to implement these emerging technologies. Businesses face several challenges when trying to adopt these emerging technologies (Verma & Bhattacharyya, 2017).

Even though emerging technologies have recently become more affordable for businesses to adopt, the degree of adoption amongst South African SMMEs has proved to be rather slow. The lack of resources for the SMMEs sector makes the adoption rate relatively low compared to large businesses in other emerging economies (Wessels & Jokonya, 2022; Zide & Jokonya, 2022). This results in the SMME sector not realizing the benefits of adopting emerging technologies in their business operations. The emergence of new business model innovations such as Everything-as-a-service (XaaS) has narrowed the challenges of SMMES, who do not have adequate resources for digital transformation in their organization. The upsurge of XaaS platforms has made the procurement of digital technology affordable. Yeboah-Boateng and Essandoh (2014), said "These platforms create efficiencies, do not require functional staff, reduce operations and hardware costs, and do not require in-house experts, and technology infrastructure".

Everything-as-a-service (XaaS) platforms are inexpensive because they are built off a pay-as-you-go service (Wessels & Jokonya, 2022; Zide & Jokonya, 2022). One such example of the Everything as a Service (XaaS) is the Data as a Service (DaaS) business model, where SMMES outsource the service to service providers instead of having it in-house. The study's main objective is to explore the factors affecting the adoption of DaaS in small, medium, and micro-enterprise (SMMES). The rest of the chapter is structured as follows: section 2 covers the literature review, Section 3 discusses the research methodology, section 4 presents the study results, and lastly, section 5 discusses the study results and provides a conclusion.

LITERATURE REVIEW

The advent of digital transformation had disrupted several enterprises in such a way that those failing to reinvent and innovate are being faced with extinction. Attaran & Woods (2019) said "Digital transformation is not specifically about Information Technology (IT); it is about redefining your entire business strategy and considering a change to the corporate culture you once knew". Previous

studies suggest that for enterprises to survive in the digital era, they need to think of emerging technologies as a strategic competency (Attaran & Woods, 2019; Wessels & Jokonya, 2022). Digital transformation has seen enterprises creating a new business model and using technology as the platform to do so. A good example is the Amazon shopping website which has disrupted the entire concept of shopping and more. Attaran & Woods, (2019) said "In order to survive, enterprises must adapt and take advantage of how the digital world has changed consumer behavior and expectations". Most competitors and customer channels of many enterprises have already gone digital with many customers spending time online searching, reading emails, browsing, and shopping online.

The two major contributors to digital transformation are technology evolution at an exponential rate and data that has become far more usable (Attaran & Woods, 2019; Modisane & Jokonya, 2021). The difference between enterprises' competitiveness and upkeeping is defined by how they are able to master emerging technologies. Digital Transformation is different from other eras in not only the importance and volumes of data but also real-time data from different sources. The era has seen enterprises being able to keep data about their supply chain, about their competitors, about their consumers, and about their markets (Verma & Bhattacharyya, 2017; Wessels & Jokonya, 2022). The ability of enterprises to use data for critical business decisions is the cornerstone of success in the data economy. It brings intelligent options into the light, enabling businesses to do new things right to create consumer value. On that note, digital transformation has provided an opportunity to level the playing field due to low-cost tools and strategies that enable small, medium, and micro enterprises to compete with bigger enterprises (Verma & Bhattacharyya, 2017; Attaran & Woods, 2019).

Modisane & Jokonya, (2021) said "Small, Medium, and Micro Enterprises (SMMEs) are enterprises owned by one or more individuals, and they play a pivotal role in creating employment opportunities in developing countries". SMMEs contribute 30% to the country's economic growth (Small Enterprise Development Agency, 2016). SMMEs in South Africa employ approximately 10.8 million South Africans, which account for 66% of economic-wide employment. A study conducted by Bowler, Dawood, & Page (2007) showed that 40% of small start-up businesses fail within their first year; the following challenges were highlighted in the study, namely, management skills, lack of funding, and investment in adequate technologies and the associated human resources to run the operation. Unfortunately, SMMEs are discouraged from hiring skilled technical specialists due to a lack of funding, which results in a scenario whereby these small businesses hire candidates with a bit of technical knowledge, but not enough expertise (Mohamed & Weber, 2019; Modisane &

CHAPTER 7

Factors Affecting the Adoption of Emerging Technologies to Reduce Food Waste by SMEs in the Food Industry

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Abstract: Consumers have now been able to purchase whatever food they wish in the 21st century. Not all the food that is purchased is consumed, resulting in food waste. About a third of the food produced is wasted in the world. Humans are the main culprits of food waste. The problem is worsening by each day, with different attempts failing to counter the problem. The study investigates factors affecting the adoption of emerging technologies to reduce food waste by SMEs in the food industry. The TOE framework was used for this purpose. The study adopted a systematic literature review to explore the factors affecting the adoption of emerging technologies to reduce food waste by SMEs in the food industry. The results from the study suggest that complexity, security, usability, cost, and flexibility are important technological factors that affect the adoption of emerging technologies. Furthermore, the results from the study suggest that organisation size and organisation resistance are important organisational factors affecting the adoption of emerging technologies to reduce food waste by SMEs in the food industry. Lastly, the results from the study suggest that IT policy and legislation are important environmental factors affecting this technology adoption. Further studies may consider adopting other research methods to explore factors affecting adopting emerging technologies in reducing food waste by SMEs in the food industry.

Keywords: Digital supply, Emerging technologies, Food waste, Food industry, TOE framework.

INTRODUCTION

Consumers have been able to purchase whatever food they wish in this 21st century. The amount of food bought in stores has increased significantly over the

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past five years (Oelofse & Nahman, 2013: p81). However, this does not mean that the food bought is used accordingly. About a third of food waste comes from the amount of food the consumers buy (Filimonau, Krivcova & Pettit, 2019: p 48). This clearly shows how food waste has become a big problem in the food industry. Food is wasted in all parts of the supply chain. It starts with the production process, where food is wasted due to insufficient equipment. If the harvesting techniques used are not up to standard, it can result in huge amounts of wastage of food (Oelofse & Nahman, 2013: p89). There is wastage of food in storage if the storage facilities are not good enough to preserve the food.

Food is being wasted in all stages of the supply chain. The fact is that food cannot be distributed equally because people have different purchasing powers This makes it difficult to reduce food waste; some buy more than they need and end up throwing it away as it is spoiled (Heikkilä and Juha, 2016: 447). The hunger continues in some areas where people have less money to buy food. It is a big challenge (Aschemann, 2018: 169). Some developing countries are facing food shortage and hunger due to food wastage in other parts of the world. Producers target the people with the money; they do not care about those who cannot afford their products. Food waste plays an important role in reducing hunger in other areas (Filimonau & De Coteau, 2019: 234). If the correct technology is used to reduce food waste, it could benefit those who are less fortunate.

The consumer with higher incomes and increased purchasing power are the biggest culprits of food waste (Loke and Leung, 2015: 1077). They will buy food that they do not need. Unnecessary wastage arises from this. It is mostly experienced in developed countries (Loke and Leung, 2015: 1082). However, in developing countries, it is not the only case; food is also wasted in the development phase due to a lack of proper equipment. The lack of technology in the food industry has increased the amount of food waste, and this trend continues to increase. There is still a gap between the technology available to reduce food waste in the industry and success. This brings the need for emerging technologies that can counter the problem of food waste (Martin-Rios, 2018: 198). The focus is more on food waste in the fast-food industry; the restaurants that provide food as a service. The amount of food wasted in this sector is massive due to the lack of digital technologies that can be used to reduce food waste (Mattila & Mesiranta., 2018: 9). Hence it is an area of interest even though there are other areas where food is wasted in the food industry. Hospitality is another area where food is wasted, but the focus is limited due to the lack of resources for the research required in this sphere. The study objectives were to explore factors affecting the adoption of emerging technologies to reduce food waste by SMEs in the food industry.

LITERATURE REVIEW

History and archaeology believe that people evolved from apes to humans. The theory of evolution for humans could be questioned by many; unfortunately, for technology, it does not seem to be the case. The shift from computers to emerging devices, the automation of computers connecting via wireless devices, and the use of these devices to produce information for humans to use in production and processing are termed industry 4.0 (Tjahjono, 2017: 1176). Approximately 13 billion was invested in digital supply chain technologies in 2017, and an estimated 19 billion is expected to be invested in 2019 (Liddell and Fish, 2018: 6). Industry 4.0 comes with technologies that can be incorporated into the digital supply chain. This technology is more effective in warehouse management, transport logistics, procurement, and order fulfilment functions. However, a collaboration between customers, suppliers, and organizations is critical for the full implementation of industry 4.0 technologies (Berdykulova, 2014). It is beneficial for organizations to implement emerging technologies in the food supply chain. Benefits include increased efficiency, enhanced service levels, improved customer experience, increased responsiveness, high-quality standards, productivity, meeting customer demand and, more importantly, reducing food waste in the SMEs food industry sector.

Food Waste in Food Industry

Food continues to be wasted in all parts of the supply chain. It is in the form of raw or cooked food that is wasted before, during, and after meal preparations in households, as well as in the manufacturing, distribution, retail, and delivery process of the supply chain (Oelofse & Nahman, 2013: 82). It includes food and inedible parts of food removed from the supply chain to be disposed or recovered for example crops planted but not harvested (Aschemann, 2018: 168). According to previous studies, it is estimated that one-third of the food produced is lost or wasted globally, which makes 1.3 billion tonnes per year (Heikkilä, 2016: 451). While another study showed that about one-third of the food is thrown away after consumption.

Food waste continues to be a problematic endeavour causing food insecurity and social inequality. The poor are disadvantaged, while the rich continue to waste food. From an environmental point of view, food waste contributes to the exploitation of natural resources (Richards & Hamilton, 2018: 169). Hunger continues to increase with food not being sufficient to feed the rest. The food and agriculture sector head the top list in damaging the environment. Greenhouse gas emissions released during food preparation also pollute the environment; a study showed that food waste also contributed to water wastage and depleted natural

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