



DURBAN UNIVERSITY OF TECHNOLOGY
INYUVESI YASETHEKWINI YEZOBUCHWEPHESHE

**THE INFLUENCE OF EMERGING TECHNOLOGIES ON SMALL AND MEDIUM
MANUFACTURING ENTERPRISES IN ETHEKWINI DISTRICT MUNICIPALITY
OF KWAZULU-NATAL**

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DECLARATION

I, the undersigned, Miss L.S Ntuli, hereby declare that this is my own, original work, and all sources used in this dissertation have been properly acknowledged and accurately reported. This dissertation has, furthermore, not been submitted and will not be presented at any other University for a similar or any other degree award, and no journal articles/conference papers have been published.

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ABSTRACT

Manufacturing Small and Medium Enterprises (SMEs) in South Africa (SA) contribute meaningfully to economic growth, poverty reduction, social stability and job creation. Research on the influence emerging technologies have on SME has been conducted all over the world; however, few studies focused on the manufacturing sector, with specific reference to the eThekweni District Municipality. Therefore, this research study aims to explain and clearly define the factors that influence manufacturing SMEs in the eThekweni District Municipality towards adoption of emerging technologies, in order to enhance productivity and business processes which, in turn, result in improved customer satisfaction.

Furthermore, this study examines how emerging technologies influence SMEs operating in the eThekweni District Municipality. The factors influencing adoption of emerging technologies among manufacturing SMEs in eThekweni remain unclear. This study aims to investigate the influence emerging technologies will have on the manufacturing SMEs operating in the eThekweni District Municipality. Data were collected from the sample of 300 manufacturing SME owners/managers in the eThekweni District Municipality, selected by means of non-probability stratified sampling, with respondents completing a questionnaire with the support of the researcher. The study used quantitative techniques. Results from the questionnaire survey reveal that most manufacturing SMEs in the eThekweni District Municipality who were respondents in the study are still at an infant stage with emerging technologies, due to financial constraints and lack of skills expertise associated with the cost of emerging technologies. However, these small enterprises do consider the use of emerging technologies such as computer devices, the cloud and emails to gain competitive advantage and improve production. Further research should aim to establish training programmes that will offer manufacturing SMEs emerging technologies skills and encourage the use of emerging technologies as the world is changing with technologies so they can be innovative.

Keywords: Emerging technologies; influence; manufacturing SMEs; skills; Innovation.

DEDICATION

I dedicate this study to my wonderful late mom, Bongiwe Nontobeko Ntuli and lovely late grandmother, Maswelase 'Mempuphu' Ngubane. Forever loving you.

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LIST OF ACCRONYMS AND ABBREVIATIONS

AGVs	Automated/automatic guided vehicles
AI	Artificial Intelligence
AM	Additive Manufacturing
AR	Augmented Reality
BI	Business Intelligence
CAD	Computer-Aided Design
CPS	Cyber-physical system
DTI	Department of Trade and Industry
GDP	Gross domestic product
GEDI	Global Entrepreneurship & Development Institute
GEM	Global Entrepreneurship Monitor
IoT	Internet of Things
IIoT	Industrial Internet of Things
Industry 4.0/4IR	Fourth industrial revolution
KZN	KwaZulu Natal
NPO	Non-Profit Organisation
NTIP	National Technologies Implementation
PtSA	Platform Production Technologies Association of SA
R&D	Research and development
RFID	Radio-frequency identification
ROI	Return on investment
SA	South Africa
SAPS	SA Police Service
SARS	South African Revenue Service
SME	Small and Medium Enterprise
SPSS	Statistical Package for Social Sciences
TC	Technical capabilities
TEL	Technology enhanced learning
UK	United Kingdom
USA	United States of America
VAT	Value added tax

CHAPTER 1

1.1 INTRODUCTION

Emerging technologies have been considered by Howard Dresner, a Gartner research group analyst, as hot themes in both industry and the academic sector since Business Intelligence (BI) was introduced in the early 2000s (Power 2007). Considered an indigenous tool, emerging technologies offer the business excellent benefits with data driven decision-making (Haddad, Ameen and Mukred 2018). According to Sivarajah *et al.* (2017), new models of decision-making have been created by emerging technologies, enabling internal and external extraction and storage of data; such as online news, web content from the Internet of Things (IoT) and other emerging technology advances (Joshi 2017).

In addition, rapid changes in innovation and technology show that technology learned previously has become obsolete. The IoT, big data, artificial intelligence (AI) and Cybersecurity have indeed changed the landscape of businesses globally; from manufacturing to service rendered industries that influence these emerging technologies to produce models of business with innovation as their limited competitive advantage (Shamsi *et al.* 2018). Examples include companies such as Blackberry, Kodak and Nokia, which were exiled by Uber, Google and Amazon as too limited. However, Small and Medium Enterprises (SMEs) in the manufacturing sector are challenged by factors that include financial constraints (Chiu *et al.* 2019), technological skills, cost of technology, political willingness and knowledge, which hinders them to innovate with emerging technologies. Moreover, (Baharuden, Isaac and Ameen 2019) concluded that for manufacturing SMEs to be robust in the era of emerging technologies, they must embrace these technologies to avoid being at risk of lagging the competition.

1.2 BACKGROUND OF THE STUDY

SMEs in the manufacturing sector have been playing a vital role in the economy over the last decades. Manufacturing SMEs have provided both employment and been economic drivers of SA's economy (Roxas, Ashill and Chadee 2017: 163). The manufacturing sector is a major contributor to the KwaZulu Natal (KZN) province

Gross domestic product (GDP) at 22 percent, with 20 percent unemployment in the province (KZN top Business portfolio 2020). In Africa, SMEs contribute 60 percent of total employment and 50 percent towards the continent's GDP (Mwanza and Benedict 2018). This emphasises that SMEs are employment providers across the continent (Myslimi and Kaçani 2016: 158), while in South Africa (SA), SMEs hire approximately 68 percent of their employees (Rabie, Cant and Wiid 2016: 1009).

Manufacturing SMEs all seek increased productivity, digitalisation, and innovation with the use of emerging technologies. SMEs lie in their competence for innovation and performance (Ouma-Mugabe, Chan and Marais 2021: 237). Emerging technologies transform and analyse data across machines, correcting inefficient processes to produce high-quality products (Min *et al.* 2019). Digitalisation in SA is expected to rise with between 25-57 percent in the next five years (Mkhabela 2020). Moreover, (Moss 2018) pointed out that developments through innovation have improved those organisations that utilised emerging technologies by 18 percent in 2017

Emerging technologies are an essential tool for SMEs in manufacturing industries as the world is changing to a digital world; this means SMEs need to embrace emerging technologies in their businesses to become more competitive (Bam and Adao 2019).

Failure by SMEs to do so may lead to their business being leapfrogged against their global peers (Bam and Adao 2019). However, emerging technologies will enable efficiency as well as innovation in manufacturing SMEs (Masood and Sonntag 2020: 1). In addition, developing SMEs can use emerging technologies such as automation to advance their businesses (Manda and Ben Dhaou 2019: 244). considering that not being innovative can also lead to failure, since the world of manufacturing is changing to emerging technologies ((Manda and Ben Dhaou 2019: 245).

According to Gastrow and Oppelt (2018: 10), emerging technologies will continue to develop massive scales of distortion in the production of goods and services while improving the value proportion of the traditional industry, with robots potentially

replacing humans as a result of automation. This means a modified environment with altered work conditions, resulting in the need for SMEs to equip and modify their strategies to adapt to these new technologies. These emerging technologies pose questions as to what the world of work will look like in the future, how long it will take to get there and what new technological developments will impact the labour market globally using emerging technologies? Moreover, the possibility of mass unemployment and poverty due to emerging technologies has to be considered (Wisskirchen *et al.* 2017: 9).

1.3 PROBLEM STATEMENT

The adoption of emerging technologies has been ongoing for a decade, (Kearney 2017), allowing research on the use of these technologies internationally, nonetheless, no research exists that investigates the influence of emerging technologies in the eThekweni District Municipality. Particularly, emerging technologies such as big data, the cloud, robotics and the IoT, as well as their influence on business growth.

Emerging technologies such as the IoT, AI and big data have gained increased prominence as innovation mechanisms to sustain business growth. Nevertheless, the readiness level for emerging technologies by SMEs is moderately low (Garzoni *et al.* 2020). The author adds that emerging technologies have been entirely utilised by large enterprises. This may be as a result of manufacturing SMEs in the eThekweni District Municipality facing the challenge of finances which, in turn, hinders their innovation and development (Rabie, Cant and Wiid 2016: 1009). The inability to access funding from banks for manufacturing SMEs limits the ability of these small enterprises to innovate to be sustainable and grow (Ngibe, Lekhanya and Garbharran 2019).

1.4 OBJECTIVES

- To investigate the influence emerging technologies will have in the future of SMEs at eThekweni District Municipality manufacturing industries.

- To assess the influence emerging technologies will have on SMEs' future growth in eThekweni District Municipality manufacturing industries.
- To determine how manufacturing SMEs in the eThekweni District Municipality can equip themselves to survive in future work using emerging technologies.
- To recommend intervention strategies that can be employed by manufacturing SMEs in the adoption of emerging technologies.

1.4.1 Study Aims

To investigate the influence of emerging technologies on manufacturing SMEs in the eThekweni District Municipality.

- Assessing how manufacturing SMEs will be innovative, sustainable and grow in the future with emerging technologies.
 - Identifying the potential influence emerging technologies might have on manufacturing SMEs.
 - Accessing how emerging technologies can be used as a tool to enhance innovation.

1.5 RESEARCH QUESTIONS

- What influence the emerging technologies will have in the future for the SMEs at the eThekweni District Municipality?
- What influence does the emerging technologies will have in the growth of SMEs of the eThekweni District Municipality in the manufacturing industry?
- How can SMEs equip their skills to survive in the future with emerging technologies in the manufacturing industry at the eThekweni municipality?
 - What are the recommendations that can be employed by SMEs?

1.6 MOTIVATION OF THE STUDY

From a worldwide view, it has been recognised that SMEs play a pivotal role in reducing unemployment, by creating job opportunities in developing and underdeveloped countries. In developed countries that make up In developed

countries that make up the EU, SMEs contributes 50-70 percent of the total effort towards reduction of unemployment (Müller *et al.* 2017: 303). In South Africa They make a major contribution in reducing unemployment, with approximately 68 percent of SME employees in SA hired to work for these small enterprises (Rabie, Cant and Wiid 2016). SMEs are faced with challenges to their survival for growth, if these challenges are not addressed growth will be limited, these challenges include financial obstacles hinders manufacturing SMEs to adapt to emerging technologies (Moyo 2019: 30).

The study is expected to contribute by answering imposed questions on how emerging technologies can be used to be a tool to enhance innovation and improve manufacturing SMEs' growth. To achieve this, the study will share the benefits of using emerging technologies to manufacturing SMEs, as the use of emerging technologies can lead to innovation in the eThekweni District Municipality. Furthermore, to communicate the researcher side of solution to problems faced by manufacturing SMEs in eThekweni District Municipality, to address challenges that are faced by manufacturing SMEs in eThekweni District Municipality.

1.7 SIGNIFICANCE OF THE STUDY

The significance of this study is to contribute to the body of knowledge concerning the development of an exploratory framework of the Technology Acceptance Model (TAM), linked to SMEs in the eThekweni District Municipality. The present study attempts to integrate concepts, practices, and existing SMEs frameworks, applied in the private and public sectors. Furthermore, the study will explore the most beneficial structure for implementation of emerging technologies in SMEs of the eThekweni District Municipality. The study will further contribute to SME awareness of the complete change emerging technologies bring to everyone and every aspect of the manufacturing industry. SMEs will have to be ready by educating their employees on the skills needed to survive these emerging technologies. Findings will enable SMEs to change their strategies and adapt to emerging technologies to grow.

Limited research exists on how emerging technologies will influence manufacturing SMEs at the eThekweni District municipality, therefore, this study sought to

investigate how emerging technologies can enable manufacturing SME innovativeness in the eThekweni District municipality. However, many studies have been conducted on emerging technologies, stating it will increase productivity, yet factors contributing to the innovation of emerging technologies are not clear. This study thus seeks to assist SMEs, their community, and employees to learn that emerging technologies are here to stay, entails many changes, therefore, all need to be ready to adapt to emerging technologies to survive future changes.

1.7 SCOPE AND LIMITATIONS OF THE STUDY

The study will be limited only to manufacturing SMEs operating at eThekweni District Municipality whose number of full-time employees ranges from 50-250, due to time and cost other SMEs that are not under the eThekweni District Municipality will be excluded.

1.8 STRUCTURE OF DISSERTATION / THESIS CHAPTERS

Chapter 1 offered an overview of the study, it addressed the problem statement, aim of the study, research objectives, and research questions, as well as the significance of the study.

Chapter 2 will investigate the impact of emerging technologies in manufacturing SMEs and how it will affect SME employees and the future of SMEs. The chapter continues with the implications that emerging technologies will have on SMEs' future growth, concluding by assessing SMEs and their employees' skills in respect of emerging technologies in the eThekweni District Municipality.

Chapter 3 will discuss the research methodology and research design. It includes discussion on the target population, sampling method and size, measuring instruments, and data collection, as well as data analysis, pilot testing, validity and Reliability, while also dealing with respondent anonymity and confidentiality.

Chapter 4 will present an analysis of results using the SPSS version 27.0 or Windows and a detailed discussion of the research findings. The findings of the literature review and the results will be interpreted in this chapter.

Chapter 5 will outline the conclusions drawn from the findings in chapter 4 and various recommendations will be made for further research.

1.9 CONCLUSION

The main aim of this research study was to investigate the influence of emerging technologies on manufacturing SMEs in the eThekweni District Municipality. The conclusions drawn from the study were informed by data acquired from a questionnaire administered to owners of manufacturing SMEs in the eThekweni District Municipality.

This chapter summarised the study objectives, as well as outlining the research design and research methodology used for the overall dissertation.

The study's literature review, relating to the influence of emerging technologies in manufacturing SMEs, follows in the next chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

In the preceding chapter, the context of the study was discussed, problem statements, objectives and questions pertaining to the research were provided, as well as the aim of the study. In this chapter, the researcher offers a review of literature based on the impact of emerging technologies on eThekweni-based SMEs and their employees in the manufacturing sector, how they can adopt these technologies to be innovative, sustainable and grow in the future.

2.2 OVERVIEW OF SMEs GLOBALLY

From a worldwide view, it has been recognised that SMEs play a pivotal role in reducing unemployment by creating job opportunities in developing countries. In developed countries that make up the EU, SMEs contribute 50-70 percent in total to the unemployment reduction (Müller *et al.* 2017: 303). In contrast, UK contributes 60 percent to employment (Tikakul and Thomson 2018: 114). While United Arab Emirates contributes 30 percent to the GDP in Asia (Saqib, Zarine and Udin 2018: 283). Furthermore, in Brazil, the SMEs contributes 27 percent to employment and 20 percent to the GDP (Godke Veiga and McCahery 2019: 634). This is supported by Roxas, Ashill and Chadee (2017: 163) contend that globally, SMEs are both economic drivers and employment stimulators, Heinicke (2018: 458) noted that SMEs reduce poverty globally and are the bedrock of economic activities through their potential of using less resources to be effective. In Nigeria, SMEs contribute 45 percent to GDP and 25 percent to employment (Ibrahim and Shariff 2016: 473). In Ethiopia, SMEs contribute 3.4 percent to GDP and 90 percent to employment, however, in Ghana, SMEs contribute 70 percent to GDP and 49 percent to employment (Ussif and Salifu 2020: 65). Furthermore, Cote d'Ivoire contributes 18% to the GDP and 20% in modern employment (Hongbo, Lucien, Raphael and Boris 2018: 1898). This emphasises that SMEs are employment providers across the continent (Myslimi and Kaçani 2016: 158).

2.2.1 Overview of manufacturing SMEs in South Africa

SMEs in SA are classified as organisations that have between 50-200 workers, with an annual turnover estimated from R10 to R40 million and a gross asset value of R3,75-15 million, exclusive of property assets (Futcher and Sunjka 2018: 24). SMEs are described as job creators, as they feed large companies to remain competitive and growing, they are perceived and seen as profit businesses (Leboea 2017: 11). This echoes findings by Thusi and Zondo (2016: 211) that small businesses are job creators and play a crucial role in the country's economy. They make a major contribution in reducing unemployment, with approximately 68 percent of SME employees in SA hired to work for these small enterprises (Rabie *et al.* 2016).

2.3 DEFINITION OF EMERGING TECHNOLOGIES

Emerging technology refers to currently developing technology, such as AM; a process of connecting 3D model data and traditional machines (Niaki and Nonino (2017: 56), to construct a three-dimensional object from a digital 3D model or from a model designed with the aid of a computer (CAD) (The Economist 2013). Even though these emerging technologies are fast becoming integrated with mainstream manufacturing (The Economist 2013) and dramatically changing the way SMEs in manufacturing industries operate (Kolla, Minufekr and Plapper 2019: 753), the likelihood exists they will transform the old manufacturing system, instead of complimenting existing production systems (Ayentimi and Burgess 2019: 644). According to Pagani (2013: 617), SMEs need to take the lead by adopting these changes, in order to be innovative. However, many SMEs in the manufacturing sector remain challenged in the application and identification of emerging technologies to enable adoption (Yoshino and Taghizadeh Hesary 2016: 5).

Wollschlaeger, Sauter and Jasperneite (2017: 18) describe emerging technologies as a fast and efficient way to integrate the IoT and Cyber physical systems into automation in industries. In addition, Rao and Prasad (2018: 147) state that emerging technologies is a name for contemporary trends of automation that involve cognitive computing, the IoT and cloud computing. These emerging technologies have a massive impact on SMEs in the manufacturing sector, as they are able to automate their end-to-end operations, remotely working in real-time, which enables transformation and growth that will contribute to economic development (Rao and

Prasad 2018: 153). However, “it is a combination of emerging and concurrent technology that appends to the value of the product life cycle” (Wang *et al.* 2016: 2).

Emerging technologies can influence manufacturing SMEs by increasing their production processing speed and flexibility (Li, Hou and Wu 2017: 627). Furthermore, (Sanders, Elangeswaran and Wulfsberg 2016: 19) define emerging technologies as “the emerging mechanical unrest applying the standards of digital actual frameworks, web and future-situated innovations and shrewd frameworks with upgraded human-machine collaboration ideal models”. Nonetheless, (Matt, Modrák and Zsifkovits 2020: 10) assert that emerging technologies portray “the progressing upset” of the global manufacturing industry.

Beier *et al.* (2020: 2), on the one hand, defined emerging technologies as the interaction of technology with business and social expectation. Vaidya, Ambad and Bhosle (2018: 233), on the other hand, defined emerging technologies as a term that describes different kinds of technology, such as cloud computing, big data, AM, and the IoT, as well as systems integration, simulation, autonomous robots, and cybersecurity, in addition to block chain, AR and AI. This definition of emerging technologies by (Vaidya, Ambad and Bhosle 2018) is relevant to the study, as manufacturing SMEs are influenced by emerging technology tools to be competitive, efficient, flexible and to achieve performance.

Nevertheless, manufacturing SMEs are hindered in acquiring some of the other technology tools, such as robotics, due to the lack of capital and capacity with infrastructure incurring high costs. Therefore, SMEs can start by using tools, for example, IoT, big data analysis and collaborative autonomous machines, which allow for interaction between human and machine (Mittal *et al.* 2018: 6). However, Henning (2019: 2) added that SA manufacturing SMEs are still at the infancy stage of adopting emerging technologies, with persisting obstacles of connectivity, accessibility, and lack of funds; more so when compared to other countries.

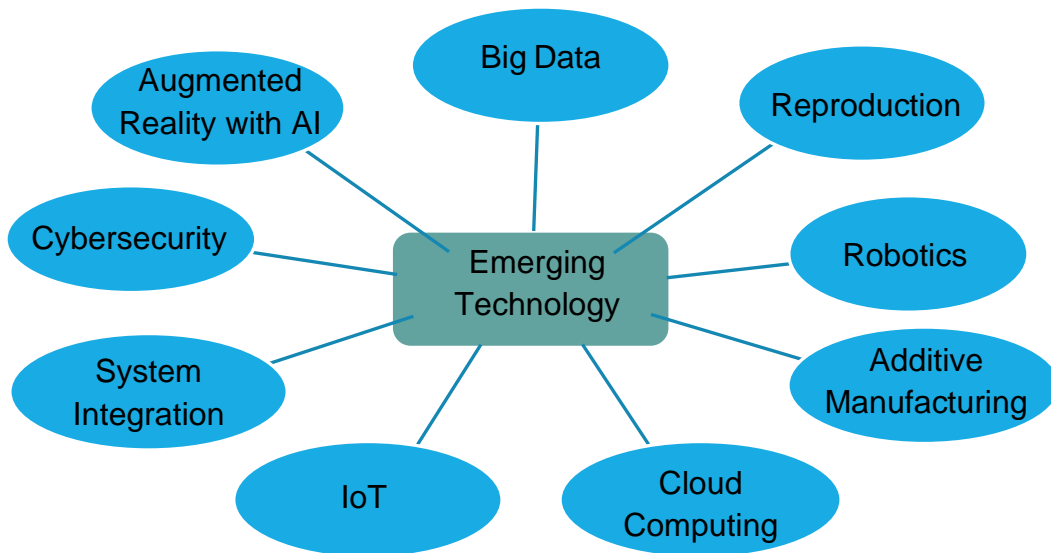


Figure 2.1: Definition of emerging technologies

Source: (Melanson 2018)

The definition of emerging technologies (Figure 2.1) is discussed as follows:

2.3.1 Internet of Things (IoT)

“The introduction of low-cost devices that have Internet connectivity capability brought about a rapid evolution of a new type of low-cost technology that offers endless application possibilities while presenting the ability to be controlled over the Internet. This new movement of interconnecting devices over the Internet is known as the Internet of Things (IoT)” (Prinsloo, Sinha and von Solms 2019: 5).

Jones and Graham (2018: 4) described the IoT as “connections between the extensions of the internet to different devices”, while Smart (2017: 1) defined the IoT as the tool that can exchange data with another device or external environment, by means of a network, without the intervention of human beings. This is supported by (Jones and Graham 2018: 4) in their observation that the IoT can be a tool to track inventory, as it can be integrated with other operating systems, such as radio-frequency identification (RFID) tags that enable inventory to be tracked from packaging to delivery at the retail store, in real-time.

Advancement of the IoT is another main impetus of emerging technologies. It incorporates interconnection, distinctive progress and electronic contraptions, as

well as stages through correspondence organisations, particularly by way of the Web. This emerging technology tool has the ability to connect different technological platforms and link production equipment anywhere and at any time (Prinsloo, Sinha and von Solms 2019: 2).

While the IoT is recognised to have ‘agitated’ the consumer-focused market, businesses are able to leverage the IoT for their manufacturing operations through the Industrial Internet of Things (IIoT). With this new ability for machine-to-machine communication, an entire new section within the IoT, which is the IIoT, is now open to industries (Wired Insider 2018),

In addition, the IIoT is driving extraordinary disruption in an industry that, in recent years, has encountered many obstacles due to shortages of talent, which offers hope for the future of the manufacturing industry. Transformation of traditional, linear manufacturing supply chains, into systems that allow ecosystem partners to be incorporated more easily is made possible with the IIoT. The resultant, dynamic, interconnected systems, or a digital supply network (DSN) are key enablers of transformation. In other words, technologies in the IIoT assist in changing the manner in which products are manufactured and delivered, resulting in more efficient factories, improved safety for human operators, and in certain instances, with cost savings valued at millions.

“The Industrial Internet of Things (IIoT) takes networked sensors and intelligent devices and puts those technologies to use directly on the manufacturing floor, collecting data to drive artificial intelligence and predictive analytics”, according to Wired Insider (2018). In an article by Wired Insider (2018) examining how connected things are changing manufacturing, Robert Schmid, Chief Technologist at Deloitte Digital, explained it this way: “...sensors are attached to physical assets....gather data, store it wirelessly and use analytics and machine learning to take some kind of action”.

The bottom line is that the IIoT saves time for manufacturing processes, enabling manufacturers to prevent downtime by alerting them about failure that can occur in production equipment before it takes place. The sensors referred to above, are

attached to equipment as detectors; hence reducing waste in the production process because SMEs will be aware of the waste before it occurs, thus resulting in efficiency.

In SA, SMEs contribute towards the GDP of the country and although the importance of using emerging technologies such as IoT is acknowledged, the challenge of limited technology skills and managing digital transformation appropriately, is reported to remain (Co-operation and development 2019). The IoT increases SME performance and sustainability of the business by using sensors built into their manufacturing system and other intelligent objects. However, the implication is then that SMEs invest in ICT to make use of the IoT (Zaidi and Faizal 2017: 41). This is a challenge, as SMEs lack funding to invest in ICT adoption of technologies to benefit from the IoT.

According to Ray (2018: 291), from a technology viewpoint, the strong establishment of emerging technologies is achieved by the quick improvement of the IoT, with improved devices becoming even smarter, ensuring effective communication. Therefore, investing in the IoT could improve performance.

2.3.2 Additive manufacturing (AM/3D)

Although a fairly new process, AM or 3D printing, as it is more commonly referred to, has been recognised as one of the emerging technology tools that manufacturing SMEs have become familiar with in the 21st century; both the concept and its application (Alabi, De Beer and Wichers 2019: 752). This is supported by (Godina *et al.* 2020: 1), who describe AM as a fundamental component of emerging technologies. While different authors have described this 'new' technology process in different ways, it is most aptly explained as "a cycle of making an actual item from a three-dimensional advanced model layer upon layer" by (Alabi, De Beer and Wichers 2019: 752).

According to Zollo *et al.* (2015: 82), AM can be defined as "a production tool that speaks to a new technological advancement", which is gaining interest from manufacturing industries, as it is suitable for use in various sectors. AM is a part of emerging technologies that connect with other mechanical ideas, which permits

investigating or exploring its latent capacity. Among the other mechanical ideas available to enterprises in the manufacturing industry is AR, can be used to enhance SME effectiveness when integrated with AM (Ceruti, Liverani and Bombardi 2017: 386).

Nonetheless, AM is one innovation among the numerous under the emerging technology advancement umbrella. While AM is growing quickly and can assist SMEs to achieve competitive advantage, this technology tool likewise represents a few challenges to overcome before such advantages can be accomplished (Stentoft *et al.* 2020: 1). Furthermore, AM can be suggested as a means to improve the making of models and models of parts or completed products faster than the traditional production process (Attaran 2017: 678).

SMEs in the manufacturing sector depend on utilisation of AM advancements to address these difficulties inside any traditional assembly method or item-based attempt, however, they are seen as the most problematic. Many corporations are accepting the adoption of AM strategies to enhance their performance and that of cost saving measures within their environments (Shah and Mattiuzza 2018: 2). As an AM measure, 3D printing has made it workable for makers to create complex items at a small amount of the assembly cost involved in traditional assembly strategies. Simultaneously, AM offers a significantly higher creation productivity than that offered by traditional assembly measures (Zhang, Demir and Gu 2019: 205).

Based on the advancement of innovation and the improved control, required due to Covid-19, it is evident that firms are at a defining moment, whereby AM becomes an alternative in the production process (Nandi *et al.* 2021: 12).

The expanding fame of AM comes from its capacity to deliver quickly, with simple coordination, extending the opportunity for new business sectors to develop.

According to Yosofi, Kerbrat and Mognol (2018: 118), AM can have an impact in terms of implementation in SMEs. One fundamental issue related to the appropriation of innovation produced by AM is the absence of information concerning the effects innovation selection will have on upgrading value chain

design and embracing new plans of action. The focus is thus on mandatory objectives related to manageability, to an ever-increasing extent.

The use and adoption of AM inside any elements of the product portfolio control allows for “exceptional degrees of adjustments” in the structure. For example, remodelling the enterprise corporation, specifically that of SMEs, may be seen “as a prime shape of transformation in the surroundings, with the adoption of additive production practices” (Shah and Mattiuzza 2018). For manufacturing SMEs to reach cost effective AM, they need to develop genuine measures of cybersecurity (Prinsloo, Sinha and von Solms 2019: 2).

Research conducted by Martinsuo and Luomaranta (2018: 946) on the challenges experienced by manufacturing SMEs in the adoption of 3D manufacturing, found that technological challenges are hindering manufacturing SMEs to adopt 3D. SMEs have additionally stated the price of AM as a limiting factor, with the requirements for materials difficult to meet in their environment. There are a few manufacturing SMEs that have started to use AM/3D, however, most are still using other traditional manufacturing processes. This is because they are challenged by the expense of 3D models and simulations of this tool are still underdeveloped. Therefore, Martinsuo and Luomaranta (2018: 946) concluded that the use of AM/3D is very low in manufacturing SMEs.

2.3.3 Cloud computing

Cloud computing can be defined as the arrangement of IT administrations through the Internet, including capacity, programming, and processing power (Alsafi and Fan 2020). It is a service controlled by a third party and can be used in public, private or hybrid form (Skafi, Yunis and Zekri 2020: 70). As a vital mainstay of the computerised change innovation biological system, cloud computing has become an integral piece of innovation, and a major contributor in formulating plans of action. It has, however, constrained organisations to adjust to innovation strategies (Ramachandra *et al.* 2017), offering associations more decisions on how to run frameworks, as well as save on expenses and representative liabilities to outsider suppliers in the process.

This tool of emerging technologies quickens innovation reception and has yielded new plans of action. Even more critically, cloud computing has established a basis from which new innovations, such as the IoT and AI, have been developed (Alsafi and Fan 2020: 1). The cloud computing worldview offers a level battleground to SMEs as they can receive advancements that were not previously available to them. (Al-Ruithe, Benkhelifa and Hameed 2018: 1037) indicated that most SMEs are doubtful where the adoption of cloud computing is concerned, due to the issue of privacy and security that lacks corporal structure.

The expression of this tool of emerging technologies can be adjusted to the activity of gaining access to data from all over and whenever. This can be done through “essential utilisation of a web stage with the assistance of a steady Internet association” (Neicu *et al.* 2020). Cloud computing may demonstrate significance for SMEs, since it permits customers to reach practically limitless figuring power, without significant interest in the framework.

Adoption of cloud computing in SA is very low (Ayong and Naidoo 2019: 43). This is because SA SMEs, particularly in the KZN eThekweni District Municipality, are challenged by a lack of skills expertise, knowledge and capital to invest in cloud computing (Murimbika 2018: 65), It was further found that in SA manufacturing SMEs, 70 percent have started using cloud computing, even though some remain challenged (Murimbika 2018: 64).

2.3.4 Cybersecurity systems

While also referred to as a cyber-physical system (CPS), a cybersecurity system is the framework through which human-made and natural frameworks, such as actual spaces and items, “are immovably coordinated and intertwined with the assistance of computational programming, digital spaces, and cooperation between them” (Vaidya, Ambad and Bhosle 2018: 236). It is also defined as a faster tool of emerging technologies in the production process, with the ability to improve performance; a CPS is thus characterised by accuracy (Fuchs 2018: 283).

This is supported by Onu and Mbohwa (2021: 3), who state that a CPS can improve productivity and flexibility with its accuracy. This is achieved by ensuring real-time

data of other elements of emerging technologies are used to improve transparency that results in the efficiency of manufacturing SMEs. However, since the world has become digital, the analysis of data has improved and increased, resulting in a more complex supply chain and the need for additional analysis. For these reasons, a CPS is deemed as the solution, although this data require management (Bibri 2018: 230).

According to Kabanda, Tanner and Kent (2018: 274), aspects of cybersecurity such as information security activities, require independent testing that needs to be done in the organisation. This can be performed by a third party, to check the robustness of security defences. However, SMEs face challenges in the employment of an internal or external third party, due to the cost. The authors find that SMEs do not have budget to spend on cybersecurity, since its return on investment (ROI) is not immediate (Kabanda, Tanner and Kent 2018: 274). A study conducted by Patterson (2017: 64) in the United States of America (USA), with regard to SME cybersecurity, found SMEs have financial constraints to adopt cybersecurity, even though they know they need it. Adu and Adjei (2018: 158) noted that in Ghana, SMEs do not use cybersecurity due to internet problems, instead, they save their data to their own devices, which makes them vulnerable to cybercrime.

In SA, the study conducted by Kabanda, Tanner and Kent (2018: 279) concurred that SMEs have limited use of cybersecurity as protection, due to technological factors. The authors determined that these small businesses make use of web server logging, as this is what they can afford as small businesses that is cost effective. Even though the SMEs are aware of cybersecurity, they are constrained by a lack of security experts, security simulation culture and financial resources to take advantage of cybersecurity. Kabanda, Tanner and Kent (2018: 280) noted the challenge of internal organisation as another impediment in SME cybersecurity implementation. This involves budget for cybersecurity, attitudes and management assistance. There is a need for institutional forces to address the issue of how SMEs can implement cybersecurity because the threats of cyberattacks continue within their organisations, particularly in the eThekweni District Municipality, in the KZN province.

2.3.5 Big Data

Big data are defined as datasets of sizes “beyond the capability of an ordinary database software program tool to seize, save and control information” (Duong, Nguyen and Nguyen 2020: 12). More on topic, Moyne and Iskandar (2017: 1) defined big data as the tool with the “ability to permit manufacturing SMEs to foresee, plan and manage explicit circumstances to improve their production”. According to Shah (2017: 4), SMEs need to adopt innovation and technology for growth. Therefore, big data can be the driver of that growth, by recognising, forecasting and assessing market data to stimulate the customer service process.

SA manufacturing SMEs are, nevertheless, still falling behind in using big data analysis. This is because they are challenged by poor connectivity and cybersecurity (Pillay, Ori and Merkofer 2017: 4). The author further noted the economic growth of the country as an obstacle in the adoption of big data in SA. The country is battling to attain growth, as a result, manufacturing SMEs have to lower their costs, which leads to insufficient spending in innovation (Pillay, Ori and Merkofer 2017: 4). Manufacturing SMEs in SA are additionally challenged in terms of using big data, faced with challenges of lacking infrastructure. According to Zicari *et al.* (2016: 18), it is not easy for SMEs to start a new system utilising big data, as well as managing it; this is because big data is costly and requires an IT expert to manage it. This means that SA manufacturing SMEs, particularly in the eThekweni District Municipality, cannot afford IT experts such as developers and data science engineers, due to financial constraints.

Makhele (2018: 151) noted that SMEs find it complicated to use emerging technologies such as big data. This tool needs capable skills, thus requiring experts with suitable talent to work with this emerging technology tool, in order to analyse data to be meaningful to the business. However, SMEs do not have financial muscle to adopt big data analytics (Makhele 2018: 161). Results from research by

Noonpakdee, Phothichai and Khunkornsiri (2018: 3) in Thailand, determined that manufacturing SMEs do not use big data, instead, they use paper forms for their data or capture data in Microsoft Excel format. In addition, some SMEs are challenged by insufficient technical skills; their staff have moderate computer skills.

The authors further found financial obstacles among the challenges, with SMEs lacking budget to invest in big data, while some SME managers said their companies are too small for big data and they have no idea about big data (Noonpakdee *et al.* 2018)

2.3.6 Robotics

Described as an integration of science, engineering and technology that produces machines, robotics involves design, construction, operation and use of machines (robots) to assist and help humans, by performing tasks traditionally done by humans. Furthermore, Moraes and Lepikson (2017: 732) indicated that the use of robots leads to smart automation and flexibility, allowing the control of complex production processes. Robotics can work safely with human beings; hence they could be integrated into manufacturing systems. In addition, Li, Hou and Wu (2017: 628) found robotics has the potential to learn from human beings. Nonetheless, robotics also useful in the creation of prototypes, which will have a positive effect on manufacturing SMEs. Prototypes assist in the production process, as new production line setup is not needed while the prototype is being produced (Bahrin *et al.* 2016: 142).

According to Ballestar *et al.* (2020: 124), manufacturing SMEs in Spain have started to use robotics. The sector has evolved positively since 2008, with 14 percent use of robotics in SMEs, and an increase to 22 percent in 2015. While UK manufacturing SMEs have started using robotics and other emerging technologies, some are still too constrained financially to implement emerging technologies (Masood and Sonntag 2020: 11). In SA, Calitz, Poisat and Cullen (2017: 7) found that for manufacturing SMEs, it may be difficult to use robotics, however, they can start by implementing Cobots, which allow for integration of humans with machines. An example is the collaborative industrial robot known as Sawyer, designed to assist with manufacturing tasks and work alongside humans (IEEE 2021). However, the authors also state that due to high cost and an inexperienced workforce, implementing Cobots can also be challenging (Calitz *et al.* 2017).

Research on how SA SMEs are using robotics is limited. Nevertheless, (Bayode, van der Poll and Ramphal 2019: 343) maintain that emerging technology in SA

SMEs is still at its nascent stage, as it is presently expensive. This means the use of robotics is very low in SA manufacturing SMEs due to financial impediments.

Robotics may eliminate human jobs, thereby requiring SMEs to change their business models (Bayode, van der Poll and Ramphal 2019: 345), However, according to Delloite (2019: 2), only two percent of SMEs were confident enough about changing their business models. Furthermore, Fitsilis, Tsoutsas and Gerogiannis (2018: 130) agree that emerging technologies require a high level of skills and complexity. Therefore, due to skills challenges, robotics is not used by manufacturing SMEs in the eThekweni District Municipality.

2.3.7 Augmented Reality (AR) with Artificial Intelligence (AI)

AR is a useful tool in production process maintenance, as it eases the instructions to carry out the task. For instance, some manufacturing SMEs use it to facilitate their training processes (EKREN, OBERER and ERKOLLAR 2017: 1). In addition, AR has the ability to add layers on computer created information, such as graphics, text, videos and feedback in real-time (Ulas 2019: 665). While AI is a portion of computer science that strives to create intelligent tools as Chapman (2021: 44) explains, it has become a vital part of the technology industry. Utilising AI encompasses programming computers for specific aspects, such as planning, knowledge, reasoning, and problem-solving as well as the capacity to alter and improve objects (Kumar 2019: 1).

Countries such as Brazil and Argentina are aware of AR and its benefits but are hindered by internal connectivity, lack of knowledge about AR, and lack of infrastructure (Ascúa 2021: 18). According to Ghobakhloo and Ching (2019: 9), few SMEs have invested in the tools of emerging technologies due to their limited operational costs. However, EKREN, OBERER and ERKOLLAR (2017: 1) stated that the ROI of AR can provide advantage to SMEs in the long-term.

A study conducted by Erol (2016: 16) found that Australia introduced a “Pilot factory”, which enables SMEs with no or limited infrastructure to access new technologies within a learning factory. Kleindienst and Ramsauer (2016) commented on the challenges within SMEs in adoption of emerging technologies

such as AR. The authors find that SMEs are constrained by a lack of awareness about the benefits of AR. While some fear they could lose data, others lack an IT specialist in their organisation, thus challenging them to adopt AR. In SA, the use of AR and AI is limited, as SMEs are challenged by connectivity, lack of resources and privacy protection (Mueller, Stegelmeyer and Mishra 2018: 178).

The above definition discussed emerging technologies and the different types of emerging technologies. In this regard, an examination of the state of emerging technologies in SA is necessary to assist the country's manufacturing SMEs to be aware that emerging technologies are not merely available for adoption but already in use.

2.4 STATE OF EMERGING TECHNOLOGIES IN SA MANUFACTURING SMEs

SA manufacturing SMEs make a major contribution to the economy of the country, supplying approximately 20 percent of the country's GDP and employing 1.7 million people. While the adoption of emerging technologies is inescapable for their competitiveness to survive (BUSINESSTECH 2019), SMEs in manufacturing continue to produce products to add value in the economy, other than service industries.

Furthermore, SMEs are influenced by many factors in their growth, sustainability, and innovation. Goldschmid (2016) noted, from the theory designed by O'Regan and Gallear in 2006, that innovation is an important element of the company; it is needed for a company to grow. In addition, a significant relationship has been shown to exist between innovation and organisational growth performance (Arshad and Arshad 2019: 622).

Manyika *et al.* (2017: 2) asserted that little productivity has been shown in SME growth during the past decades. This has resulted in SMEs remaining stagnant, with no business growth, due to their lack of "specialised ability, fundamental utilities, reasonable or improved innovation, low preparation and expertise advancement" (Onu and Mbohwa 2021: 1). These factors result in the failure of manufacturing

SMEs, thus hindering growth (Ngibe and Lekhanya 2019). The authors further observed that SA SMEs fail within a period of two years as a result of these difficulties.

Manufacturing SMEs are still recognised as lagging in the adoption of emerging technologies, particularly in SA (Dittrich 2016: 11). This can be attributed to the limitations placed on manufacturing SMEs by traditional manufacturing. Conventional manufacturing did not allow the combination of operation processes, for example, automation and lean manufacturing. Similarly, emerging technologies such as cloud computing are still below the average scale, owing to privacy challenges and security between users and providers (Albelaihi and Khan 2020: 107).

Emerging technology is still at an infant stage in SA, with the government yet to finalise the national plan on how to take full advantage of technological advances. As a result, President Ramaphosa stated that as a nation, capacities on science and technology need to be improved (Republic of South Africa 2018: 10), with the government having organised a commission to facilitate the emerging technologies national plan of action (Republic of South Africa 2018: 5). The Department of Trade and Industry (DTI) has taken the initiative by implementing a skills development programme, under the auspices of the Intsimbi future production technologies initiative (FPTI), which is a Non-Profit Organisation (NPO) under management of the National Technologies Implementation Platform (NTIP) since 2018, a subsidiary owned by the Production Technologies Association of SA (PtSA), which aims to enhance the capacity to adopt emerging technologies in SA SMEs (INTSIMBI 2019). This includes, amongst others, training in mechatronics, robotics and industrial maintenance, in the fully-fledged fourth Industrial Revolution (Industry 4.0 or 4IR) programme.

Thapelo (2020: 53) determined that, on the one hand, SA SMEs are aware of emerging technologies and willing to encourage innovation with the use of new technologies by their employees. This is evident with 86 percent of SMEs found to always be learning new technology to be innovative. On the other hand, (Maisiri and van Dyk 2021: 6) established that SA manufacturing SMEs are adopting emerging

technologies in a way that does not affect employee jobs, as workers are given the opportunity and time for innovation, so they can learn to adapt to emerging technologies

From the discussion above it can be concluded that SA SMEs are still falling behind with the adoption and implementation of emerging technologies. Those SMES that wish to implement it, face challenges. In the next section, the importance of emerging technologies is outlined.

2.5 IMPORTANCE OF EMERGING TECHNOLOGIES IN MANUFACTURING SME SECTOR

The manufacturing sector has been continually advancing with technology to improve their products (Esmaeilian, Behdad and Wang 2016: 80). Manufacturing has gone through vital industrial revolutions in the past centuries. The first of these was in the 18th century, with the use of steam power (Mahmoud *et al.* 2018: 1927). The next was in the 19th century, whereby electricity was unveiled, and production lines were developed and put to use. The third industrial revolution was when automation started, by using computers and ROM/RAM controls (Mahmoud *et al.* 2018: 1927). The third industrial revolution has made it possible for manufacturing processes with the use of technology.

The fourth industrial revolution (Industry 4.0 or 4IR) in this 21st century, embraces AI, the IoT, Robotics, and Cybersecurity, as well as Big Data. This shows that technology has been emerging for years in industries within the manufacturing sector. Industry 4.0 has resulted in the full automation of production processes in manufacturing, whereby human involvement is an exception due to fully automated production processes (Kang *et al.* 2016: 111).

Emerging technology is perceived as a market shaper by encouraging technology with new ways to merge resources and value creation (Kaartemo and Nyström 2021: 459). This is supported by Attaran and Gunasekaran (2019: 434), who assert that through technology such as blockchain, devices remain protected where ownership rights are concerned. According to O'Leary (2017: 149), emerging

technologies such as blockchain could improve the supply chain in manufacturing SMEs, by enabling transparent tracking of their streams, both upstream and downstream, to improve speed.

The challenge is that with emerging technologies, there is no formal legal framework with regard to its implementation (Attaran and Gunasekaran 2019: 428). However, it is of vital importance that manufacturing SMEs have technology capacity to be able to utilise these tools. Organisations with technology capacity can develop their product and produce products that suit existing market requirements, which enhance organisation performance (Salisu and Abu Bakar 2019: 81)

Authors such as Basu and Bhola (2016: 1181), Dutot and Bergeron (2016: 1186) and Jin and Jung (2016: 820) have confirmed technology as a tool for success in manufacturing SMEs. Therefore, SMEs in the manufacturing sector that innovate using technology, exhibit organisational performance and growth. Nevertheless, the use of emerging technologies is driven by many challenges and complexity for SMEs, particularly in the manufacturing sector (Skafi and Ahmad 2020: 79170).

In previous years, SMEs were constrained by challenges, including lack of capital and skills to implement tools of emerging technologies, such as ICT, yet these challenges persist, due to the huge investments and high cost of maintenance required. Nonetheless, cloud computing has an exceptional significance for SMEs as this internet service is paid per usage (Kumar, Samalia and Verma 2017: 27).

With cloud computing rented from a third party, companies are free of worry with regard to asset management as they do not own infrastructure (Haris and Khan 2018: 632). Subsequently, maintenance costs are also eliminated as there is no need for a complicated in-house ICT system (Kumar, Samalia and Verma 2017: 27).

The innovative technology tool called cloud computing can be used anytime, anywhere and can be accessed via smartphone or tablet, thus allowing SMEs to share information with customers. This means manufacturing SMEs will be able to access their information no matter where they are, provided they are connected to the network. This is supported by Razzaq and Mohammed (2020: 7512), who aver

that since cloud computing can be accessed everywhere, it allows quick responses to customer needs, by enabling collaboration between the company and customers with its unlimited storage and safety. Therefore, there is a need for manufacturing SMEs to adopt cloud computing to be innovative (Razzaq and Mohammed 2020: 7513).

However, as much as Cloud computing can benefit SMEs, in SA, cloud computing adoption remains a challenge. When referring to SMEs in SA, it must be understood that these businesses are characterised by poor communication infrastructure (Mwila and Ngoyi 2019: 1). One of the studies by Mudzamba (2019: 39) found that electricity remains the biggest challenge in developing countries, particularly SA. This electricity problem affects SMEs in a manner whereby even to connect to a wireless network becomes a challenge. Kreslins, Novik and Vasiljeva (2018: 6) noted the inefficiency of certain principles to follow when SME adopt cloud services, while Adane (2018: 197) argued that SMEs need to have a clear strategy to achieve cloud computing benefits. Therefore, these challenges continue to slow the rate of ICT adoption, particularly cloud computing in SA (Oyebiyi *et al.* 2017: 459). There is, however, a limited literature focus on the aforementioned problem within the context of SA.

Digitalisation has played a vital role in manufacturing SMEs; it enhances business by modifying traditional business processes to the digital environment (Schallmo and Daniel 2018: 6). On the one hand, manufacturing SMEs can easily penetrate new markets through digital technology (Stoldt *et al.* 2018: 179). On the other hand, digital data in Big data are important to manufacturing SMEs, as it enhances the forecasting of demand, production development, increases sales and improves planning in the supply chain (Soroka *et al.* 2017: 693).

Manufacturing SMEs use data from different streams, for example, email, social media, websites, and logs (Soroka *et al.* 2017: 693). This means that SMEs experienced difficulties in previous years to create data, since it was created by humans. While it previously took a long time to create at least 10 exabytes, this was created within two days through the use of big data. Due to the circumstances SMEs

operate under, for example, inefficient capacity and poor communication infrastructure, manufacturing SMEs are hindered in adopting big data.

Manufacturing SMEs in SA perceive emerging technologies as a disruptive phenomenon. Hence, when technology is put into place and integrated in all other technologies, it creates a real and virtual world that results in powerful new ways of operations, which lead to efficiency of the business. This brings about positive results in SME performance; thus, an increase in profit (Geissbauer, Vedso and Schrauf 2016). Manufacturing SMEs were additionally able to trace their production throughout the entire process, from start to finish, by means of emerging technologies (Geissbauer, Vedso and Schrauf 2016).

Emerging technology is likely to move manufacturing SMEs to skills concentrated manufacturing and labour production knowledge (Schulz 2018: 22). However, this will only be possible when manufacturing quickly puts emerging technologies into place, thereby becoming flexible enough to innovate (Antoniuk *et al.* 2017: 102).

From the discussion above, one can conclude that emerging technologies have an essential role in the performance and growth of manufacturing SMEs, as they contribute to the economy of the country, and their vital role cannot be ignored. The contribution of emerging technologies in SA is discussed below.

2.6 CONTRIBUTION OF EMERGING TECHNOLOGIES IN SA

In economics, it is widely acknowledged that technology plays a major role in the economy of the country, allowing for more efficient production, which is what the country needs to boost its economy. However, few studies have shown the contribution of emerging technologies in SA.

Globally, emerging technologies have created new markets for jobs, for instance, Uber and Bolt have made it easier for restaurants to deliver food and made transportation more convenient (Park 2017: 3). Locally, this demand for jobs contributes to the economy; the SA Government receives tax and VAT from this technology, and companies, in turn, improve the economy of the country. In addition,

the contribution of emerging technologies can indirectly benefit the economy, by manufacturing SMEs, government services and education.

Manufacturing SMEs are an essential part of SA that contribute to the GDP of the country (almost 45 percent), and in the creation of jobs; thus, reducing unemployment in the sector (Seseni and Mbohwa 2018a: 1404). According to (Statistics S.A 2018), SMEs are recognised as the fourth largest industry and benefactor in the SA economy, with a contribution of 14 percent by the manufacturing sector, through their use of individual skills to innovate and increase productivity (Leboea 2017: 59). This means that when productivity in manufacturing SMEs increases, the economy of SA will improve, as more products will be produced that could lead to higher profits.

ICT makes a major contribution to the SA economy, as it enables SMEs to be drivers of economic growth. Furthermore, ICT increases productivity in SMEs “by adding value at a business sectoral level, which results in productivity that enhances the economy” (Aghaei and Rezagholizadeh 2017: 261).

With ICT tools such as the IoT, performance in manufacturing SMEs can improve. This is because the IoT employs sensors that manufacturing SMEs attach to their products as part of theft prevention measures in their security system. According to (Sutjiatmo *et al.* 2019: 941), this allows manufacturing SMEs to detect when thieves are stealing stock. Prevention against stock theft using IOT sensors could improve profits because businesses sell what they have produced; thus, the more profits generated by SMEs the better the opportunity for the country’s economy to improve.

Another aspect where emerging technology has played a role, is in e-Government of SA. E-Government can be defined as the use of ICT in government to provide services to businesses, citizens and government (Chipeta 2018: 2). According to Ali, Hoque and Alam (2018: 1179), emerging technologies are contributing to up-to-date governance by providing e-Government. SMEs in the SA manufacturing sector can register their businesses online using the Government portal, which is the most important initial contribution to the economy. The higher the number of registered SMEs, the more data will be available for government to analyse and develop

appropriate support and assistance measures for this sector; the products SMEs are manufacturing and selling for profit improves the economy.

As explained by Chipeta (2018: 4), e-Government allows the community to access Government programmes in one website. This can either be programmes that improve the skills of the community or education programmes that will enhance the knowledge in the community, in order to contribute to the economy of a country. However, the challenge of high internet tariffs and poor communication infrastructure remains an obstacle to SMEs in making use of e-Government.

Nowadays, emerging technologies play a major role in education. These emerging technologies involve ICT, which promotes e-learning. An abbreviation of electronic learning, e-learning can be defined as the method of learning and training electronically, without physical interference by humans (Rodrigues *et al.* 2018: 8950). According to Huynh *et al.* (2020: 12), ICT contributes to the economy of SA because e-learning allows students and learners to study at a distance, using tools such as smartphones and the internet. With e-learning, educators can send material to potential students without any physical interconnection.

Applications such as Teams, zoom and social media, particularly WhatsApp connectivity, makes learning effective. This impacts the economy positively because when the people in the country are educated, more jobs can be created as they may open their own businesses and acquire skills to be competitive, which will contribute to the economy of SA.

Furthermore, studying at a distance with e-learning improves technological skills of students while learning (Nguyen, Nguyen and Huynh 2019: 9). One of the aims of this study is to contribute to society to be technological driven; this means the skills students acquire while using e-learning can assist them to be creative and innovative, thus increasing the opportunity to be employable. Moreover, students who study abroad with e-learning gain knowledge and skills of other students in other countries, applying these skills on their return to SA, thus improving the country's skills and its economy.

Emerging technology tools such as Cloud computing have contributed to the way teaching and learning takes place within the SA education system. For example, Blackboard is a tool used in the technology enhanced learning (TEL) environment, widely used in universities today. It is a reliable and simple, convenient and collaborative online solution, with a level of engagement that lets learners perceive they are in the same room, via collaboration and conference tools. In other words, Blackboard stores data in the cloud and makes it easier for students to access the information (Hassan *et al.* 2020: 118).

E-learning has thus cut the cost of infrastructure in schools, while the mass scale of teaching has prevailed (Nguyen, Nguyen and Huynh 2019: 8). This has a positive effect on the economy, as the government is unable to carry the cost of investing in classrooms to provide spaces for physical interactions between teachers and students/ learners.

2.7 CRITICAL CHALLENGES OF EMERGING TECHNOLOGIES IN SA MANUFACTURING SMEs

2.7.1 Political Willingness Challenges

The famous picture of the two siblings Albert and Albrecht's "praying hands" emphasises the fact that no man can live alone, notwithstanding how blessed and skilful he is, there is always a need for another hand to assist (Desy 2018). Similarly, with SMEs it is impossible to make it alone and a helping hand from the internal and external environments is needed to fulfil their dreams. Otherwise, it will not be possible to implement their ideas without some precise action being put into place (Akinyemi and Adejumo 2018: 1).

SMEs in SA are regarded as economic drivers of the country as they can sustain its economic development. In recognition of SMEs being significant to the economy of the country, Government had initiated a support system to sustain SME development (Thapelo 2020: 2). However, the high percentage failure rate for start-up SMEs indicates that the Government initiative has a negative impact on SMEs. Ayandibu and Houghton (2017: 134) determined that 80 percent of the country's start-up SMEs are not doing well.

A study conducted by Ntiamoah, Li and Kwamega (2016) stated that due to a lack of trust in the government and political favouritism, investors are less self-assured to finance South African SMEs. This results in SMEs battling to be funded and continuing to struggle with less resources to access the market. Typically, limited resources hinder SMEs to be innovative and improve in entrepreneurial activities. Yet, Peter *et al.* (2018: 1) argued that access to finance assists manufacturing SMEs to grow and develop their businesses.

Although government is less likely to support SMEs that are still in their infant stage, greater support is nonetheless given to already established SMEs (Ntiamoah, Li and Kwamega 2016: 563). Corruption and uncertainty associated with high investment risk made for innovation has made Government less likely to invest in SME innovation (Jugend *et al.* 2018: 56). While Cano-Kollmann, Hamilton III and Mudambi (2017: 1) stated that government support plays a role in sustaining manufacturing SMEs directly and indirectly for their innovation.

2.7.2 Government policy

Policy is a strategy that people, companies or political parties concur with and select to be used and followed. Businesses also have policies to be followed for organisational activities. The policies can be either internal or external to the business, but both influences how the business operates. Internal policies are those stated by the company owners which they have control over, but they are influenced by government policies, as they are drawn from them, while external policies involve government policies that can be defined as policies the business has no control over but are required to adopt (Akinyemi and Adejumo 2018: 3).

In every country, government policies have an influence on business growth, performance and the way business operates (Alabi, David and Aderinto 2019: 5). These policies can either influence the organisation in a direct or indirect way, for example, policies that influence business performance involves interest rates, taxes, and exchange rates (Alabi, David and Aderinto 2019: 5). According to Basham *et al.* (2020: 31), emerging technologies generate fundamental changes that require government to be in place and address technology transformation that affects government policy decision-making.

The Global Entrepreneurship Monitor (GEM (2020: 7) established that one of the challenges that impede manufacturing SMEs in SA to develop and grow is in fact government policies. Radebe (2019: 65) indicated that poor government policy is difficult to implement and poses challenges for SMEs. Government regulations imposed on SMEs make it difficult for them to survive in the long-term, while red tape and regulations also impede growth in SMEs (Nieuwenhuizen 2019: 669). In addition, (Herrington and Coduras 2019: 7) indicated that the SA Government pays little attention to supporting SMEs and as a result, received a 3,64 score out of nine for their support towards SME programmes in the 12 EFS for different countries in Africa. The author continued expands that Mozambique scored the lowest of 2.25 and the highest was Senegal with 5.31. This shows that South Africa not suitable to support the advance of a robust economic contribution from entrepreneurial activity (Herrington and Coduras 2019: 7)

Worku (2016: 134) indicated that government policies for manufacturing SMEs do not foster a culture of innovation and entrepreneurship. Moreover, government policies such as investments and financial policy are critical hinderances to SME development. Thus, the SA Government has inadequate policy stated for the development of manufacturing SMEs in the country, particularly the KZN eThekweni District municipality (Moyo 2019: 20).

Taxation compliance affects SME performance and growth, and is perceived as a large, burdensome, regulatory expense that is time-consuming, which influences the overall regulatory environment of small businesses (Junpath, Kharwa and Stainbank 2016: 100). Dealing with Tax issues in SA is problematic, with a very high Tax Paying Index, with the Post Tax Index somewhat less; an estimation of roughly 80,1 percent of the Tax Paying Index and 58 percent for the Post Tax Index (Doing Business 2017: 14).

In comparison, countries such as the UK, report a Tax Paying Index of 90,74 percent, whereas their Post Tax Index is 84,74 percent (Doing Business 2017: 15). This indicates that the SA Revenue Service (SARS) influences SME growth by

delaying payments due to them, which resulted in the establishment of a Tax Ombudsman in year 2017.

Government rules are stated to be restricting SME growth activities. As a result, there are many informal SMEs in SA that do not contribute to tax and are not registered, due to institutional regulations in developing countries (Matsongoni and Mutambara 2018: 3). It was found by Zivanai, Chari and Nyakurima (2016: 1546) that SMEs are fully aware of the rules and regulations they need to comply with, but take the risk in not complying as they know the chances of being caught are poor.

However, these acts of non-compliance generally disadvantage SMEs. They are hindered in obtaining funding from financial institutions, whether as customers or suppliers for businesses, or even government tenders because they have outdated and/or outstanding tax matters (Naicker and Rajaram 2018: 103). This, in turn, impedes manufacturing SMEs from being innovative through the use of emerging technologies.

2.7.2.1 Conventional environment

This refers to the normative pressures stated in the organisation that shape organisational outcome and behaviour. IT can either be regulations, constraints, norms, or rules, which have an influence on business operations (Swaminathan and Wade 2016). Conventional environments can either restrain or enable business activities and growth (Belas *et al.* 2019: 601).

However, regulations for SMEs are not clear, particularly with regard to start-up SMEs (Mallett, Wapshott and Vorley 2018: 12). In addition, the burden of compliance has an influence on the conventional environment of manufacturing SMEs. Nevertheless, Belas *et al.* (2019: 602) claimed that conventional environments are essential in a country, as they shape entrepreneurship.

Each country is governed by compliances SMEs need to follow, in SA, with specific reference to the KZN province, SMEs are required to adhere to rules and regulations imposed by Government on their sector. This is supported by (Čepel *et al.* 2018: 23), who found that legal conditions and regulations, in combination with strict rules,

influence the business environment in SA, thus impeding SME development. In other words, SMEs fail to grow due to stated rules and regulations that influence their growth and performance (Nieuwenhuizen 2019: 668), while the survival of SMEs relies on these.

Nonetheless, Boudreaux, Nikolaev and Klein (2019: 180) argued that conventional environments are “the facilitators of entrepreneurial activities”, with Li (2020: 2) expanding on this, in finding that “higher quality conventional environments lead to higher business growth”.

The primary concern in SMEs not growing, is found with conventional environment regulations and restrictions in legislation (Herrington and Kew 2017: 9). This is because SMEs in SA are hindered by burdensome laws and regulations, such as regulatory environment changes and keeping track of conflicting and overlapping environment regulations; which they spend much of their time dealing with, instead of focusing on activities that will enable their business to grow (Leboea 2017: 73).

Herrera and Kouamé (2017: 3) are of the opinion that business growth is impeded when the business environment is unconducive, as business growth is firmly correlated with the business environment. Regulatory environment also has an influence on SME growth. According to Rehman *et al.* (2019: 4), the rules stated for SMEs give rise to growth constraints, due to SMEs not having adequate resources to adhere to those aspects. By implication, it then becomes necessary for SMEs to move on to informal sectors, as they are trying to bypass complicated regulations (Gamidullaeva, Vasin and Wise 2020: 262). Bureaucracy is another challenge that SMEs have to deal with.

The Small Enterprise Development Agency (SEDA (2016: 9) reported that Government Bureaucracy influences the sustainability of SMEs with factors such as red tape, time delays for permits and licencing for business to trade, as well as long waiting times after registration. The long waiting period when obtaining permits and licencing indicates that Government bureaucracy is standing in the way of newly established SMEs in the eThekweni District Municipality (Moyo 2019: 20), while these factors also hinder business growth.

Key issues that government departments evaluated as inadequate to deal with, additionally include the vulnerability of SA SMEs to labour law regulations, which involve high labour costs, specifically its effect through high minimum wages. Nevertheless, Sanusi and Connell (2018: 201) found that SME performance can be improved by the quality of bureaucracy in terms of used resources.

2.7.3 Economic Factors

Waterhouse (2017: 1) claimed that SMEs act as nurturers of the socio-economic, because of their ability to innovate and be risk-takers. SMEs seek to learn new processes and procedures in doing business. However, SME innovation attracts foreign investments, even though they are challenged by corruption, particularly in SA, they tend to learn through failure to acquire the necessary skills to grow their business. SME involvement in the export business is specifically for growth; therefore, this establishes the generation of foreign currency required for a healthy economy.

The effect of local SME involvement in the export business is more opportunities to gain additional skills and knowledge from other countries (Mwale 2020: 77), which will result in informed decision-making, thus improving opportunities for innovation that will result in growth.

Nevertheless, SMEs encounter challenges in exports, such as the high cost of delivery, administration rules to be followed and dealing with foreign taxation (Isac and Badshah 2020: 11). This impacts growth achievement of SMEs, as they have little or inadequate resources to deal with such challenges. Another point of view, expressed by Dlova (2017: 22), asserts that “SMEs achieve social and political stability through job creation, hence, maintaining the social system”, which positively impacts these small enterprises because, with SMEs being locally owned, they “enhance social coercion and reduce social conflict”.

SMEs are generally characterised as being owned/managed by skilled labour, which has a positive influence on the socio-economic environment, since larger enterprises have fully automated their activities, resulting in job losses. On the

whole, SMEs employ those people who have been retrenched by larger businesses, thus acquiring their skills so they can grow their businesses. In addition, Masuku, Jili and Selepe (2016: 6) further substantiated that “SMEs alleviate poverty by hiring people who cannot access the capital to start their own business and who do not have social support”.

While SMEs are perceived as innovators and as a major contributor to the economic development, certain socio-economic factors that have a significant influence on their growth, namely cost of labour, economic conditions, red tape, and SARS issues, as well as Value Added Tax (VAT) (Naicker and Rajaram 2018).

Cost of labour and local economic conditions impact the growth of SMEs, which has an implication for dramatically reducing employment. The red tape SMEs must deal with includes SARS regulations, BEE, and labour issues, which impede SME growth. As VAT is charged on an invoice basis, it poses the challenge of cashflow to SMEs, who expect payment from their suppliers (Naicker and Rajaram 2018: 99). However, SMEs must pay VAT to their supplier before they can receive the amount from their customers, thus they must carry the cost burden of their customers for SARS.

SA is characterised by a high unemployment rate and violent crime that affect the business environment of SMEs (SOUTH AFRICA 2016: 1). The Global Entrepreneurship and Development Institute (GEDI (2017) conveyed that SA has an inadequate job market and poor education, which add up to a high unemployment rate. Furthermore, SA has an unfavourable environment within which to start a business, due to bureaucratic burdens created by the SA Government that, in turn, contribute to the unemployment rate (GEDI 2017).

Interest rates influence the ability of SMEs to innovate using emerging technologies. According to Shaukat, Zhu and Khan (2019: 2), interest rate growth leads to the depletion of business profit and a decline in investments. In September 2020, the SA interest rate was seven percent (Bracher 2020). The higher interest rate reduces opportunities for small businesses to invest, as the cost of capital rises, which hurts

their innovation because they do not have sufficient working capital to improve their business (Bushe 2019: 3).

Among other challenges faced by the SME manufacturing sector in SA is the import of products, for instance, countries such as Brazil do not eat chicken feet, while in SA, there are SMEs that produce this product. This product is imported to SA at the lowest price, while in SA they double that amount in the sale of chicken feet. This results in lower revenue, as customers are unwilling to buy from local manufacturers, hence limiting the ability to invest in emerging technologies due to inadequate funds from the organisation. This calls for the government to assist local manufacturing SMEs in terms of capacity to meet market demand.

2.7.4 Technological Factors

Manufacturing SMEs in SA are challenged by a lack of technological capabilities to adopt emerging technologies. This compels them to import the equipment for their operations at a higher price (Saha 2021: 303).

ICT is a technological tool to communicate and access information, which include technologies such as the internet, cell phones and wireless connectivity that allow people, companies, and organisations to interact in the digital world (França *et al.* 2020: 13). Furthermore, Parida, Oghazi and Cedergren (2016) added that ICT refers to the capacity of a company to use applications of emerging technologies, such as intranets, websites, emails, and e-commerce.

The world today is characterised by fundamental changes, especially in businesses worldwide, with a forecast that without technology performance is difficult to achieve, particularly in manufacturing SMEs that do not use it compared to those innovating with technology (Rahman, Yaacob and Radzi 2016: 510). This makes technology vitally important for SMEs to adopt to remain competitive and performing (Agwu *et al.* 2016: 3415).

In contrast, manufacturing SMEs are characterised as being labour-intensive, as well as having a high number of uneducated employees and a lack of technology knowledge. This means manufacturing SMEs lack ICT (Mustafa and Yaakub 2018:

59). Insufficient knowledge in advanced technology and uneducated personnel result in SMEs falling behind with ICT. Nonetheless, Mustafa and Yaakub (2018: 59) noted that there are factors that influence manufacturing SMEs to implement ICT, such as capabilities of the organisation and lack of skills that, in turn, influence the growth of their businesses.

Technical skills influence manufacturing SME operations. Shabbir, Shariff and Shahzad (2016: 69) defined technical skills as having a better understanding of how to operate machines, technical equipment, product and service development, as well as understanding the supply chain process. Technical skills are essential in a business to complete work effectively and efficiently. Mamabolo, Kerrin and Kele (2017: 8) are of the opinion that there are certain skills required by manufacturing SMEs for their performance, such technical skills involve techniques, processes, and procedures for their production line. Similarly, Panigrahi (2016: 239) reviewed that industry specific skills are also of requirement for SMEs to achieve performance; this includes production management, IT skills and production development. These skills are essential for manufacturing SMEs, hence management duties are made impossible without them, as they sustain performance.

Jane (2017) argued that technical skills reduce tensions generated by external expertise, hence leading to time and costs saving, while Leg-tero (2016) indicated that approximately 65 percent of manufacturing SMEs are losing money and time due to a lack of technical skills. As a result, it is difficult for manufacturing SMEs in the eThekweni District Municipality to adopt emerging technologies. However, the prosperity of manufacturing SMEs does not rely only on technical skills because a wide range of managerial skills such as analytical skills, can be used to attain sudden positive performance (Chatterjee and Das 2016: 235).

For better performance in SMEs, they will need to invest in technical and managerial skills coherently, so they can easily innovate using emerging technologies. In conclusion, technical skills are essential for operations in SMEs to achieve competitive advantage and thus improve innovation (Ikupolati *et al.* 2017: 2)

Technical capabilities (TC) play a huge role in the overall strategy of the company; therefore, SMEs can use TC to achieve effectiveness, efficiency, flexibility and better products and services, as well as serving new and existing markets (Salisu 2019: 46). This means SMEs will have to monitor TC regularly, since it has a strong hand in manufacturing sectors. Furthermore, TC assist in the success of the strategy and development process of technology in the company, therefore, as emerging technologies are introduced, SMEs who make use of TC will reach performance, as it is the component that steers manufacturing SMEs.

Anjum (2018: 860) observed that adopting emerging technologies in manufacturing SMEs will maximise their business performance because TC are what the company rest on. However, Salisu (2019: 46) expanded that TC is the master plan for efficiency in manufacturing SMEs. The implication is that SMEs with TC will gain competitive advantage as they are efficient.

In addition, TC go hand-in-hand with emerging technologies and performance, when the emerging technologies are implemented in a way that supports the strategy and organisational goal, it can have a positive impact on the performance of the organisation. The section below discusses how Manufacturing SMEs can use Porter's generic value chain and emerging technologies in their businesses to achieve performance and be innovative.

According to Pillay (2016) manufacturing SMEs are still falling behind in the use of advanced ICT. They do, however, make use of general ICT such as email, internet and cell phones. Nonetheless, SMEs remain challenged by lack of infrastructure, existing hardware and that the ROI is not immediate, making it difficult to adopt advanced ICT.

2.8 PORTER'S GENERIC VALUE CHAIN

Porter's value chain was developed by Michael Porter in 1985, with the aim to break down activities according to their indirect or direct relationship with their performance. (Lopez and Martin 2018: 123) presented that the value added can increase and there can be achievements in the value of the product "by focusing on the sequence in which the product proceeds". With these activities, it is foreseen

that they can result in competitive advantage to manufacturing SMEs as well as a rise in profitability. The activities are divided into two categories, namely: primary and support activities. A summary of activities is drawn in the table below.

Table 2.1: Porter’s generic value chain

<p>Primary Activities: are performed by an organization to contend on the lookout. There are five nonexclusive classifications delegated essential exercises.</p>	<p>Inbound logistics: This involves stockpiling, reception, stock control and distribution in the production process internally (Koc and Bozdogan 2017: 561)</p> <p>Production or operation: This involves the conversion of inputs to outputs (Stevenson 2017: 3).</p> <p>Outbound logistics: This involves all the activities of delivering the product to the customers from the production process (Lopez and Martin 2018: 122)</p> <p>Marketing and sales: These are the activities associated with selling the product (Lopez and Martin 2018: 122)</p> <p>After sale service: This involves checking up the product after it is sold to the customer, for example how it is performing, how to repair and maintain it to have a long-lasting time (Koc and Bozdogan 2017: 561)</p> <p>Procurement: This involves the purchasing or buying of raw materials to be used in the manufacturing process of the product (Schofield 2017: 41)</p>
<p>Supporting Activities are indirectly involved in the production process but do support the primary activities.</p>	<p>Human resource Management: This involves all the activities related to personnel, such as recruiting, hiring, interviewing and induction of personnel (Schofield 2017: 41)</p>

	<p>Company Infrastructure: These are activities that provides support to the business such as planning, information and controlling</p> <p>Source: (Chatha 2019: 13)</p>
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2.8.1 Emerging technologies and Porter’s value chain

Emerging technology does not mean manufacturing SMEs will instinctively achieve competitive advantage, innovation can, instead, have strategic inferences (Porter 1985). It is foreseen that the entire organisation can be influenced by emerging technologies such as, for example, interconnected, advanced technology development attained from the value chain (Bär, Herbert-Hansen and Khalid 2018: 747).

2.9 INFLUENCE ON PRIMARY ACTIVITIES

(Zhong *et al.* 2017: 618) reported that the use of emerging technologies, such as the IoT, can influence Porter's value chain, The IoT can track products using wireless communication standards and other radio frequencies, such as RFID, which operates through sensors. This tool of emerging technologies can track products from the beginning of the manufacturing processes until the end, inside the organisation. Thus, manufacturing SMEs are able to track their inventory with IoT, from receiving to stockpiling, until it is dispensed.

In using emerging technologies, manufacturing SMEs save costs related to labour, for example AR (Yusuf *et al.* 2020: 9), as it eases the preferable parts of stock, giving real-time information about the product inside the organisation, as well as easing stock in the stores, which in turn result in efficiency, flexibility and time saving (Rejeb, Sūle and Keogh 2018: 78).

Emerging technologies, such as the IoT, big data analysis and cloud computing, as well as AR, and AM, along with simulation and robotics, influence production activities. Production can be defined as the transformation of inputs to outputs (Stevenson 2017: 4). Moreover, the IoT can enhance productivity in manufacturing SMEs, since it uses RFID with sensors that can track the production process from the beginning phase to the final phase (Minoufekr, Driate and Plapper 2019: 587).

This is supported by (Moeuf *et al.* 2018: 1128), who found that the IoT and RFID can assist with performance analysis, through the feedback it provides. Manufacturing SMEs can track variations used in the production process with the IoT. The author further reviewed that utilisation of the IoT, likewise, improve the joint effort between SMEs in conveyed creation organisations.

The function of big data analytics is to provide data generated by the IoT feedback. Therefore, the data collected can improve the production process and the quality of production, which in turn result in the performance of manufacturing SMEs. This is because when SMEs produce quality products, they are likely to have loyal customers and once they have customers, profitability will be increased (da Silva, Kovaleski and Pagani 2019: 553). Nevertheless, according to Moeuf *et al.* (2018: 1126), big data analytics assist producers to discover basic boundaries that generally affect variety quality.

Competitiveness and performance can be achieved with the use of AM/3D printing. This type of emerging technologies tool uses CAD to produce the prototypes or models, therefore, the lead-time will be shorter. Flexibility and process will be improved as waste will be reduced and customisation of products will improve (Suzić, Suzić and Forza: 34).

Simulations can be used for scheduling and analysing contemporary production systems. Hence, manufacturing SMEs are able to detect any defects in production systems; from the beginning of the production process, to reduce the chances of failure (Simons, Abé and Naser 2017: 83). According to Moraes and Lepikson (2017: 732), simulations could create real-time data.

As an emerging technology tool that can influence outbound logistics, cloud computing stores data analysed in big data for the production process, which results in better decision-making and flexibility. Since cloud computing can be accessed by other companies, better cooperation is possible among companies in their outbound activities, such as sending and receiving of products, as well as distribution. This will have a positive influence on the supply chain, as a cost-efficient supply chain will be achieved (Preuveneers and Ilie-Zudor 2017: 5)

(Szozda 2017: 409) noted that the use of big data analysis will lead to manufacturing SMEs gaining a better understanding of customer requirements, sales design and trends, since its other function is to analyse data. Once the product has been put into sale, the IoT stage utilised for correspondence can consequently refresh and finish the process.

Bahrin *et al.* (2016: 138) articulated that emerging technologies have the potential to meet customer demand, due to customers requiring customisation with the use of smart machines such as robotics and AM. Faster customisation can thus be done, allowing for product changes. In addition, the use of data obtained from customers and better demand prediction by designers can be achieved (Santos *et al.* 2017: 974). Furthermore, featuring customers in the production process from the beginning phase can alter the quality, therefore, customers would be willing to pay higher prices for products when they are in need. This will, subsequently, result in higher profits for manufacturing enterprises (Kanama and Kido 2016: 689).

Emerging technology tools, such as the IoT that is able to store data, can be the best instrument for manufacturing SMEs to improve service, along with big data analysis. These tools enable customers to share their after-sales service, with SMEs then able to use that data to improve their production process, which will lead to flexibility (Zhong *et al.* 2017: 622). The following structure discusses how emerging technologies can improve service to enhance the manufacturing process

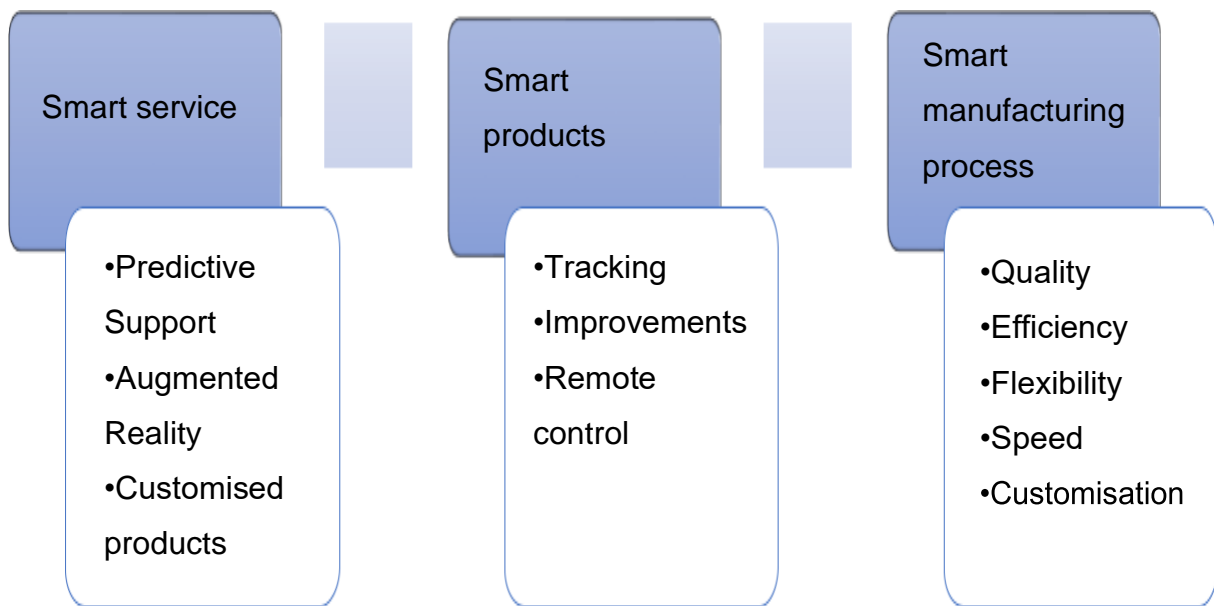


Figure 2.2: Overview of the benefits of smart industry

Source: (Mbuyane 2020: 28)

2.10 INFLUENCE ON SUPPORT ACTIVITIES

Argument visuality can be the tool to enhance manufacturing SMEs planning, as they are able to give visible account for stock on hand, which will help manufacturing SMEs to reduce out-of-stock occurrences, since they will track stock on hand using portable robots, known as automated/automatic guided vehicles (AGVs). The IoT plays a huge role in procurement by providing data collected through sensors to managers, in order to monitor how much inventory has been used and how much to order. This will assist manufacturing SMEs to be efficient, as they will buy stock on time and be able to track movement of inventory (Rejeb, Súle and Keogh 2018: 80). The utilisation of cloud computing innovation can likely encourage the making of new products and services through electronic interfaces and distributed computing stages that can improve client devotion, while also offering admittance to new business sectors to manufacturing SMEs.

Simulations can assist manufacturing SMEs to optimise resources and procurement cycles. In traditional cycles the simulated manual process expects about 49,914 seconds, while automated cycles need only 29,048 seconds and fully automated

cycles only 14,089 seconds. This means that when processes on procurement are automated, manufacturing SMEs will be efficient, which will result in profitability in the organisation (Bag *et al.* 2020: 10). Though, the benefits of having fully automated procurement can give SMEs the advantage. In SA, particularly the eThekweni District Municipality, manufacturing SMEs are lagging due to some constraints. This involves the high cost of implementing full automation, awareness of emerging technologies, as well as an unskilled workforce being employed (Henning 2019: 2). Therefore, this means that emerging technology adoption is limited in manufacturing SMEs of SA.

The HRM function is to manage humans, with virtual reality, HRM in manufacturing SMEs is able to obtain real-time experiences of customers, which they can use for planning and training staff visually so that the production process can be improved (Moeuf *et al.* 2020: 1384). In fact, with the cloud, hiring of staff can be easier, since it is possible to share data with other companies that could assist in obtaining the right talent needed in the organisation, through cloud-based information-sharing. The IoT can help an organisation to create models that pay attention to the entire value chain.

Pereira and Romero (2017: 1212) indicated that the IoT can influence the value chain, as a result they pointed out some other uses of the cloud, such as resource improvement, Information sharing, collaboration and distribution creation. This tool of emerging technologies can assist in greater communication, hence improvement of manufacturing SMEs by connecting and integrating different stakeholders, both internal and external, to interchange information, resulting in the effectiveness of the organisation. In addition, infrastructure and preservation costs can be controlled with an IoT plan, allowing for communication among organisations. Collaboration between manufacturing SMEs can, therefore, be achieved through the use of the cloud, as it allows for information and knowledge sharing, which will result in a positive partnership between SMEs, leading to higher performance and effectiveness (Yang *et al.* 2019: 12)

2.11 CULTURAL FACTORS

Cultural factors refer to norms, beliefs, perceptions and attitudes, as well as values, which influence organisational performance (Mashene 2020: 73). For SA manufacturing SMEs to be competitive, the adoption of emerging technologies is a requirement, yet there are some cultural factors, such as attitude and resistance to change, which challenge them to innovate.

Negative beliefs and values, especially in owners and managers of SMEs, can result in non-adoption of emerging technologies. For instance, when “owners do not perceive emerging technologies as a strategy to improve performance of the organisation, it can impact how they accomplish and deal with challenges they face to adopt emerging technologies” (Haseeb *et al.* 2019: 2). Moreover, SMEs are likely to develop positive attitudes towards emerging technologies they know will enhance their performance (Sugandini, Effendi and Istanto 2020: 46). This means manufacturing SMEs, despite the challenges they are facing in adopting emerging technologies, are contributing to the challenges by their attitudes.

Matikiti, Mpinganjira and Roberts-Lombard (2018: 4) noted the attitude toward management support plays a significant role in the adoption of emerging technologies. When the manager has a positive attitude towards new technology, it will influence the entire organisation, thus, when the attitude of management is negative, organisational members will be influenced and perceive the adoption of emerging technologies with the same negative attitudes, which result in resistance to change.

According to Sugandini, Effendi and Istanto (2020: 46), resistance to change can be differentiated in two ways, namely active and passive resistance. Active resistance is when an individual or a company decides not to adopt innovation, while passive resistance occurs in two ways, firstly, no attention is given to the innovation and secondly, there is no realisation with regard to innovation. However, interested individuals or companies are usually aware of innovations and do engage in innovation, while unaware individuals or companies do not (Sugandini, Effendi and Istanto 2020: 46)

In SA, manufacturing SMEs are aware of the innovation resulting from emerging technologies but manufacturing SME owners are resistant to change brought about by emerging technologies because they fear the complexity thereof and lack of confidence in its use (Haseeb *et al.* 2019: 2). Job insecurity in SME employees is another concern in the resistance to change.

Mabulele (2020: 41) indicated that employees fear not only the actual loss of employment but also the freedom in their routine. The author further expanded that the complexity of emerging technology may require taking on new staff with the appropriate skills and knowledge, however, with SMEs constrained by a lack of funding, they remain resistant to change in their attempts to avoid costs associated with the acquisition and training of new staff.

2.12 SOCIAL FACTORS

Education is the core of planning, marketing analysis and budgeting. Muchoka (2020: 8) described education as one element that can provide skills to individuals to be developed. The lack of business skills that accompany a lower level of education has a negative influence on SME performance, as SMEs use business skills obtained from inefficient education to run their businesses. This affects the lifespan of SMEs; they exist for less than five years in the industry due to the lack of adequate business skills and education (Ngibe and Lekhanya 2019: 1). This has a negative impact on manufacturing SMEs in the adoption of emerging technologies, as they need to focus on sustaining their business while, at the same time, find strategies to adopt emerging technologies.

Although most manufacturing SME entrepreneurs do have formal education, some do not, which raises concerns that Government still has the responsibility to address factors of entrepreneurship education, particularly in universities (Ndofirepi and Rambe 2018: 2). According to Masovic (2018: 4), an acceptable and appropriate level of education is essential for SMEs. The author compared developed countries with developing countries, such as Germany and England with Poland and Romania, with the findings stating that developed countries invest more in education since they have efficient resources, and they turn to easily adopt emerging technologies. However, with SA, the level of education in SMEs is very low.

Managerial competencies also influence SMEs to innovate with emerging technologies. Exploration in management competencies search for understanding whether managers in SMEs obtain and bring objectives to fulfilment. Numerous factors contribute to the growth of the business and its performance, which involve personal, marketing and financial skills. Agbenyegah and Mahohoma (2020: 66) agreed that these skills are crucial to SME performance and facilitate complex tasks in production and management.

Managerial competencies refer to the skills, abilities and behaviour required in a managerial job, in order to perform successfully in this position (Velu and Manxhari 2017: 59). Furthermore, Tripopsakul and Charupongsopon (2017: 255) described managerial competencies as the ability to manage operational activities of the business.

Levels of high competence in owner-managers are more likely to improve performance of SMES and their growth (Nakhata 2018: 20). However, Agbenyegah and Mahohoma (2020: 67) discussed that managerial competencies are not only essential for business experience but also for augmented business growth and performance. (Mahohoma 2018: 20) showed that most SME managers are either underqualified or have no formal qualifications, which hinders their competencies to grow their business and perform.

Ansong and Agyemang (2016: 239) claimed that managerial competence in SMEs enhances business reputation and competitiveness, hence making it easier for SMEs to access resources, allowing results in financial performance of the business. It is important that managers develop competencies that will make them efficient and able to perform effectively, as well as developing relationship between their competencies and performance, for their business to grow. In addition, Velu and Manxhari (2017: 61) argued that a master relationship exists between business performance and managerial competencies. This is due to the successfulness of any business or its failure depending on the competencies of managers and their effectiveness. Degefa (2017: 30) concurred that managerial competencies influence the performance of SMEs in the manufacturing industry.

A study conducted by Chetty and Sherefedin (2018: 152) stated that there is high rate of crime in SA, particularly in the eThekweni District municipality. SA is listed in the top five among countries with excessive crime. The crime that impacts SA manufacturing SMEs is differentiated into internal and external organisational crime, whereby internal crime is when employees commit fraud and steal from the company, while external crime is when people from outside the organisation commit crimes against the company.

The SA Police Service (SAPS) reported in 2018 that different kinds of crime in SA had dropped, while business crime was rising. This is among the challenges that lead to failure in SA SMEs, particularly in the eThekweni District Municipality. Manufacturing SMEs therefore invest much time in operational matters associated with crime, instead of focusing on how they can innovate to grow (Leboea 2017: 40).

From an external point of view, the author further noted that some manufacturing SMEs in SA fear that with the eThekweni District municipality faced with excessive crime, particularly theft perpetrated by criminals commonly known as “Parasites “or “Phara”. While SMEs can afford to implement portable tools of emerging technologies such as computers and Wi-Fi, due to their small size and scale, this becomes an added risk, as the parasites will steal those tools (Leboea 2017: 40).

Corruption has been found to be the main factor that demotivates entrepreneurs to start their business, hence reducing their economic outcome because they have to spend much money on corrupted activities, which lowers their business profit (Čepel *et al.* 2018: 23). In SA, manufacturing SMEs are challenged by corruption they sometimes commit themselves, due to a lack of support and regulatory laws. The case of OR Tambo in 2017 with a heist by bogus police is on point.

According to Bushe (2019: 17), one can find different crimes such as theft, armed robbery, and burglary in SA. This creates unfavourable conditions for doing business, resulting in SMEs having to invest more in security matters, as opposed to innovation, hence limiting opportunities to adopt emerging technologies.

SA SMEs have strong capabilities when it comes to innovation, yet they remain challenged by human capital for the near future of production, attributable to the lack of skills relevant in emerging technologies, such as science and engineering skills. In fact, this challenges their preparedness in dealing with fundamental changes to emerging technologies, their continued refusal to acknowledge the changes, as well as to provide fixed and steady policies, along with straight transformation (Levin 2018: 15). Therefore, the following section discusses the innovation challenges experienced by manufacturing SMEs in the eThekweni District Municipality.

2.13 INNOVATION CHALLENGES

By definition, innovation is the process of developing an existing product and processes, through the adoption of new technologies or processes (Egbetokun *et al.* 2016: 162). However, innovativeness is the circumstance the organisation keeps track of to ensure constant performance improvement (Saqib, Zarine and Udin 2018: 278). Nonetheless, SMEs are challenged to innovate by unforeseen changes in the market, limited access to resources, current market inadequacies and new technology (Saqib, Zarine and Udin 2018: 278). Abisuga Oyekunle and Sirayi (2018: 240) additionally determined that innovation is hindered by SMEs “failing to manage their full capacity of benefits”.

Muriithi (2017: 36) maintained that while SA SMEs have access to more advanced information and better conditions for their markets, their lack of resources, skills, knowledge and finance remain obstacles to them being innovative. SMEs, regardless of their size, need to adopt emerging technologies in order to be innovative (Ribeiro-Soriano, McDowell and Kraus 2020: 654). This will enable them to be competitive and thus, improve performance.

A study conducted by Anjum (2018: 857) further expanded on SMEs that adopt innovation as more likely to improve their performance, create jobs and contribute to the economic growth of the country. In addition, Tidd and Bessant (2020: 4) noted that growth and business performance are achieved by those SMEs that participate continuously in innovation. This is because an organisation with the capacity for innovation gains competitive advantage, which contributes to business growth and performance.

Uvarova and Vitola (2019: 157) concurred with the need for manufacturing SMEs to adopt innovation, which can be achieved through collaboration of SMEs. Innovation has a positive influence on business performance, improving productivity, market share and profitability of the organisation. SMEs are, nonetheless, faced with several challenges that act as barriers for them to innovate and achieve business growth. These involve lack of finance, knowledge and skills as well as performance Innovation related challenges (Andalib and Halim 2019: 1). Yet, innovation determines business success (Mustafa and Yaakub 2018: 57).

The drastic changes that come with emerging technologies require manufacturing SMEs to implement change and adapt to emerging technologies. However, SMEs remain challenged with regard to the strategies they need to formulate and implement to adopt emerging technologies. Challenges include poorly skilled labour and limited use of technology (Seseni and Mbohwa 2018b: 1687) In the opinion of Freel and Robson (2017: 579), SMEs that acquire growth are those that invest in innovation. Manufacturing organisations, particularly SMEs, confront different difficulties and should continually innovate to stay competitive. One approach to improve the rate of innovation and adoption is by “actualising new advances into organization measures” (Yu and Schweisfurth 2020: 76).

Petrillo *et al.* (2018: 1) postulated that emerging technologies will force many companies to change the manner in which their operations are run by investing in new machines to benefit from using emerging technologies and become innovative. Conversely, value will be created with the use of emerging technologies and innovative ideas by changing existing models to new models (Müller, Kiel and Voigt 2018: 5). In conclusion, SMEs need to employ emerging technologies to be innovative, as this could help them to move from centralised to decentralised production through the adoption of smart factories that allow machines to communicate by themselves and take autonomous decisions (Santos *et al.* 2018: 111).

SMEs are challenged where performance and being innovative with emerging technologies are concerned, due to their lack of skills in technology, lack of

sustainable practices and training in new and emerging technologies (Kumar 2020: 123). Nonetheless, Kamble, Gunasekaran and Dhone (2020: 1319) reviewed that emerging technologies can be a tool that may provide a positive direction for SME innovation. Therefore, it is of vital importance that manufacturing SMEs use digitised production processes to be efficient so they can be innovative (Shivajee, Singh and Rastogi 2019: 4).

2.13.1 Infrastructure

Infrastructure refers to structures and facilities such as roads, water and electricity, bridges and education. One of the leading factors that raises concerns among manufacturing SMEs is the lack of power supply. The poor supply of electricity to manufacturing SMEs brings constraints in the production processes, as machines are interrupted while processes continue, which results in poor performance by manufacturing SMEs due to under-functioning machines, thus making the production process run slowly and inefficiently (Degefa 2017: 28).

While infrastructure such as power supply has a positive impact on the performance and growth of the business, Muriithi (2017: 46) affirmed that power supply interruptions bring the high cost of service suppliers, with SMEs required to carry extra backup costs for disruptions caused by power supply interruptions. This hurts the profit margin and affects SME performance. Hartley and Mills (2019) concurs that Eskom causes disruption with load shedding for emerging technologies in SA that require electricity to function. Manufacturing SMEs therefore fall behind with implementation of IoT, big data and applications that transform processes to enhance productivity (Alansari *et al.* 2018: 48).

Contrary to this, Maisiri and van Dyk (2021: 11) found manufacturing SMEs are hindered by infrastructural factors to adopt emerging technologies, including those related to ICT infrastructure. Manufacturing SMEs do not have the pillars of emerging technologies such as cybersecurity systems and IoT. They are challenged by the lack of advanced technologies. Emerging technology is expensive, therefore, manufacturing SMEs in SA, with specific reference to those in the eThekweni Municipality, cannot afford the necessary emerging technology support infrastructure. While (Maffeo 2019) highlighted that despite infrastructure

challenges, the adoption of emerging technologies by SMEs is essential to gain competitive advantage, Marwala (2020) suggested that the adoption of emerging technologies can improve the country's SME competitiveness.

2.13.2 Labour skills shortages

According to Lee and Sahu (2017: 2), labour skills shortages are a critical challenge in SME performance. As emerging technologies surface, skilled labour will be a requirement to improve their performance since labour skills influence SME performance and development. Therefore, when they lack skilled staff, there is a greater likelihood that these manufacturing SMEs will fall behind in their performance (Lee and Sahu 2017: 2). Another reason for SMEs experiencing labour skills shortages is that of funding.

Manufacturing SMEs lack funding to hire the skilled employees relevant to emerging technologies, therefore, Government needs to assist manufacturing SMEs in the eThekweni municipality with funding to enable them to fill the gap of labour skills shortages (Seseni and Mbohwa 2019: 3014). Emerging technologies demand that SMEs and workers be skilful in order to adapt to the accompanying changes. However, SA manufacturing SMEs are characterised by unskilled and semi-skilled workers, even though the requirements of emerging technologies have an influence on their business (MerSETA 2018).

In contrast, Calitz, Poisat and Cullen (2017: 5) shared their opinion that emerging technologies in SA manufacturing SMEs have increased the complexity in jobs, along with changes in competency requirements, while it has also affected employee motivation, as well as give rise to a noticeable rise in unemployment. There is the possibility that these factors will impede the semi-skilled and unskilled workforce in manufacturing SMEs as manual jobs are replaced by automation (Maisiri, Darwish and van Dyk 2019: 92). There are, however, no studies that examine the problem of skills within manufacturing SMEs in SA. Gumbi and Twinomurinzi (2020: 41) suggested the need for investigation of skills for emerging technologies in manufacturing SMEs in SA, particularly in the eThekweni District Municipality.

2.13.3 Lack of knowledge

Knowledge plays an important role in manufacturing SMEs and their production processes (Alqam and Saqib 2020: 124). While the definition provided by Deveaux *et al.* (2020: 1) describes knowledge as “a condition of understanding acquired through experience and examination of gathered data”, knowledge also incorporates, awareness and comprehension. Mirkes, Sarasola and Jarmai (2019: 4) stated that manufacturing SMEs lack both an understanding of the benefits and the awareness of emerging technologies, with insufficient investment in research and development (R&D), as well as little space for pilot testing.

This echoes findings by Meissner, Ilse and Aurich (2017: 165) that with emerging technology implementation, real-time manufacturing control systems can take place that are able to manage complex decisions and irregular workloads. A lack of understanding exists among SMEs with regard to the elements and circumstances of emerging technologies and the effect on their system of production (Matt and Rauch 2020: 5). Lack of procedures and insufficient expertise play a huge role in the innovation of manufacturing SMEs with emerging technologies (Moeuf *et al.* 2020: 1384). The innovation process requires knowledge on methods and approaches of the process; however, manufacturing SMEs lack methods on how to innovate, with lower coordination efforts in SMEs regarding the implementation of emerging technologies (Orzes *et al.* 2018: 1348).

2.13.4 Cost of emerging technologies

Adding value to end clients is one of the main difficulties for organisations in developing business sectors (Howell, van Beers and Doorn 2018: 227). Findings by Lee *et al.* (2017: 3) show that SMEs are able to create value out of nothing, yet, even though they possess the ability to be creative, there are some constraints to investing in emerging technologies. Therefore, implementing tools such as robotics and smart technology may be restricted. The cost of emerging technologies has, nonetheless, been a hinderance in the adoption of these technologies by SMEs. Costs of emerging technologies, such as CAD and other software, range from approximately \$5 000-\$30 000, depending on the attributes. Furthermore, this initial cost does not cover all expenses, for example, training of employees on how to use the tools, with these matters hidden from the buyers (Marie 2018).

These obstacles related to the costs of investment in emerging technologies result in SMEs falling behind with the adoption and implementation of emerging technologies, thus hindering growth and innovativeness of SMEs in the manufacturing sector of the eThekweni District municipality. While Yoon *et al.* (2021: 90) argued that although emerging technology adoption is relatively costly, their advantages in innovation and growth are essential.

Manufacturing SMEs are challenged to implement emerging technology such as smart manufacturing due to its cost since they are having inadequate capabilities and their personnel practical limitations (Jun *et al.* 2017: 1949). As SA manufacturing SMEs are faced with finance obstacles, it is difficult to have Cobots in their companies.

2.13.5 Lack of finance

According to (Chiu *et al.* 2019), the biggest challenge faced by SA SMEs is the lack of access to finance, hence it does not only hamper SME growth but also hinders being innovative to survive. Conversely, this is supported by Pradhan and Agwa-Ejon (2018: 1), in establishing that SMEs are prevented to make use of emerging technologies by their lack of finance and access thereto. The clear version on how emerging technology resources provide ROI is one of the challenges for SMEs.

While manufacturing SMEs may be eager to invest in emerging technologies, they have to be cautious to not find themselves in danger of suffering losses and shutdown (Qeshmy *et al.* 2019: 29). Furthermore, Gumbi and Twinomurinzi (2020: 41) note the challenge of finance for adoption of emerging technologies in manufacturing SMEs. The author further expands that although manufacturing SMEs in SA are characterised by lack of expertise, skills and knowledge but financial issues remain the biggest challenge.

Where manufacturing SMEs are concerned, there is the scenario of the German industry that invested in an emerging technologies project of approximately 40 billion euros, for a span of three years (Moester 2017: 23). It is forecasted that very few or none of the local municipal structures, such as the eThekweni District municipality,

would be able to invest in such emerging technologies, as they do not have the appropriate credit or equity, another reason is that the return on investment will not be instant. Pradhan and Agwa-Ejon (2018: 1) noted that for manufacturing SMEs to be eligible for investment, enhanced production in their organisation will be requirement.

2.14 COVID-19

Covid-19, which is also referred to as the corona virus pandemic, has been a threat to the entire world and all aspects of businesses for the past 18 months (Dladla 2021: 59). The SA Government had to impose rules and regulations for the country; these rules include lockdown (Stiegler and Bouchard 2020: 695). These imposed regulations by Government influence SMEs as they are now obliged to operate online to reduce the spread of the virus, while having inadequate resources to use for their operations (Gregurec, Tomičić Furjan and Tomičić-Pupek 2021: 1).

Although all businesses have been affected by the pandemic as they contribute to the economy of the country, SME marketing processes have eventually been disrupted, across the board (Sugandini, Effendi and Istanto 2020: 916). The Covid-19 pandemic has introduced emerging technologies that many SMEs in manufacturing perceived as a tool to benefit their business positively. However, the pandemic has resulted in SMEs no longer focusing on innovation as the emerging technologies driver, instead, their focus is on survival (Eggers 2020: 199). Nonetheless, Dladla (2021: 63) indicated that SMEs have been more severely affected, for example, in countries such as Iraq the pandemic has impacted their production and sales.

In SA, prior to Covid-19, SMEs were constrained by a lack of funding, insufficient government support and the high rate of crime (SEDA 2016). The Covid-19 pandemic has compounded these challenges (Atiku and Randa 2021: 19), resulting in decreased productivity for manufacturing SMEs in SA. As a result, the country has availed R1 billion as funding from the Rupert family and Remgro limited (CNBC AFRICA 2020). However, information as to whether this money was distributed fairly or not is unclear, giving rise to questions regarding who benefited from it and

whether that money is to sustain or resuscitate SME growth, as well as what percentage of SMEs benefited, since they are the drivers of the economy.

According to Nyanga and Zirima (2020: 24), there are no exact statistics in SA on how the pandemic has really impacted the country. In contrast, this has been contested by the National Treasury (2020), which reported an expected 5,5 percent shrinkage in SA's GDP, with seven million jobs lost due to Covid-19. Moreover, manufacturing revenue declined by 14 percent in SA by 2020 (National Treasury 2020: 24). Nevertheless, Covid-19 is an ongoing pandemic and it is still early to draw conclusions with regard to the numbers.

Rajagopaul, Magwentshu and Kalidas (2020: 3) articulated that SMEs operating in the manufacturing sector have experienced a fall in revenues due to the lockdown regulations enforced because of Covid-19. In addition, Guo *et al.* (2020: 5) noted the importance of digitalisation in SMEs during the time of Covid-19. Many manufacturing SMEs that cannot digitise their business models and innovate may shut down after lockdown. However, manufacturing SMEs experience challenges in obtaining Government support, with some SMEs unaware of where they can find support. Therefore, it becomes a challenge for manufacturing SMEs to innovate while they are fighting for survival. Guo *et al.* (2020: 2) found that the ways in which SMEs can build their capacity during Covid-19 are unclear.

It is noted from the above section that Covid-19 has affected SMEs, particularly in the manufacturing sector, with SMEs battling to sustain their businesses due to a lack of financial support. The section below discusses the impact financial support or the lack thereof has on manufacturing SMEs in the eThekweni District Municipality.

2.15 FINANCIAL SUPPORT

The problem of financial support in SMEs is a common issue in developing countries. Ambad, Andrew and Amit (2020: 8) stated that in Malaysia, SMEs are challenged by a lack of finance to innovate and grow. Similarly, Yoshino and Taghizadeh-Hesary (2018: 3) identified access to finance as a major contribution

towards SME growth in Asia. Performance and growth of SMEs thus rely on the availability and access of financial sources (Rehman *et al.* 2019: 5).

Financial sources are the means by which SMEs are able to access funds, since they cannot issue bonds and stocks (Asai 2019: 299). Conversely, SMEs are described as being crucial contributors to the country's GDP and economy. Yet, SA SMEs remain restrained in terms of obtaining financial funding, with financial institutions hesitant to fund them. This results in the inability of SMEs to innovate using emerging technologies, due to insufficient funds to assist in the adoption of these new technologies to be innovative (Ombongi and Long 2018: 43).

Typically, SMEs are hindered by their creditworthiness to access finance; creditworthiness has been regarded as one of the major obstacles for funding of SMEs, which restrict SMEs in accessing funding in the long-term. Therefore, innovation is a continuous investment, requiring an organisation to be financially stable, particularly in the acquisition of emerging technologies such as robotics and 3D printing. However, SA SMEs cannot afford these emerging technology tools due to a lack of funds.

According to the financial institutions, SMEs are contemplated as high-risk organisations as a result of inefficient resources available as collateral when they fail to repay the funds, simply because they endure on poor capital (Ombongi and Long 2018: 40). Creditworthiness remains a challenge for SA manufacturing SMEs as they solemnly depend on external funding to be innovative; This means they lag with regard to emerging technologies required to be competitive.

Similarly, Nizaeva and Coskun (2019: 3) further expanded that other observed constraints from the perspective of SMEs not being funded include demographic factors, such as how long the company has existed and the size of an organisation. All these factors impact the funding of SMEs by financial institutions. SA manufacturing SMEs are, therefore, faced with an impediment of failure, with most not surviving in the industry for an extended term (BUSINESSTECH 2019). resulting from difficulties to obtain funding, when considering the requirements of financial institutions. Financial Institutions tend to invest more in the organisation that has

survived for at least a period of five years and more. (Albuquerque, Quirós and Justino 2017: 286) determined that these obstructions continuously affect innovation by SMEs in SA, hence limiting their capacity for investing in emerging technologies.

2.16 CONCLUSION

This chapter shared findings from literature regarding the topic under study, including what emerging technologies are, with examples and research on their impact and influence, with specific reference to the SME manufacturing sector, as well as the benefits and challenges experienced in the uptake thereof.

The next chapter sets out the research methodology employed in undertaking this study.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

The preceding chapter analysed and discussed literature reviewed on the influence of emerging technologies on small and medium manufacturing enterprises in the eThekweni District Municipality. The aim of this chapter is to give an outline of the method approaches used for this research. According to Adedoyin (2020), research is a well-structured review that aims at establishing facts about a phenomenon and reaching logical innovative conclusions. Research comprises two types, namely, basic and applied research. Neuman (2014) defined research methodology as a great structure that houses approaches, while Howell (2013) explained research methodology as the overall strategy research responsible that defines the methods the research study will be using. Kumar (2014) stated that research methodology is aimed at discovering responses to the questions of the research. A discussion and explanation thus follow on research design, methods of research, target population, and data collection instruments, along with validity and reliability, as well as ethical considerations.

3.2 RESEARCH DESIGN

According to Abutabenjeh and Jaradat (2018: 237), choosing a proper design is only possible once a researcher has identified a research title. Asenahabi (2019: 78) pointed out that adequate knowledge of research design and its implications in research is required. Various definitions below offer a more comprehensive view of what the design of research involves.

The definition of research design as a method deliberated on to provide a suitable framework for the study was used by Sileyew (2019: 2), which echoes Akhtar (2016: 68), who defined research design as a research structure that embraces all the sections of the research. The author added that research design is the “glue” that joins the sections of the research (Akhtar 2016: 68), Furthermore, Boru (2018: 1) described research design as a general plan for conceptual research problems

connected with the relevant empirical research. Research design is also defined as ideas which researchers reflect on (Asenahabi 2019: 78).

When a research design is selected, Blanche, Durrheim and Painter (2012) state that the researcher considers the following:

- the purpose of the research,
- the theoretical framework,
- the context in which the research will be carried out, and
- the research technique applied to collect and analyse data

While various research designs may be used in research studies, typical research designs are explanatory, exploratory, and descriptive research design.

An explanatory research design is when the research objective is to investigate new discoveries, in other words, those not previously explored (Akhtar 2016). It is also a type of research design based on explaining the research elements (Bowen, Rose and Pilkington 2017: 12). When a topic has not been extensively investigated or researched it is known as exploratory analysis (Stebbins 2001). Descriptive research is objective or neutral in its attempts to explain relationships that exist between variables (Du Plooy-Cilliers, Davis and Bezuidenhout, 2014: 29), while descriptive research can also be summarised as being about how reality is represented.

Having considered these three designs, it seemed appropriate to use a descriptive design for this study, since the relationship between variables is explained, such as attitude toward emerging technologies, intention to make use of/implement emerging technologies and factors influencing manufacturing SMEs in the eThekweni district municipality to adopt emerging technologies.

3.3 RESEARCH APPROACHES

Creswell and Creswell (2017) explained that research approaches are the plans and procedures for research, starting with broad assumptions that lead to detailed data

collection, analysis, and interpretation methods. The three kinds of approaches to research are: quantitative, qualitative, and mixed methods, explained as follows:

3.3.1 Quantitative Research Approach

Quantitative research can be defined as a method which is appropriate to provide an overview of the overall study (Apuke 2017: 40). This method deals with calculating and analysing data variables to find an answer (Apuke 2017: 41), constructing tables that reveal frequency occurrences by connecting different factors statistically. This method of quantitative research is mostly chosen by the researcher because it saves respondents time, as it is statistically driven with the use of numbers, which helps in providing more information (Queirós, Faria and Almeida 2017: 370). The figures provided make it easier for data compilation into graphs and charts, allowing the researcher to conduct research on a wide scale. This provides a huge amount of information.

Nevertheless, this method also has the disadvantage of being more costly than the qualitative method, as in quantitative research used numbers change more frequently. This method also has smaller strength in terms of focusing on the background of the problem (Queirós, Faria and Almeida 2017: 380). The study was based on a purely quantitative research method. Therefore, there was no use of interviews, with a questionnaire employed instead. The target population is discussed below.

3.3.2 Qualitative Research Approach

Silverman (2016: 39) states that, “researchers can understand the world around them through a qualitative approach”, with the qualitative approach also described as more flexible than the quantitative method (Bernard 2017: 452). While Gibbs (2018) found this approach to offer more insights than a quantitative approach, qualitative data comprise open-ended data, typically obtained through observations, interviews and focus groups (Bryman 2017), which was not appropriate for the current study.

3.3.3 Mixed Method Research Approach

Although research approaches may be used effectively on their own, Creswell and Creswell (2017: 16) maintain that a researcher can gain “breadth and depth of understanding and corroboration by combining both qualitative and quantitative methods, while at the same time compensating for the shortcomings inherent in using either approach alone”. In addition, mixed methods research is described as “the form of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches for the broad purposes of breadth and depth of understanding and corroboration” by Schoonenboom and Johnson (2017: 108).

3.4 SURVEY METHOD

This quantitative study used primary data to pursue the research objectives. Sekaran and Bougie (2019) state that primary data consists of information the researcher obtained directly, for the specific purpose of the study. Therefore, this study used a questionnaire to obtain relevant primary data for the quantitative study. Furthermore, Struwig and Stead (2013) argue that online questionnaire administration is quick, simple, and inexpensive. Due to the Covid-19 pandemic situation and lockdown regulations, the researcher opted for online administration and in person collection of data for those who were challenged to access link of the questionnaire.

Research instruments such as a questionnaire play a major role in studies (Gray 2014), particularly social studies. In deciding on the survey instrument to use when collecting data, the researcher opted for a questionnaire with closed-ended questions and a response rating on a 5-point Likert scale. This method was adopted for statistical reasons, with regards to study results and findings. A total of 300 survey questionnaires were distributed among manufacturing SMEs in the eThekweni District Municipality, considered appropriate for primary data collection.

The literature review was the source of information for the construction of the questionnaire, which was formulated in a way that assisted the researcher to attain fairly accurate information from respondents, allowing the influence of emerging technologies on manufacturing SMEs to be easily measured and calculated.

3.5 MEASURING INSTRUMENT

According to Christley (2016: 138), a questionnaire is the best instrument with which to collect information from participants. Furthermore, Albers (2017: 1) is of the opinion that closed-ended questions are appropriate with a questionnaire, since they can be plotted in graphs and show shifts in percentages. The design of a questionnaire can be differentiated into three methods, namely, open-ended, closed-ended and a mixed method of open- and closed-ended questions. This study used only a quantitative research method.

Closed-ended questions produce information, with respondents indicating their opinions following the set of alternatives given to them by the researcher. The closed-ended questions in the survey instrument had a 5-point Likert Scale response rating. The use of this instrument was to ensure well presented data, reflecting respondent views regarding the variables that influence adoption of emerging technologies in eThekweni District Municipality manufacturing SMEs.

This type of instrument (questionnaire) is faster to answer, particularly when closed-ended questions are used, thus, the researcher elected to use this format. Furthermore, a questionnaire is able to keep the focus of the research study narrow through the use of closed-ended questions, which in turn, restricts respondent creativity. Conversely, open-ended questions would allow respondents to elaborate more on their answers. In addition, Chen (2017: 2) pointed out that respondents answering open-ended questions could easily skip some questions or provide inadequate responses, while respondents might also become reluctant participants as completing the questionnaire was time-consuming. Therefore, use was made of closed-ended questions in the current study's questionnaire. Formulation of the research questionnaire was based on the study research objectives, informed by a thorough literature review, with two sections:

3.5.1 Section 1: Demographic details

The first section allowed the researcher to build a picture of the participants who responded as representative of the target population, with demographic details that included:

- Location of the business
- Type of business
- Number of employees
- Years of operation
- Gender of participants

3.5.2 Section 2: Business activities (Likert Scale)

Respondents were requested to indicate their agreement, disagreement or neutrality to statements in the questionnaire (Appendix B) with an X.

3.6 TARGET POPULATION

A target population can be defined as all people who are eligible for meeting criteria stated for the research investigation (Alvi 2016: 10). Emerging technologies need owners or managers with refined emotional intelligence, who can balance innovations and disruptions, as well as forecast threats and opportunities that will come with emerging technologies., The target population comprised 2 400 manufacturing SMEs registered in the eThekweni District Municipality (SEDA (2016), in the KZN province. The study focuses areas on the eThekweni District Municipality were: South Coast, Durban Central, Mhlanga and other.

Manufacturing SME owners are the ones who innovate the business and determine strategies for growth, by examining the threats and opportunities that emerging technologies offer. This includes bringing critical thinking into their strategies for growth, thus enabling them to avoid threats and take advantage of opportunities. Therefore, they were able to offer more information on how they think emerging technologies will impact their businesses in their responses to the statements presented in the survey questionnaire.

Due to Covid-19 regulations, the researcher was sending emails that contained the questions, to the respondents for those who were able to access links. For those manufacturing SMEs that were challenged to access link, the researcher delivered the hard copies of questionnaires following the Covid-19 protocols. It was anticipated that respondents would complete the questionnaire, returning the link to the researcher and for those who had received hardcopies collected the copies.

3.7 SAMPLING

Data collection was done based on the research objectives and questions, with answers provided by manufacturing SME owners/managers; nonetheless, finding participants for the study under Covid-19 and its lockdown regulations was challenging. Creswell and Creswell (2017) describe a sample size as the total number of individuals or items selected from the bigger population to be part of the research.

The total population size for this study was 2 400 registered manufacturing SMEs (SEDA (2016) in the eThekweni District Municipality. An online sample size calculator was used to compute the sample size at 95 percent confidence, and a five percent interval level (<https://surveysystem.com/sscalc.htm>), producing a preferred sample size of 331, with 300 participants considered adequate for the purposes of the study.

3.7.1 Sampling strategies

Sampling strategies enable researchers to designate a group of individuals or objects from the wider population to be involved in the study. In research design, there are generally two modes of sampling, namely probability and non-probability sampling. Also known as random sampling, probability sampling permits every single item in the universe an equal chance of selection to the sample. Thus, the probability of choosing each individual, is the same. Types of probability sampling techniques include; systematic, random sampling, sampling, and stratified random sampling (Gray 2014; (Sharma 2017).

The researcher could not use all manufacturing SMEs; thus, a sample was drawn using a non-probability sampling technique, as it is more affordable than probability sampling. Ngcobo (2016: 58) stressed that financial constraints and limited time make it impossible to collect all data. In non-probability sampling, each member of the population does not have an equal chance of being selected, however, it is generally employed due to time or financial constraints. Non-probability sampling technique examples are: quota, purposive, snowball, and convenience sampling (Sekaran and Bougie 2014; Struwig and Stead 2015).

3.7.2 Sampling method

A stratified random sampling method was used for this study. (Tashakkori and Teddlie 2009) explain this as when the researcher obtains prior definition of categories within the targeted population, before being able to draw samples from its sub-groups. In this study, the sample was drawn from the targeted manufacturing SME population, characterised by: size of business (up to 250 employees; being in operation within the eThekweni District Municipality manufacturing sector for 10 years, within selected areas; and annual turnover had to be up to R10 million, Furthermore, type of ownership had to be stipulated; for example, sole trader, partnership and corporation.

Therefore, the study was conducted in one municipal district in the KZN province, namely the eThekweni District Municipality, where the questionnaire distribution occurred to identified manufacturing SMEs.

3.8 DATA COLLECTION METHODS

As the method of collecting data was a closed-ended questionnaire, administered online, and in person to manufacturing SMEs registered in the eThekweni District Municipality, from the following areas of the eThekweni District Municipality: South Coast, Durban central, Umhlanga and other, were identified and invited to participate by the researcher. The questionnaire links and hard copies were provided to participants during working days, via email.

As stated above, due to the issue of Covid-19, the link was sent to those manufacturing SMEs that were not physically seen as the study was aimed to be administered online not face-to-face. However, the researcher also used in person for those participants who had challenges to access link. Emails were sent to those owners, with a link to the questionnaire to be completed and returned to the researcher as well as copies of questionnaires was delivered to those who were able to be seen physically. The link and hard copy questionnaires were accompanied by a letter confirming the researcher's identity and explained the purpose of the research. It was anticipated that respondents would take at least 15-

20 minutes to complete the questionnaire. The questionnaire was disseminated during weekdays, while SME owners were at work.

3.9 VALIDITY AND RELIABILITY

3.9.1 Validity

Validity and reliability form an important aspect of Research methodology as they represent precision and consistency of the questionnaire (Taherdoost 2016: 34). Validity in research determines how truthful and how accurate the results of the research are, by considering scale interpretation (Mohajan 2017: 14). The study is said to be valid when it portrays what it intended to (Pavot *et al.* 2018: 6). For this study, internal and external validity threats were thoroughly checked to identify whether any impacted the research findings.

Internal validity refers to the extent whereby related conclusions are warranted with regard to intercession effects and allows for reliable responses to the questions of the research (Andrade 2018: 499). Internal validity was assured by using member checks, which allow the researcher to hand the questionnaire back to respondents to validate and confirm these, by means of email (Zohrabi 2013: 258). External validity was achieved by using a stratified random selection method to identify participants.

Validity is differentiated into four types. The first is face validity, which is recognised when instruments conclude its characteristic measures of the interest, reviewed by an individual. The second, content validity, refers to the degree of measuring the construct of interest. The third is construct validity, which pertains to the degree to which an instrument scales the theoretical construct it is projected to measure (Flake, Pek and Hehman 2017). Nonetheless, (Westen and Rosenthal 2003) disagree, describing it as the suitability of inferences, completed on the basis of measurements, when test measures the projected construct. The fourth type of validity is criterion-related validity; evaluated to determine the scores of a relationship, from a test to an explicit criterion.

In this study, data validity was achieved through data analysis. A convergent validity was achieved, with construct measures loaded at >0.5 ; (the recommended weight) to their factors.

3.9.2 Reliability

According to Gali (2011: 119), reliability refers to the degree to which an instrument assessment provides the same results obtained, each time the same settings and kinds of subjects are used. Reliability determines whether the results are consistent with the questionnaire and free from random error (Mohajan 2017: 10). For reliability assurance, a pilot questionnaire was adopted.

A Cronbach coefficient alpha test, together with SPSS version 27, was used for reliability calculations because it is the most used method for measuring reliability of a questionnaire. Validity and reliability of data collection were done by the researcher to ensure no duplication within the variables tested and proofreading the research study for consistency and strength of the findings check. Proofreading was considered appropriate for findings, stability and consistency.

3.10 LIMITATIONS

Lack of time and unwillingness by respondents to complete a survey may cause constraints in obtaining a representative sample. This study was focused on manufacturing SMEs operating in the eThekweni District Municipality, whose number of full-time employees ranges between 50 and 250. The researcher sent emails to identified respondents explaining the aim of the study and questionnaire completion in full detail. This was done to arouse the willingness of the respondents to participate.

The use of a quantitative technique in the form of a structured questionnaire limits respondents in terms of explaining, as they were only expected to tick next to the appropriate answer.

3.11 ELIMINATION OF BIAS

The study research did not identify people by race or ethnic group and gender-neutral words were not used. No assumptions were made about any age groups, with language that supports stereotypes avoided.

3.12 ETHICAL CONSIDERATIONS

3.12.1 Informed consent

Study respondents were informed about the nature of the study preceding its commencement (Appendix A). informed consent entails the following:

- Respondents understand the nature of the study and their involvement in the research study being conducted;
- Autonomous decisions are taken whether to participate in the study;
- Respondents are aware that participation in the study is purely voluntary;
- Respondents are aware of their rights to terminate participation in the study;
- The researcher is truthful to the respondents about the environment of the study and in no way are respondents forced into participating in the research.

3.12.2 Ensuring safety of respondents

The risk was assessed before the respondents participated in the research to protect them against any harm, with no risk found.

3.12.3 Confidentiality and anonymity

When data are collected from participants who are completely unknown to anyone associated with the study, only the respondent knows of their participation in the study, and the researcher cannot identify the participants (Guttman, Shouldice and Levin 2019: 66). Confidentiality means that identities of those participating in the study cannot be made known in any way.

For this study, confidentiality was the most important aspects that was taken care of; participants did not provide their names in the questionnaire. Furthermore, as participation required no subscription, participants were not required to sign any forms; they were doing it voluntarily and could withdraw at any time they wanted to, without any given reason. For this study, respondents were signing consent form

before participation. Therefore, their identification will be kept in a safe place where it can only be accessed by the supervisor and researcher. Findings will be reported in a manner that does not identify the respondents, with completed questionnaires shredded after five years.

3.12.4 Pilot testing

According to Ismail *et al.* (2017: 1), a pilot study is the small scale used to test for the larger, final, full study. The purpose is to dictate the feasibility of using a questionnaire in the study, so that the researcher can conduct the best final research (Fraser *et al.* 2018: 261). The study is said to be valid when it portrays what it intended to.

For this study, 15 randomly selected SME owners/managers who did not participate in the main study, were sent the pilot test to reduce the chances of failure in the larger questionnaire. This enabled the researcher to identify problems that could arise when respondents answer the questionnaire, and report back inconsistencies raised by these faithful for corrections (the purpose of pretesting). Suggestions from these participants were considered as a necessary comment; for example, how much time respondents will spend answering the questions, as well as to check whether the method used was appropriate to administer a larger questionnaire, so that the quality of the study will be improved (Fraser *et al.* 2018: 261)

3.13 CONCLUSION

In this chapter, the research design was well-defined and the objective visibly presented. The method approach to research methodology was clarified, the data instrument used explained and method of data collecting determined. The questionnaire development was also exemplified, while the data analysis tool used was explained, as were validity and reliability. The following chapter focuses on presenting the data analysis findings obtained from respondents and results interpretation.

CHAPTER 4

DATA ANALYSIS

4.1 INTRODUCTION, PRESENTATION AND DISCUSSION

The research methodology outlined in the previous chapter described the processes involved in the study to fulfil the research aims and objectives. This chapter discusses and presents an analysis of data gathered from the respondents. The aim of the study was to investigate the influence of emerging technologies on SMEs in the eThekweni District Municipality. The study objectives were to investigate the influences of emerging technologies on the future of SMEs, their future growth, preparedness in adoption of emerging technologies and survival of SMEs in the manufacturing sector. Data collected from the respondents were analysed using SPSS version 27.0, with results presented by means of descriptive statistics, in the form of cross tabulations, graphs and other quantitative data figures collected. Correlations and chi-square test values were tested with the use of inferential techniques, which were used to interpret the *p-values*.

4.2 PRESENTATION OF RESULTS

4.2.1 SECTION A: Factor analysis

In this study, the factor analysis was used to identify variables/components that found to be the most factoring into the participants feedback, this was done due to find the most significant factors that were identified by literature review in the previous section (Chapter 2), where the literature shows the gaps in the variables that were used to formulate the questionnaire of the study.

Factor analysis is a statistical technique used to lessen variables/components in a large number, to a fewer number of factors (Yong and Pearce 2013: 79). Its main goal is to reduce data. Factor analysis is mainly used by a researcher who conducts survey research, with the aim of presenting questions into a smaller number of hypothetical factors (Yong and Pearce 2013: 79). For example, as part of health survey on Covid-19 lockdown levels, participants may answer five questions regarding Covid-19 levels, reflecting issues on all lockdown levels. Each question, by itself, would be an insufficient measure of attitudes towards Covid-19 lockdown

levels, but together, they may provide a greater measure of the attitude. Factor analysis can be used to institute whether the five measures do, in fact, compute the same thing. Should that be the case, they can be combined to form a new variable, a factor score variable that encompasses a score for each participant on the factor.

Factor techniques are used in different situations. A researcher may seek to know whether skills required to be a heptathlon are differed as the five events, or if a slight number of core skills are required to be successful in a heptathlon. It is not essential for one to be of the opinion that factors literally exist in order to present a factor analysis, however, in application the factors are usually given names, elucidated and stated as real things (Dlamini 2017: 94)

Factor analysis is mainly used in data reduction so that a smaller number of factors can be identified that mostly illustrate the variance observed in a larger number of those variables that can be observed directly (manifest variables). The screening of variables for subsequent analysis uses factor analysis to develop a hypothesis concerning casual mechanisms. The results will be shown in the Kaiser-Mayer-Olkin (KMO) and Bartlett's Test tables. The factor analysis tables extracted from matrix tables were anticipated by a concise table that shows a KMO and Bartlett's Test table. It is required that the KMO Measure of Sampling Adequacy be greater than 0.50 and Sphericity for Bartlett's Test be less than 0.5.

For Likert scale items, factor analysis was done. Established components were segregated into finer components the explanation is reflected in the rotated component matrix. Factor analysis was done only for the Likert-scaled items. Certain components were divided into finer components. This is explained below (Tables 4.6 and 4.7). The factor analysis was done successfully, the Bartlett's and KMO Measure Tests were taken into consideration, and results presented (Table 4.2).

Table 4.1: Presentation of results

Questionnaire question/statement	Chi-square	Df	Asymp. Sig
a) 2. What type of manufacturing SMEs are you owning? (Please tick one).	10.975 ^a	12	0.531
b) 2. What type of manufacturing SMEs are you owning? (Please tick one). * 4. How many years have you been operating in this business? Crosstabulation	33.880 ^a	24	0.087
c) 2. What type of manufacturing SMEs are you owning? (Please tick one). * What is your gender? Crosstabulation	34.547 ^a	12	0.001
d) 2. What type of manufacturing SMEs are you owning? (Please tick one). * 6. Manufacturing SMEs owners at the eThekweni District Municipality think emerging technology will replace their work Crosstabulation	41.047 ^a	24	0.016
e) 2. What type of manufacturing SMEs are you owning? (Please tick one). * 7. SMEs at the eThekweni District Municipality have proper training offered to them by Government for growth regarding on how to adapt to emerging technology Crosstabulation	24.974 ^a	24	0.407
f) 2. What type of manufacturing SMEs are you owning? (Please tick one). * 9. There are socio- cultural factors such as beliefs and values affecting the eThekweni District Municipality SMEs to grow and adopt emerging technology Crosstabulation	21.852 ^a	24	0.588
g) 2. What type of manufacturing SMEs are you owning? (Please tick one).	24.814 ^a	24	0.416

* 10. Financial factors are impacting the eThekweni District Municipality SMEs towards adapting emerging technology to grow and innovate Crosstabulation			
h) What type of manufacturing SMEs are you owning? (Please tick one). *11. Technological factors are affecting the innovation of eThekweni District Municipality SMEs to adopt emerging technology. Crosstabulation	29.063 ^a	24	0.218
i) What type of manufacturing SMEs are you owning? (Please tick one). *12. There is a significant role that emerging technology may have towards the development of the SMEs in eThekweni District Municipality. Crosstabulation	30.833 ^a	24	0.159
j) What type of manufacturing SMEs are you owning? (Please tick one). *13. The eThekweni District Municipality SMEs in manufacturing industry are prepared for emerging technology in terms of changing their operation strategies and business models to be in line with emerging technology Crosstabulation	22.889 ^a	24	0.526
k) What type of manufacturing SMEs are you owning? (Please tick one). * 14. There are strategies such as digitalisation of business process and automation of machines that need to be employed to enhances SMEs at eThekweni District Municipality to adopt emerging technologies Crosstabulation	23.266 ^a	21	0.504
l) What type of manufacturing SMEs are you	29.057 ^a	24	0.218

The following discussion relates to the data presented above (Table 4.1).

4.3 HYPOTHESIS TESTING

A correlation analysis of the results was performed to determine whether the type of business owned by SMEs has relationship associations with the number of employees in the company. The question was based on the null hypothesis of uniformity of expected responses to questions. The statistical results were found to be significant at ($X^2=10.975a$; $df=12$; $p=0.531$), which confirms a significant relationship between variables, with the p value < 0.05 , which is the recommended value and can be trusted as it is not due to chance. The minimum expected count is .08, and 61.9 percent have an expected count less than .5.

Chi-square testing with the correlation analysis of the findings was performed to determine whether type of business owned by SMEs has a substantial relationship with the number of business operations. The question was based on the null hypothesis of uniformity of expected responses to questions. Statistical results were found to be significant at ($X^2=33.880a$; $df=24$; $p=0.087$). The findings show no significant relationship between the variables because the p-value is >0.05 , which is the recommended p-value. This result was statistically significant and can be trusted as it is not due to chance, with the expected count for 57.1 percent <0.05 and the minimum expected count at .37.

Using the correlation analysis of the results, a Chi-square test was done to determine an association relationship between type of business owned by SMEs and gender of participants. The question was based on the null hypothesis of uniformity of expected responses to questions. The findings indicated ($X^2= 34.547a$; $df=24$; $p=0.001$). There was no relationship between the variables as the p value is >0.05 , which was the recommended value. While the minimum expected count is .039, 42.9 percent have an expected count less than .5.

A correlation analysis of the results was performed to determine whether the type of business owned by SMEs has relationship associations with manufacturing SME perceptions that emerging technologies will replace their work. The question was based on the null hypothesis of uniformity of expected responses to questions. The

statistical results were found to be significant at ($X^2=41.047a$; $df=24$; $p=0.016$), which confirms a significant relationship between variables because the p value is <0.05 , This is the recommended value and the result can be trusted as it was not due to chance. The minimum expected count is 1.20, with 51.4 percent having an expected count less than .5.

A correlation analysis of the results was performed to determine whether the type of business owned by SMEs has relationship associations with government training 88 offered by Government to manufacturing SMEs. The question was based on the null hypothesis of uniformity of expected responses to questions. The statistical results were at ($X^2=24.974a$; $df=24$; $p=.407$), which confirms no significant relationship exists between these variables because the p value > 0.50 , which is the recommended value. While the expected count is <0.5 for 57.1 percent, the minimum expected count is .59.

Chi-square testing with correlation analysis of the findings was performed to determine whether the type of business owned by SMEs has a substantial relationship with socio-cultural factors, such as beliefs and values affecting the eThekweni District Municipality SMEs to grow and adopt emerging technologies. The question was based on the null hypothesis of uniformity of expected responses to questions. Statistical results were ($X^2=21.852a$; $df=24$; $p=0.588$). The findings show no significant relationship between the variables because the p-value is less than the recommended p-value (0.05). This result reflected 57.1 percent have an expected count $<.5$. The minimum expected count is .27.

A correlation analysis of the results was performed to determine whether the type of business owned by SMEs has relationship associations with financial factors impact eThekweni District Municipality SMEs in adapting to emerging technology to grow and innovate. The question was based on the null hypothesis of uniformity of expected responses to questions. The statistical results were found to be significant at ($X^2=24.814a$; $df=24$; $p=0.416$), which confirms that a significant relationship exists between variables, as the p value is <0.05 , which is the recommended value. The

results can thus be trusted as they were not due to chance. While .16 is the minimum expected count, the expected count for 62.9 percent shows less than .5.

Using the correlation analysis of the results, a Chi-square test was done to determine whether there was an association relationship between the type of business owned by SMEs and the gender of participants. The question was based on the null hypothesis of uniformity of expected responses to questions. The findings indicated ($X^2= 29.063a$; $df=24$; $p=0.218$). There was a relationship between the variables with the p value at <0.05 , which was the recommended value. An expected count less than .5 is reflected at 54.3 percent. The minimum expected count is .19.

Chi-square testing with the correlation analysis of the findings was performed to determine whether the type of business owned by SMEs has a substantial relationship with emerging technologies having a significant role. The question was based on the null hypothesis of uniformity of expected responses to questions. Statistical results were found to be significant at ($X^2=30.833a$; $df=24$; $p=.159$). The findings show no significant relationship between the variables because the p-value is $>$ than the recommended p-value (0.05). This result was statistically significant and, not due to chance, reflecting that 54.3 percent have an expected count less than .5, while the minimum expected count is .21.

Using the correlation analysis of the results, a Chi-square test was performed to determine whether there was an association relationship between the type of business owned by SMEs and that SMEs are prepared for emerging technologies. The question was based on the null hypothesis of uniformity of expected responses to questions. The findings indicated ($X^2= 22.889a$; $df=24$; $p=.526$). There was no relationship between the variables because the p-value is >0.05 , which was the recommended value. The result was statistically significant and not due to chance. The expected count for 51.4 percent is less than .5, with the minimum expected count at .37.

A Chi-square test was performed using the correlation analysis of the results to determine whether there was an association relationship between the type of

business owned by SMEs and that emerging technologies will lead to high productivity. The question was based on the null hypothesis of uniformity of expected responses to questions. The results reflected ($X^2=15.201a$; $df=24$; p -value=.915). Therefore, there was no significant relationship between the variables because the p -value is >0.05 , which is the recommended value. This result was thus statistically significant and not due to chance.

A correlation analysis with the use of Chi-square testing was performed to determine whether there was a significant relationship between the type of business owned by SMEs and adoption of digitalisation and automation for emerging technologies. The question was based on the null hypothesis of uniformity of expected responses to 90 questions. The statistical results were found significant at ($X^2=23.266a$; $df=24$; p -value=.504). There was no significant relationship between variables because the p -value is $>$ than the recommended p -value, which is 0.05.

A correlation analysis of the results was performed to determine whether the type of business owned by SMEs has relationship associations with the need for restructuring of traditional supply chain to digitalised supply chain by SMEs. The question was based on the null hypothesis of uniformity of expected responses to questions. The statistical results were found to be significant at ($X^2=29.057a$; $df=24$; $p=0.218$), which confirms a significant relationship between variables, with the p value <0.05 , which is the recommended value. The significance can be trusted, as it is not due to chance. Furthermore, while the minimum expected count is .13, a less than .5 expected count was reflected by 54.3 percent.

4.4 BARTLETT'S TEST

4.4.1 KMO and Bartlett's Test

Table 4.2: Bartlett's Test

Bartlett's		
Sphericity Test	Of App. Chi-Square	467.276
	Df	36

Sig. .000

Bartlett's Test of Sphericity results=467.276; Sig=.000, which suggests data were relevant for the aim of factor analysis. The null hypothesis of the test is that the variables are not correlated, whereas the alternative hypothesis is that the variables are correlated. The Kaiser-Mayer-Olkin (KMO) Measure of Sampling Adequacy result was 0.768, indicating adequate items for each factor, with a strong positive significance on the influence of emerging technologies in manufacturing SMEs in the eThekwini District Municipality. The correlation of the variables in the dataset is shown to diverge significantly, therefore, the above two factors show the appropriateness of principal component analysis as data reduction technique.

4.4.2 Rotated Component Matrix

Table 4.3: Rotated Component Matrix^a

	Component	
	1	2
13. The eThekwini District Municipality SMEs in the manufacturing industry are prepared for emerging technology in terms of changing their operation strategies and business models to be in line with emerging technology	.771	.076
12. There is a significant role that emerging technology may have towards the development of the SMEs in eThekwini District Municipality.	.736	-.087
18. Emerging technology will lead to high productivity to eThekwini District Municipality SMEs	.719	-.094
14. There are strategies such as digitalisation of business process and automation of machines that need to be employed to enhance SMEs at eThekwini District Municipality to adopt emerging technologies	.705	.093
7. SMEs at the eThekwini District Municipality have proper training offered to them by Government for growth regarding on how to adapt to emerging technology	.033	.813

6. Manufacturing SMEs owners at the eThekwini District Municipality think emerging technology will replace their Work	-.039	.800
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Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

As stated before, factor analysis is a technique that statistically lessens variables in a large number to a fewer number of factors, with the aim of reducing data. Factor analysis is typically used in survey research, whereby a researcher desires to present hypothetical factors in a small number from numerous questions (Yong and Pearce 2013: 79). The extraction method used was Principal component analysis, and Varimax with Kaiser Normalization as rotation method (Table 4.3). This method is referred to as an orthogonal rotation method that reduces the number of variables loading high on each factor. It clarifies the explanation of the factors. Loading of factors indicates inter-correlations between variables. The questions that loaded comparably suggested measurement through a similar factor (Dlamini 2017).

A component test was conducted on the question statement pertaining to whether “SMEs in the eThekwini District Municipality manufacturing industry are prepared for emerging technologies in terms of changing their operation strategies and business models to be in line with emerging technologies”. Responses showed two classifications of the component, where the first component reflected 0.771, while component two presented 0.076. This validated that those respondents have the same opinion concerning this variable, in terms of preparedness for emerging technologies.

The statement regarding “There is a significant role that emerging technology may have towards the development of the SMEs in eThekwini District Municipality”, was present in the first component at 0.736, while the second component indicated 0.087. This confirmed a similar opinion from the respondents on the matter. Furthermore, the statement “Emerging technology will lead to high productivity to eThekwini District Municipality SMEs” presented results in component one of 0.719 and component two showed 0.094. This verifies that respondents have the same thoughts regarding this variable.

Regarding the statement “There are strategies such as digitalisation of business process and automation of machines that need to be employed to enhances SMEs at eThekwini District Municipality to adopt emerging technologies”, the results reflected for component one is 0.075, while component two is 0.093. The results therefore indicate that the respondents have the same opinion about this variable.

However, the results presented on the statement, “SMEs at the eThekwini District Municipality have proper training offered to them by Government for growth regarding on how to adapt to emerging technologies”, presented 0.033 for the first component and 0.813 for the second component. This validated that the opinions from the respondents differed.

The final statements, with regard to “Manufacturing SMEs owners at the eThekwini District Municipality think emerging technology will replace their work”, showed that the first component indicated 0.039 while second component showed 0.813. This confirmed different perceptions presented by the respondents.

4.5 CRONBACH’S ALPHA

Taber (2017: 1273) indicated that Cronbach’s alpha is the tool that validates those tests and reliability of scales that have been created. Summarised scales were utilised to review the fundamental constructs in survey instruments that the researcher wanted to measure. Specifically, it shows how well a set of variables are measured or items measure single, one-dimensional latent aspects of individuals. Cronbach’s alpha is mainly used in measuring reliability, especially in social organisational sciences. Mohamad, Evi and Nur (2018: 85) state that Cronbach’s alpha measures the reliability among various items or ratings and internal consistency.

4.5.1 Validity and Reliability

Reliability is defined as the degree whereby the consistency of a construct is measured (Kubai 2019: 2). The question that needs to be asked to determine the reliability of the findings, is whether the verification and conclusion stand up to the closest examination? The study will use Cronbach’s alpha as a method to test the

measure of internal consistency or reliability. The two important points of exactness are reliability and validity. Reliability is determined by taking some essential aspects of measurements on identical subjects. The newly created construct or acceptable reliability coefficient is acceptable when it is 0.60 or higher for a recently created construct. The following table shows the score of the Cronbach's alpha for all items that formed the questionnaire.

Table 4.4: Reliability Statistics

Cronbach's alpha	No. of items
0.704	26

The above score for reliability for all sections indicate 0.704, which exceeds the recommended value of Cronbach's alpha. This means the degree of reliability is acceptable, with scoring for these segments of the research consistent.

Table 4.5: Questionnaire for Reliability Statistics

13.	The eThekwini District Municipality SMEs in manufacturing industry are prepared for emerging technology in terms of changing their operation strategies and business models to be in line with emerging technology?
12.	There is a significant role that emerging technology may have towards the development of the SMEs in eThekwini District Municipality?
18.	Emerging technology will lead to high productivity to eThekwini District Municipality SMEs.
14.	There are strategies such as digitalisation of business process and automation of machines that need to be employed to enhances SMEs at eThekwini District Municipality to adopt emerging technologies?
7.	SMEs at the eThekwini District Municipality have proper training offered to them by Government for growth regarding on how to adapt to emerging technology?
6.	Manufacturing SMEs owners at the eThekwini District Municipality think emerging technology will replace their work?

The score for the ordinal data was 0.704 for total reliability, which is above 0.50, therefore this value recommends reliability of this study.

4.6 CONCLUSION

The conclusions for this research study can be drawn from the collected data analyses. The study response was 100 percent. The inter-item consistency was measured by Cronbach's alpha and to establish data normality. Figure, tables and charts were used to present demographic variables for actual findings. A significant number of similar responses from respondents is a component to note. The findings also disclosed a positive significant relationship among the objectives. To ascertain correlation among questions, Pearson's correlation was used.

The next and final chapter presents the conclusions and recommendations of the study. Furthermore, the objectives achieved will be presented and lastly, study limitations and important areas for further study will be highlighted.

CHAPTER 5

RECOMMENDATIONS AND CONCLUSIONS

5.1 INTRODUCTION

The following chapter provides the findings in relation to the literature reviewed, research questions, implications and recommendations, as well as conclusions and areas for further study, along with a brief conclusion of the chapter.

5.2 STUDY KEY FINDINGS SUMMARY AND CONCLUSIONS

The aim of this study is to investigate the influence of emerging technologies in manufacturing SMEs in the eThekweni District Municipality in the SA province of KZN. For a proposed prototype model derived from this indication.

The following conclusions were drawn based on the findings, where the background and biological data reflect that:

- The majority of respondents in manufacturing SMEs were from the area indicated as “other” in the eThekweni District Municipality.
- Most respondents were from clothing manufacturing SMEs.
- The largest group of owners (respondents) were those with manufacturing SMEs that had 1-50 employees.
- Most respondents were from those manufacturing SMEs that have been in operation for more than 10 years in the eThekweni District Municipality.
- Males were shown as the majority of participants who owned manufacturing SMEs in the eThekweni District Municipality.

Findings from Likert-scaled questions indicated:

- The study discloses that most manufacturing SME owners think emerging technologies will replace their work at eThekweni District Municipality. Nonetheless, the literature review showed that emerging technologies such as blockchain could improve the supply chain in manufacturing SMEs, by enabling transparent tracking of their streams, both upstream and

downstream, to improve speed. In addition, it was also revealed that value will be created through emerging technologies, with new ways to merge resources, as it is perceived as a market shaper. Therefore, the study concluded that emerging technology will not replace manufacturing SME owners' work, instead, it will improve their speed and productivity.

- The research study findings indicate that the manufacturing SMEs in the eThekweni District Municipality are not offered training by the SA government for growth, concerning how to adapt to emerging technologies. However, literature reviewed reflected that the government of SA is yet to finalise the national plan on how to take full advantage of technological advances, as emerging technologies are still at an infant stage in the eThekweni District Municipality. The literature further indicated that government in the form of the DTI, has organised a commission to facilitate the emerging technologies national plan of action, while being resourceful in their implementing of the INTSIMBI future production programme. This government initiative intends to enhance SA SME capacity to adopt emerging technologies. Therefore, the conclusion can be drawn that the SA government does not provide manufacturing SMEs with emerging technology-specific training programmes, which would allow SMEs to learn how to adopt these technologies.

According to the findings of the research study, manufacturing SMEs require proper training from the government, with a need for government interventions in assisting these SMEs in the eThekweni District Municipality. However, literature indicates that the SA government pays little attention to supporting SMEs and as a result, received a 3,64 score out of 9 for their support towards SME programmes in the 12 EFS for different countries in Africa. The author continued expands that Mozambique scored the lowest of 2.25 and the highest was Senegal with 5.31. This shows that South Africa not suitable to support the advance of a robust economic contribution from entrepreneurial activity (Herrington and Coduras 2019: 7).

- In addition, findings from the literature show that inadequate policy is stated by the SA Government for the development of manufacturing SMEs in SA, particularly the eThekweni District municipality. The conclusion drawn from the

study is that the SA Government has not paid adequate attention to the training of manufacturing SMEs for emerging technologies.

- The study finds that manufacturing SMEs in the eThekweni District Municipality are not affected by socio-cultural factors such as 'beliefs and values to grow and adopt emerging technologies. However, the literature reviewed reveals that managerial attitudes and resistance to change influence SME adoption of emerging technologies. In SA, manufacturing SMEs are aware of the innovation resulting from emerging technologies, nevertheless, manufacturing SME owners are resistant to change brought about by emerging technologies because they fear the complexity thereof and lack confidence in its use. Therefore, the study concluded that socio-cultural factors do not influence the manufacturing SMEs towards adoption of emerging technologies.
- The findings of the study also consider that financial factors impact manufacturing SMEs in adopting emerging technologies to grow and innovate. This is supported by the literature reviewed, which showed the lack of finance as the biggest challenge faced by SA SMEs, hence it does not only hamper SME growth but also hinders being innovative to survive. Although manufacturing SMEs in SA are characterised by lack of expertise, skills and knowledge, financial issues remain the biggest challenge. Consequently, the study concluded that financial factors impact manufacturing SMEs in adopting and implementing emerging technologies.
- According to study results, technological factors were indicated as affecting innovation of manufacturing SMEs in the eThekweni District Municipality in their adoption of emerging technologies. The literature review reflected that manufacturing SMEs in SA are challenged by a lack of technological capabilities to adopt emerging technologies. This compels them to import equipment for their operations at a higher price. In addition, manufacturing SMEs are characterised as being labour-intensive, as well as having a high number of uneducated employees and a lack of technology knowledge. This means manufacturing SMEs have insufficient ICT knowledge in advanced technology and uneducated personnel result in SMEs falling behind with ICT.

Furthermore, money and time are lost by approximately 65 percent of manufacturing SMEs due to a lack of technical skills. Hence, the conclusion can be drawn that technological factors hinder manufacturing SMEs in the eThekweni District Municipality to innovate with emerging technologies.

- The study further finds that emerging technologies will have a significant role in the development of manufacturing SMEs operating in the eThekweni District Municipality. These technologies will lead to high productivity in the eThekweni District Municipality manufacturing SMEs, which is supported by the literature reviewed that showed tools such as cloud computing can be used anytime, anywhere and can be accessed via smartphone or tablet, thus allowing SMEs to share information with customers. This means manufacturing SMEs will be able to access their information no matter where they are, provided they are connected to a network. Since cloud computing can be accessed everywhere, it allows quick responses to customer needs by enabling collaboration between the company and customers with its unlimited storage and safety. The conclusion can be drawn that emerging technologies will play a significant role in development of manufacturing SMEs.
- Manufacturing SMEs in the eThekweni District Municipality are shown by the study results to be prepared in terms of changing their business models and operation strategies to be in line with emerging technologies. These strategies include digitalisation of business processes, automation of machines employed to enhance manufacturing SMEs, and business models, for example, restructuring a traditional supply chain to digital format. Whereas the literature reveals that manufacturing SMEs are challenged by government policies imposed on them, it was also found that a lack of finances to adopt emerging technologies; infrastructure issues; technological factors and political willingness were further obstacles faced. Thus, the conclusion can be drawn that the adoption of emerging technologies in manufacturing SMEs in the eThekweni District Municipality is still at an infant stage, regardless of the study finding them prepared to change business models and operation strategies; this may take time to be implemented, due to the above challenges revealed by the literature reviewed.

- The study findings show that global factors such as legal issues and technology do not impact manufacturing SMEs in the eThekweni District Municipality to adapt to emerging technologies. However, literature reviewed reveals that government regulations and policies are challenges that impede manufacturing SMEs in SA to develop and grow. Poor government policy and regulations are difficult to implement and pose challenges for SMEs. Government regulations imposed on SMEs make it difficult for them to survive in the long-term, while red tape and regulations also impede their growth, thus hindering the ability of manufacturing SMEs to innovate. The study concluded that legal issues do not impact manufacturing SMEs to adopt emerging technologies.

- The findings of the research study confirm that eThekweni District Municipality SMEs in the manufacturing sector do not perceive emerging technologies as a tool of disruption that will make their business vanish or disappear. However, they perceive emerging technologies as a tool for gaining local, as well as global competitive advantage. The findings from literature reviewed reflect that emerging technologies have played a vital role in manufacturing SMEs; it enhances business by modifying traditional business processes to the digital environment.

On the one hand, manufacturing SMEs can easily penetrate new markets through digital technology. Digital data in big data are important to manufacturing SMEs, as forecasting of demand and production development are enhanced, while on the other hand, it increases sales and improves planning in the supply chain, hence improving competitive advantage. When technology is put into place and integrated in all other technologies, it creates a real and virtual world that results in powerful new ways of operations, which lead to efficiency of the business. This brings about positive results in SME performance; thus, an increase in profit. The conclusions can be drawn that emerging technologies will not make businesses vanish; however, new ways of operation will be enhanced that will result in competitive advantage for manufacturing SMEs.

- The study findings also indicate a need for training of employees by SMEs in emerging technologies to be retained, with a further requirement for information about emerging technologies in manufacturing SMEs and collaboration of all stakeholders in manufacturing SMEs. While the literature review indicated that emerging technologies are characterised by full automation and digitalisation of production processes in manufacturing, human involvement is an exception due to fully automated production processes. One of the biggest fears among manufacturing SME employees is to lose their jobs. The literature also showed that the complexity of emerging technology may require taking on new staff with the appropriate skills and knowledge, however, with SMEs constrained by a lack of funding, they attempt to avoid costs associated with the acquisition and training of new staff. The study concluded that despite the challenges, SMEs in the manufacturing sector have to consider training their employees with skills related to emerging technologies and should collaborate to share information about emerging technologies.

- The research findings indicate that emerging technologies will enable manufacturing SMEs in the eThekweni district municipality to have a relationship with international SMEs. While literature reviewed indicated the effect of local SME involvement in the export business is more opportunities to gain additional skills and knowledge from other countries, with informed decision-making, consequently improving opportunities for innovation that will result in growth. Manufacturing SMEs in SA are challenged by a lack of technological capabilities to adopt emerging technologies, which compels them to import operations equipment at a higher price. Therefore, the study concluded that emerging technologies would enable international relationships through imports and exports.

Finally, it is found from the results that financial obstacles and awareness of benefits of emerging technologies challenge manufacturing SMEs with regard to implementation of emerging technologies in the eThekweni District Municipality. While the literature review supported this finding, there is a lack of awareness and

understanding from manufacturing SMEs concerning the benefits of emerging technologies, along with insufficient R&D investment, while pilot testing space is also limited. SMEs are described as being crucial contributors to the country's GDP and economy. Yet, SA SMEs remain restrained in terms of obtaining financial funding, with financial institutions hesitant to fund them. This results in the inability of SMEs to innovate using emerging technologies, due to insufficient funds to assist in the adoption of these new technologies to be innovative. It is thus concluded that the major obstacles of manufacturing SMEs to innovate with emerging technologies lies with the identified financial obstacles and awareness of technology benefits.

Table 5.1: Main findings on statistical tests

THEMES	STATEMENT	COMPONENT
Preparedness of SMEs	The eThekweni District Municipality SMEs in manufacturing industry are prepared for emerging technology in terms of changing their operation strategies and business models to be in line with emerging technology	0.771
	There is a significant role that emerging technology may have towards the development of the SMEs	0.736
	Emerging technology will lead to high productivity to eThekweni District Municipality SMEs	0.719
	There are strategies such as digitalisation of business process and automation of machines that need to be employed to enhance SMEs	0.705
Proper training and owner perceptions	SMEs at the eThekweni District Municipality have proper training offered to them by Government for growth regarding on how to adapt to emerging technologies	0.813

		Manufacturing SMEs owners at the eThekweni District Municipality think emerging technology will replace their work.	0.800
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The statistics of variables analysed using a component matrix are shown in Table 5.1. The component test was done on the preparedness of SMEs, proper training of SMEs and owners' perceptions. The main aim of this analysis was to distinguish the most influential variables and establish their reliability. It can be concluded that SMEs in the manufacturing sector should improve on the variables mentioned.

5.3 LITERATURE REVIEW FINDINGS

The literature reviewed disclose that emerging technologies such as the IoT, AM, cloud computing, and cybersecurity systems, as well as big data, robotics and AR, along with AI, can influence manufacturing SMEs to achieve performance and growth. The IIoT saves manufacturing processes time, allowing manufacturing to run smoothly and preventing downtime in the process, alerting the user to potential failure before it can occur, since it uses built-in sensors.

Grube, Malik and Bilberg (2017: 1167) observed the use of RFID tags by the IoT for movement of material and tracking inventory from packaging to delivery in real-time not only saves costs, it also contributes to strategic planning. This helps manufacturing SMEs save on costs related to downtime in the production process which, in turn, improves efficiency that results in improved SME performance, thus gaining competitive advantage as they track the production process from beginning to end.

The findings of the literature based on AM reveals its ability to improve the making of completed parts, for example, models, faster than the traditional production process and it signifies innovation in manufacturing technologies (Martinsuo and Luomaranta 2018: 937). This enables manufacturing SMEs to achieve optimal performance, as they become efficient and improve productivity (Ituarte, Khajavi and Partanen 2016: 241). However, Martinsuo and Luomaranta (2018: 937) concluded that AM in SMEs is very low.

In contrast, findings reflect that cloud computing can be used to gain access to data anywhere, which can be utilised in the organisation to achieve performance. Cybersecurity systems are more popularised by their accuracy, with Onu and Mbohwa (2021: 3) noticing that cybersecurity systems can improve flexibility and productivity through accuracy. This can be achieved by enduring real-time data of other elements of emerging technologies. In this regard, Big data is a tool that can foresee, plan and manage circumstances to enhance productivity (Moyne and Iskandar 2017: 1).

The review of literature on emerging technologies in manufacturing SMEs showed that robotics is useful for controlling complex production processes, which allows for smooth production, resulting in efficiency of the organisation. In addition, AR is found as useful for maintenance in the production process, with instructions of how to carry out the task. This can have positive results in performance of the organisation, as cost for maintenance will be saved. Furthermore, Ulas (2019: 665) stated that AR can provide feedback in real-time by using information created on the layers of the computer.

The findings from literature also determined that emerging technologies are still at a nascent stage and below the scale in SA manufacturing SMEs (Dewa11 *et al.* 2018: 659). Moreover, the IoT, big data, 3D printers, and RFID are rarely used, possibly due to the high investment costs required for implementation, according to the results. Low use of the IoT could possibly be attributed to a lack of awareness, insufficient bandwidth infrastructure and insecurity with regard to cyber-attacks (Albelaihi and Khan 2020: 107) that SA SMEs are challenged by privacy and security between users and providers. However, emerging technologies are important for an organisation in this changing world, particularly to achieve performance. Furthermore, organisations should have technology capacity to be able to use these tools, as they are able to produce products that best suit the requirements of their market, which improves the performance of the organisation (Salisu and Abu Bakar 2019: 81).

Emerging technologies have contributed to the economy of SA, with the use of ICT in manufacturing SMEs. In addition, e-Government has played a major role as part of the use of ICT, as SMEs are able to register their businesses using the online Government portal and the higher the number of registered SMEs, the more the economy improves. Chipeta (2018: 4) stated that e-Government allows the broader community to access Government programmes which, in turn, enable the community to improve their skills and use them to improve their life quality.

The literature review findings reflected critical challenges faced by manufacturing SMEs in SA related to emerging technologies. This involves political willingness, government policy, conventional environment, and economic as well as technological factors. The literature reviewed showed that political willingness challenges manufacturing SMEs to grow with emerging technologies. Ayandibu and Houghton (2017: 134) determined that of all start-up SMEs, 80 percent are not doing well. This failure rate shows that Government initiatives have a negative impact on SMEs (Thapelo 2020: 2).

Furthermore, corruption and uncertainty associated with innovation investment risks have made the government less likely to invest in innovation for SMEs (Jugend *et al.* 2018: 56). This has seen many SMEs in manufacturing, particularly those in the eThekweni District Municipality fall behind with the adoption and implementation of emerging technologies.

Government policy was found to have an influence on business growth, performance and the way business operates (Alabi, David and Aderinto 2019: 5). Nonetheless, Worku (2016: 134) indicated that government policies for manufacturing SMEs do not foster the culture of innovation and entrepreneurship. This includes investments and financial policies that remain critical hindrances to the development of SMEs in the manufacturing sector. The study found that tax compliance also affects SME growth and performance and thus their ability to adopt emerging technologies. Junpath, Kharwa and Stainbank (2016: 100) stated that tax compliance is perceived as a huge, burdensome, regulatory expense that is time-consuming and influences the overall regulatory environment of SMEs. This has

resulted in many informal SMEs operating in SA due to restricted government policies.

The review of literature also revealed that conventional environments such as regulation constraints, norms and rules challenge SME growth. Mallett, Wapshott and Vorley (2018: 12) noted that regulations imposed on SMEs in the manufacturing sector are not clear. This is supported by Čepel *et al.* (2018: 23), who found that regulations and legal conditions from the SA Government, combined with strict rules, influence the business environment, thus impeding manufacturing SME development. Nieuwenhuizen (2019: 668) concluded that the failure of SMEs to grow due to government rules, also influences their performance, which in turn, challenges them to innovate with emerging technologies.

Findings from the literature review regarding economic factors revealed challenges in the exportation of goods, such as high delivery costs, administration rules to be followed, and foreign taxation, which hinder SME growth and innovation through emerging technologies (Isac and Badshah 2020: 11). Furthermore, the literature review reflected the SME sector as the backbone of the country, thus, contributing to SA's GDP. However, further difficulties faced by manufacturing SMEs include certain economic factors associated with high labour costs, economic conditions, red tape, and SARS issues, as well as VAT (Naicker and Rajaram 2018).

Furthermore, the red tape referred to in literature that SMEs must deal with involves SARS regulations that are perceived by SMEs as impediments to their growth. The challenge of imported products to SA resulted in performance failure for SMEs, as customers are no longer willing to buy from local manufacturers, which in turn, lowers the revenue of manufacturing SMEs in the eThekweni District Municipality. This has also limited the ability of these small businesses to invest in emerging technologies due to inadequate funds in the organisation.

The literature review additionally established that technological factors were one of the main challenges for SMEs in the manufacturing sector to adopt emerging technologies. Manufacturing SMEs were found to lack technological capabilities and technical skills related to emerging technologies. This lack of TC compels

manufacturing SMEs in the eThekweni District Municipality to import equipment for their operations at a higher price (Saha 2021: 303). The literature further revealed that technical skills are essential for an organisation to complete tasks efficiently and effectively and are requirements for SMEs to achieve optimal performance.

The review of literature included Porter's Generic Value Chain, showing that primary activities influence emerging technologies. The use of IoT can improve performance thus, SMEs achieve growth. This tool of emerging technologies uses RFID sensors to track the product from the beginning of the production process until the end inside the organisation. This will reduce cost related to labour as machines are automated and programmable. Big data also influences primary activities inside the organisation, with the IoT providing feedback constructed from big data; this generates data that can improve the quality of production processes, as it performs according to customer requirements. This can improve performance of manufacturing SMEs.

Regarding the emerging technologies in support activities, the literature review revealed that the IoT plays a major role in procurement by providing data collected through sensors to assist managers to monitor how much inventory has been used and what is on hand. This reduces out-of-stock occurrences, hence, increasing performance, as the organisation will know when and how much to order (Rejeb, Súle and Keogh 2018: 78).

Virtual reality was shown by the review of literature to allow manufacturing SMEs to obtain real-time experiences of customers, which will assist Human Resources with planning and training of staff based on customer expectations to improve the production process (Moeuf *et al.* 2018: 1128).

The findings from the literature review indicated cultural factors that influence the adoption of emerging technologies in manufacturing SMEs. This involves negative beliefs and values, especially in owners and managers of SMEs, which can result in non-adoption of emerging technologies. Sugandini, Effendi and Istanto (2020: 46). asserted that SMEs are likely to develop positive attitudes towards emerging technologies when they know it will enhance their performance and growth. The

authors further explained that manager attitudes play a huge role in influencing the entire organisation because once the manager shows a positive attitude towards emerging technologies, he has the power to influence the whole organisation (Sugandini, Effendi and Istanto 2020: 46). However, resistance to change also influences SMEs in manufacturing in their decision to adopt emerging technologies as they fear the complexity thereof and lack of confidence in its use (Haseeb *et al.* 2019: 2).

The literature reviewed found that social factors such as lack of business skills associated with education, have an influence on manufacturing SME inclination to adopt emerging technologies. This affects the lifespan of SMEs operating in the industry, due to lack of adequate skills for business and education (Ngibe and Lekhanya 2019: 1) Managerial competencies were also found to influence manufacturing SMEs, with regard to skills, ability and behaviour required to complete tasks on a managerial level (Velu and Manxhari 2017: 59). Managerial competencies influence the performance of SMEs in the manufacturing industry because success or failure of business performance depends on managerial competencies and their effectiveness. In other words, managerial competences play major role in manufacturing SMEs.

Crime is another factor found in the review of literature regarding the adoption of emerging technologies by manufacturing SMEs. Chetty and Sherefedin (2018: 152) pointed out that the high crime rate in SA, particularly the eThekweni District municipality, influences the ability of manufacturing SMEs to adopt emerging technologies. It is reported by the SAPS that different types of crime dropped in 2018, while business crime was on the increase. Leboea (2017: 40) reviewed that the issue of crime in the eThekweni District municipality has resulted in performance failure due to manufacturing SMEs spending much time addressing crime issues, while business suffers.

The study of literature further found that manufacturing SMEs in the eThekweni District Municipality are influenced by innovation challenges to grow and adopt emerging technologies. Innovation challenges include infrastructure, labour skills shortages, lack of knowledge, cost of emerging technologies and lack of finance.

These innovation challenges hinder the growth of manufacturing SMEs, with infrastructure such as power supply negatively impacting eThekweni District municipality manufacturing SMEs. The loadshedding that disrupt operations hinders performance. This is supported by Degefa (2017: 28), who states that power supply makes production runs slow and inefficient.

Lack of skilled staff can cause manufacturing SMEs to fall behind, as emerging technology requires advanced skills. Lack of knowledge regarding the benefits of emerging technology and investment in development research plays a crucial role in innovation by emerging technologies. Challenges faced by SMEs include the high cost of emerging technologies, which hinders them to make use of it. This is due to lack of finance to afford these emerging technologies. The literature revealed the lack of finance as one of the major constraints to the manufacturing SMEs operating in the eThekweni District Municipality.

The literature review considered the issue of Covid-19 as one of the other challenges faced by manufacturing SMEs. Prior to Covid-19, SEDA (2016) reported that SA SMEs were constrained by a lack of funding, high rate of crime and insufficient support from government. The Covid-19 pandemic has compounded these challenges, which in turn, decrease the performance of SMEs resulting in inefficient affordability.

Finally, the literature review findings reflected financial support as the main issue for manufacturing SMEs to take advantage of emerging technologies and innovate. Ambad, Andrew and Amit (2020: 8) found the lack of financial support to be a common issue in all other countries. SA SMEs remain challenged by a lack of finance, since it is difficult to obtain funding with financial sources hesitant to fund them. This results in manufacturing SMEs in the eThekweni district municipality lagging in employing emerging technologies, due to the lack of funds for adoption and implementation.

5.4 CONCLUSIONS

The conclusion that follows is drawn from the research study, based on the findings of manufacturing SME owner perceptions whether emerging technologies will replace their work.

- It can be concluded from this study that respondents in the eThekweni District Municipality who are manufacturing SME owners, do not think emerging technologies will replace their work. This is confirmed by 24.7 percent respondents who disagreed and 24.3 who strongly disagreed with the statement.

The following conclusion was drawn from the study findings with regard to manufacturing SMEs receiving proper training from the SA Government, the need for training and the need for government intervention regarding emerging technologies:

- The study results concluded that respondents are not offered proper training by the SA Government. This is validated by 55.7 percent of the respondents that disagreed with the statement pertaining this.

Based on the following conclusion drawn from the study findings, there is a need for proper training for manufacturing SMEs regarding emerging technologies:

- The research results concluded that respondents do need training based on emerging technologies in the eThekweni District Municipality. This is verified by 48 percent of the respondents that indicated they do need proper training regarding emerging technologies.

The study findings whether there is a need for government interventions towards adoption of emerging technologies by manufacturing SMEs in the eThekweni District Municipality reveal that:

- The conclusion drawn, based on response analysis, shows that manufacturing SMEs need government intervention to assist them in adopting emerging

technologies. Some respondents stated that it could be training or funding that can assist them to adopt and implement emerging technologies. This is confirmed by 48.7 percent of the respondents that strongly agreed with a need for government interventions in assisting manufacturing SMEs with the adoption of emerging technologies.

The below conclusion was drawn from the study results, which questioned whether social factors affect manufacturing SME growth and adoption of emerging technologies:

- The results of the study confirmed that respondents are not affected by socio-cultural factors. This is validated by 44.3 percent of the respondents that agreed socio-cultural factors are not influencing them in adopting emerging technologies. Whether beliefs or values, none of these affect the manufacturing SMEs in the eThekweni District Municipality.

The conclusion below was drawn from the research findings whether global factors such as legal issues and technology impact manufacturing SMEs in the eThekweni District Municipality:

- The study concluded that respondents are not impacted by global factors such as legal issues and technology. The percentage of 39.7 of the respondents that disagreed with the statement about global factors validates the conclusion.

The research finding regarding whether financial factors impact SMEs in the eThekweni District municipality to grow and innovate with emerging technologies, concluded the following:

- The study concluded that financial factors are a major contributor to manufacturing SMEs in the eThekweni District Municipality to grow and innovate with emerging technologies. This is reflected by a percentage of 57,3 of the respondents that agreed with this statement.

The following conclusion was drawn regarding whether technological factors impact the innovation of manufacturing SMEs.

- The research concluded that technological factors impact manufacturing SMEs to innovate with emerging technologies in the eThekweni District Municipality. This was validated by 37.7 percent of the respondents that strongly agreed with the statement about technological factors.

The finding below shows the significant role emerging technologies may have in the development of SMEs in the manufacturing sector:

- The conclusion is based on 37.3 percent of the respondents that agreed with the statement; therefore, emerging technologies will have a significant role in developing manufacturing SMEs in the eThekweni district municipality.

The following finding drawn from the study shows that manufacturing SMEs in the eThekweni district municipality are prepared to change their business models and operation strategies to be in line with emerging technologies:

- The study findings confirmed that SMEs in the eThekweni District Municipality are prepared for emerging technologies, with 36 percent of the respondents that strongly agreed with this statement.

The following conclusions were drawn from the study regarding the statement of strategies, business models and operation strategies that need to be employed and restructured:

- The study results indicate that strategies such as digitalisation will need to be employed. This is reflected by 28.3 percent of the respondents that agreed. While results regarding the business models and operation strategies show that this will need to be restructured, with 32.3 percent of the respondents that agreed with the statement.

The conclusion below drawn from the study results shows that emerging technologies will lead to higher productivity and enable international relationships in manufacturing SMEs:

The study indicated that emerging technologies would lead to high productivity in eThekweni district municipality SMEs, particularly in the manufacturing sector. This is evident by 49.3 percent of the respondents that agreed with this statement. Furthermore, the results regarding international relationships shows 43 percent of the respondents that with the statement. This concluded that emerging technologies would enable international relationships with manufacturing SMEs in the eThekweni district municipality.

The following conclusion drawn from the findings indicates a need to train employees, for information regarding emerging technologies, and a need for collaboration of all stakeholders in the manufacturing sector about emerging technologies:

- The study findings reveal a need for training of employees to be retained. This was confirmed by 55 percent of the respondents that agreed with this statement. The conclusion regarding the need for information also indicates agreement by respondents, with a percentage of 53 of the respondents. Finally, the conclusion with regard to the need for collaboration of all stakeholders shows that manufacturing SMEs need to collaborate so they can help each other regarding emerging technologies. This is validated by 49.3 percent of the respondents that agreed regarding the statement.

Below is the conclusion drawn from the study results pertaining to manufacturing SME owner perceptions about emerging technologies. This includes perceiving emerging technologies as a disruption tool, as well as a means of gaining competitive and global competitive advantage.

- The study results indicate that, on the one hand, manufacturing SMEs do not see emerging technologies as a disruption tool that will vanish their business.

This is concluded by 25.7 percent who disagreed with the statement. On the other hand, SMEs perceive emerging technologies as a tool for gaining competitive advantage, as 36 percent agreed with the statement. Moreover, manufacturing SME owner-respondents agreed that emerging technologies could allow them to gain global competitive advantage. It can be concluded that emerging technologies would be the tool for SMEs to gain global competitive advantage, with 34 percent that agreed with the statement.

The study findings concerning challenges of finance showed it to be the biggest obstacle for manufacturing SMEs in the eThekweni District Municipality, while awareness of the benefits regarding adoption of emerging technologies was another challenge.

- This is confirmed by the results showing that SMEs are constrained by finances and the awareness of benefits to adopt and implement emerging technologies; confirmed by 56.3 percent of the respondents who agreed with the statement.

5.5 IMPLICATIONS OF THE STUDY

The study highlights many critical factors influencing manufacturing SMEs in the eThekweni District municipality in the adoption of emerging technologies.

5.6 RECOMMENDATIONS

The recommendations below are made, constructed on the study findings:

- It is recommended that the SA Government should offer proper training to manufacturing SMEs in the eThekweni district municipality regarding emerging technologies. This was supported by the number of respondents who agreed with the statement that they need proper training. Appropriate training will also help those who think emerging technologies will replace their work, as well as providing manufacturing SMEs with the benefits of using emerging technologies in their businesses.

- The study recommends that manufacturing SMEs should apply for grant-funding from the SA Government and other sources of funds. This will assist in their adoption of emerging technologies.
- It is further recommended that manufacturing SMEs in the eThekweni District municipality should invest in new technology. This can be done by equipping their staff with skills to be in line with new technologies, for example, registering for short and long-term courses about emerging technologies.
- The study results have shown that one of the constraints in manufacturing SME adoption of emerging technology is the lack of information pertaining to it. The recommendation is that all businesses, whether small or large enterprises, should collaborate and provide each other with information. All stakeholders in the manufacturing sector should thus come together to form a collaboration in sharing information about emerging technologies.

5.7 LIMITATIONS OF THE STUDY

The research study was conducted in the eThekweni District municipality, focusing only on leaders, managers and owners of manufacturing SMEs. Only the district of the eThekweni municipality has been covered. While other districts were not covered by the study, districts can learn lessons from each other. Moreover, the study employed a questionnaire with closed-ended questions to collect data from respondents. The purpose in using this type of question was to pre-establish formulated statements from an in-depth literature review and the objectives of the research. The researcher's perception was limited by this method, which was used to gain respondent perceptions to some extent.

5.8 RECOMMENDATIONS FOR FUTURE RESEARCH

Based on the study findings, it is recommended that for future research, the following should be considered:

- Additional information is needed as to the manner in which manufacturing SME growth will be influenced by emerging technologies.
- Further research should also be conducted to establish whether and in what way Government support procedures impact manufacturing SME innovation and sustainability. This kind of research can provide a comprehensible picture

of Government support and its roles in developing and supporting manufacturing SMEs to adopt emerging technologies.

- A crucial analysis of inexpensive technological growth strategies needs to be done. This will assist manufacturing SMEs to invest in appropriate advances of emerging technologies and to view it as a crucial tool for gaining competitive advantages.
- Further research should additionally be carried out on Government systems and financial support structures, as they influence the growth of manufacturing SMEs. This will assist in understanding financial constraints that challenge manufacturing SMEs.
- Another aspect requiring further investigation involves innovative business strategies that influence the adoption and implementation of emerging technologies. This type of research will allow manufacturing SMEs to better understand how they can be innovative through the use of emerging technologies and achieve improved performance.

5.9 CONCLUSION

Based on this research, the main focus of this final chapter was to provide a summary of findings for the study in relation to the reviewed literature, offer conclusions drawn from the findings, along with recommendations and suggestions for future further studies.

As anticipated, results revealed that most respondents, representative of manufacturing SME owners in the eThekweni District Municipality, indicated their enterprises were still at an infant stage where emerging technologies were concerned. This can be attributed mostly to financial constraints and inadequate skills and expertise, principally with regard to SMEs' inability to afford emerging technologies. Nonetheless, these small enterprises do make use of and aim at future use of emerging technologies, such as mobile business communication, computer devices, the cloud and emails. KZN manufacturing SMEs would, therefore, benefit from training programmes that will offer skills in emerging technologies, while also encouraging their innovative use to gain competitive edge and market share, with available and affordable finances to acquire these technologies.

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ANNEXURE A

Letter of Participation



Hello.

I am a registered student at the Durban University of Technologies in the Department of Entrepreneurial Studies and Management. I am currently pursuing a master's degree.

I would like to invite you to participate in the research, I shall be grateful if you could please complete the attached questionnaire. The questionnaire should take approximately 15 minutes to complete and requires only a cross next to the relevant response and some written comments. You can be assured that your response will receive the utmost confidentiality and will not be divulged to any other person. Besides, a summary of the response to the questionnaire, once collected, will be forwarded to you.

Title of the Research Study: Influence of emerging technologies on Small and Medium Manufacturing Enterprises in eThekweni District Municipality.

You can ask as many questions as you wish because it is important that you fully understand the study. You are entitled to discuss the study with your family and friends and are under no obligation to commit at this stage. For this purpose, a copy of the Letter of Information document is given to you to take home.

Outline of the Procedures: You will be required to answer the questionnaire sent to you by the researcher through the use of email due to COVID-19 situation, inclusions will be Small and Medium Manufacturing Enterprises with 50-250

employees, operating in eThekweni District Municipality (managers/ owners and employees), exclusions will be Small and Medium Enterprises that do not fall under manufacturing SMEs at the eThekweni Municipality. For this study a self-completion closed-ended 5-point Likert scale questionnaire will be used for collecting and gathering data. The researcher will do the follow-up via emails to check if you have questions and if you need any clarifications. The study will require 15-20 minutes for you to fill and finish the questionnaire. You are expected to answer the questionnaire using strongly agree, agree, strongly disagree, and disagree as well as 5 first questions where you choose the correct answer from given multiple-choice questions. This study will use the probability whereby simple random sampling will be adopted.

Your co-operation in assisting me with this vital part of my study is highly appreciated and I take this opportunity of thanking you in advance for enabling me to complete this research project.

Yours sincerely

Lindokuhle Senamile Ntuli

Research candidate

Email: 20613550@dut4life.ac.za

DECLARATION BY RESPONDENT

I hereby agree to participate in the completion of this questionnaire

Signature of respondent _____

ANNEXURE B



QUESTIONNAIRE

Instructions: Please complete the following questionnaire relating to your experience by making a tick (X) next to the appropriate answer below.

1. In which part of eThekweni District Municipality is your business situated?

1	South coast	1
2	Durban Central	2
3	Umhlanga	3
4	Other	4

2. What type of manufacturing SMEs are you owning? (**Please tick one**)

Food	1
Clothing	2
Furniture	3
Steel	4
Jewellery	5
Beverages	6
Sanitary	7
Other	8

3. How many employees are in your company?

1-50	
More than 50-150	
More than 150-200	

4.How many years have you been operating in this business?

Less than 1 year	
1-2 years	
3-5 years	
6-8 years	
More than 10 years	

5.What is your gender?

Male	
Female	
Other	

	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
6.	Manufacturing SMEs owners at the eThekweni District Municipality think emerging technologies will replace their work					
7.	SMEs at the eThekweni District Municipality have proper training offered to them by Government for growth regarding on how to adapt to emerging technologies					
8.	SMEs employees and owners require proper training about emerging technologies to survive					
9.	There are socio-cultural factors such as beliefs and values affecting the eThekweni District Municipality SMEs to grow and adopt emerging technologies					

10. Financial factors are impacting the eThekweni District Municipality SMEs towards adapting emerging technologies to grow and innovate

11. Technological factors are affecting the innovation of eThekweni District Municipality SMEs to adopt emerging technologies

12. There is a significant role that emerging technologies may have towards the development of the SMEs at eThekweni District Municipality

13. The eThekweni District Municipality SMEs in the manufacturing industry are prepared for emerging technologies in terms of changing their operation strategies and business models to be in line with emerging technologies.

14. There are strategies such as digitization of business process and automation of machines that need to be employed to enhance SMEs at eThekweni District Municipality to adopt emerging technologies

15. There are business models such as traditional supply chain to digitalised supply chain that needs to be restructured by SMEs at the eThekweni District Municipality to adapt to emerging technologies

16.	There is a need for interventions that are prepared by the Government to assist SMEs of the eThekweni District Municipality to adopt emerging technologies					
17.	There are global factors such as legal issues and technologies that impact the eThekweni SMEs to adapt to emerging technologies					
18.	Emerging technologies will lead to high productivity to eThekweni District Municipality SMEs					
19.	There is a need for training of employees by SMEs towards emerging technologies to be retained in the eThekweni District Municipality Manufacturing SMEs					
20.	SMEs at the eThekweni District Municipality perceive emerging technologies as the disruption that will					

ANNEXURE C



26 September 2021

Student number: 20613550

Dear Ms LS Ntuli

MASTER OF MANAGEMENT SCIENCES: BUSINESS ADMINISTRATION

This serves to confirm the approval of your research proposal by the Faculty Research Committee, at its meeting on 26th November 2020, as follows:

1. Research proposal and provisional dissertation title:
The influence of emerging technology on manufacturing Small and Medium, Enterprises at the eThekweni District Municipality.

Supervisor: **Dr L.M. Lekhanya**

Co-supervisor: **N/A**

Please note that any proposed changes in the thesis/dissertation title require the approval of your supervisor/s, the Faculty Research Committee, as well as ratification thereof by the Higher Degrees Committee.

2. Research budget to the amount of **R10 000.00**
Please note that this funding is not a scholarship or bursary and is therefore not paid directly to you, but is controlled by the Faculty. Any proposed changes to the use of this funding allocation requires the approval of your supervisor and the Dean. Please note that funding will be reimbursed to you after the provision of receipts.

The Institutional Research Committee has stipulated that:

- (a) This University retains the ownership of any Intellectual Property (patent, design, etc.) registered in respect of the results of your Masters/Doctors Degree in Technology studies as a result of the award and the provisions of the above Act;
- (b) Should you find any of the terms above not acceptable then you are given the option to decline the Research budget award to your project in writing.

On completion of this process, the Arbiters report will be tabled at FRC and ratified at HDC.

9. Results of the Arbitration process will be communicated to your supervisor

Graduation requirements:

1. Ensure that you submit a completed signed PG10 form
2. one hard bound dissertation/thesis with a pdf version on CD
3. response to post graduate examination form
4. completion of study form (IREC form)

Should you experience any problems relating to your research, your supervisor must be informed of the matter as soon as possible. If the difficulties persist, you should then approach your Head of Department and thereafter the Faculty Research Coordinator. Please refer to the 2020 General Rule Book and the Postgraduate Students' Guide 2020 concerning the rules relating to postgraduate studies, which include *inter alia* acceptable minimum and maximum timeframes, submission of thesis/dissertations, etc. Please do not hesitate to contact this office for any assistance. We wish you success in your studies.

Kind regards,



Professor FG Netswera
Faculty of Management Sciences

ANNEXURE D



2nd Floor, Berwyn Court
Gate 1, Steve Biko Campus
Durban University of Technology

P O Box 1334, Durban, South Africa, 4001
Tel: 031 373 2375
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http://www.dut.ac.za/research/institutional_research_ethics
www.dut.ac.za

21 April 2021

Ms L S Ntuli
P.O. Box 712
Kwangwanase
3973

Dear Ms Ntuli

Influence of emerging technologies on Small and Medium Manufacturing Enterprises in eThekweni District Municipality

I am pleased to inform you that PROVISIONAL APPROVAL has been granted to your proposal subject to:

□

Piloting of the data collection tool. Please note that should there be any changes to the data collection tool, in a letter signed by the researcher and supervisor, list the changes to the documents and submit to IREC with the final data collection tool. Even when there are no changes to the data collection tool, IREC has to be notified.

PLEASE NOTE THAT THIS IS NOT A FINAL APPROVAL LETTER. KINDLY SUBMIT THE ABOVE-MENTIONED DOCUMENTS WITHIN THREE MONTHS TO THE IREC OFFICE. DATA COLLECTION CAN ONLY COMMENCE WHEN IREC ISSUES FULL APPROVAL

The Proposal has been allocated the following Ethical Clearance number IREC 041/21. Please use this number in all communication with this office.

Approval has been granted for a period of ONE YEAR, before the expiry of which you are required to apply for safety monitoring and annual recertification. Please use the Safety Monitoring and Annual Recertification Report form which can be found in the Standard Operating Procedures [SOP's] of the IREC. This form must be submitted to the IREC at least 3 months before the ethics approval for the study expires.

Yours Sincerely

Prof J K Adam

Chairperson: IREC

ANNEXURE E

Frequency tables

Testing for reliability

Reliability Statistics

Cronbach's Alpha	N of Items
.704	26

ANOVA with Cochran's Test

		Sum of Squares	df	Mean Square	Cochran's Q	Sig
Between People		1233.515	299	4.125		
Within People	Between Items	5325.057	25	213.002	2761.952	.000
	Residual	9134.981	7475	1.222		
	Total	14460.038	7500	1.928		
Total		15693.554	7799	2.012		

Grand Mean = 3.51

Table 4.1: Location of business

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	South Coast	54	18.0	18.0	18.0
	Durban	105	35.0	35.0	53.0
	Central				
	Other	141	47.0	47.0	100.0
Total		300	100.0	100.0	

Table 4.2: Type of manufacturing SMEs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Food	17	5.7	5.7	5.7
	Clothing	124	41.3	41.3	47.0
	Furniture	36	12.0	12.0	59.0
	Steel	23	7.7	7.7	66.7
	Jewelry	14	4.7	4.7	71.3
	Sanitary	8	2.7	2.7	74.0
	Other	78	26.0	26.0	100.0
Total		300	100.0	100.0	

Table 4.3: Number of employees

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-50	280	93.3	93.3	93.3
	More than 50-150	17	5.7	5.7	99.0
	More than 150-200	3	1.0	1.0	100.0
Total		300	100.0	100.0	

Table 4.5: Years of business operation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 1 year	14	4.7	4.7	4.7
	1-2 years	33	11.0	11.0	15.7
	3-5 years	61	20.3	20.3	36.0
	6-8 years	44	14.7	14.7	50.7
More than 10 years	148	49.3	49.3	100.0	
Total		300	100.0	100.0	

Table 4.5: Gender of participants

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	115	38.3	38.3	38.3
	Male	184	61.3	61.3	99.7
	Other	1	.3	.3	100.0
Total		300	100.0	100.0	

Table 4.6: Manufacturing SME owner perceptions

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	61	20.3	20.3	20.3
	Disagree	73	24.3	24.3	44.7
	Neutral	45	15.0	15.0	59.7
	Agree	47	15.7	15.7	75.3
	Strongly agree	74	24.7	24.7	100.0
Total		300	100.0	100.0	

Table 4.7: Training offered by Government

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	55	18.3	18.3	18.3
	Disagree	167	55.7	55.7	74.0
	Neutral	24	8.0	8.0	82.0
	Agree	32	10.7	10.7	92.7
	Strongly agree	22	7.3	7.3	100.0
Total		300	100.0	100.0	

Table 4.8:P Owners and employees need proper training

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	12	4.0	4.0	4.0
	Disagree	45	15.0	15.0	19.0
	Neutral	18	6.0	6.0	25.0
	Agree	81	27.0	27.0	52.0
	Strongly agree	144	48.0	48.0	100.0
Total		300	100.0	100.0	

Table 4.9: Socio-cultural factors

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	10	3.3	3.3	3.3
	Disagree	133	44.3	44.3	47.7
	Neutral	60	20.0	20.0	67.7
	Agree	55	18.3	18.3	86.0
	Strongly agree	42	14.0	14.0	100.0
Total		300	100.0	100.0	

Table 4.10: Financial factors

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	6	2.0	2.0	2.0
	Disagree	31	10.3	10.3	12.3
	Neutral	32	10.7	10.7	23.0
	Agree	59	19.7	19.7	42.7
	Strongly agree	172	57.3	57.3	100.0
Total		300	100.0	100.0	

Table 4.11: Technological factors

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	7	2.3	2.3	2.3
	Disagree	69	23.0	23.0	25.3
	Neutral	33	11.0	11.0	36.3
	Agree	71	23.7	23.7	60.0
	Strongly agree	120	40.0	40.0	100.0
Total		300	100.0	100.0	

Table 4.12: Significant role of emerging technology

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	8	2.7	2.7	2.7
	Disagree	41	13.7	13.7	16.3
	Neutral	42	14.0	14.0	30.3
	Agree	96	32.0	32.0	62.3
	Strongly agree	113	37.7	37.7	100.0
Total		300	100.0	100.0	

Table 4.13: SME preparedness for emerging technology

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	14	4.7	4.7	4.7
	Disagree	51	17.0	17.0	21.7
	Neutral	46	15.3	15.3	37.0
	Agree	81	27.0	27.0	64.0
	Strongly agree	108	36.0	36.0	100.0

Table 4.14: Adoption of digitalisation and automation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	9	3.0	3.0	3.0
	Disagree	55	18.3	18.3	21.3
	Neutral	77	25.7	25.7	47.0
	Agree	85	28.3	28.3	75.3
	Strongly agree	74	24.7	24.7	100.0
Total		300	100.0	100.0	

Table 4.15: From traditional to digitalised supply chain

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	5	1.7	1.7	1.7
	Disagree	58	19.3	19.3	21.0
	Neutral	72	24.0	24.0	45.0
	Agree	97	32.3	32.3	77.3
	Strongly agree	68	22.7	22.7	100.0
Total		300	100.0	100.0	

Table 4.16: Government intervention

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	5	1.7	1.7	1.7
	Disagree	26	8.7	8.7	10.3
	Neutral	37	12.3	12.3	22.7
	Agree	86	28.7	28.7	51.3
	Strongly agree	146	48.7	48.7	100.0
	Total	300	100.0	100.0	

Table 4.17: Global factors

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	5	1.7	1.7	1.7
	Disagree	119	39.7	39.7	41.3
	Neutral	58	19.3	19.3	60.7
	Agree	65	21.7	21.7	82.3
	Strongly agree	53	17.7	17.7	100.0
Total		300	100.0	100.0	

Table 4.18: Emerging technology will lead to high productivity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	6	2.0	2.0	2.0
	Disagree	19	6.3	6.3	8.3
	Neutral	32	10.7	10.7	19.0
	Agree	95	31.7	31.7	50.7
	Strongly agree	148	49.3	49.3	100.0
Total		300	100.0	100.0	

Table 4.19: Training of employees by SMEs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	4	1.3	1.3	1.3
	Disagree	12	4.0	4.0	5.3
	Neutral	23	7.7	7.7	13.0

	Agree	96	32.0	32.0	45.0
	Strongly agree	165	55.0	55.0	100.0
Total		300	100.0	100.0	

Table 4.20: Emerging technology as the disruption

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	68	22.7	22.7	22.7
	Disagree	77	25.7	25.7	48.3
	Neutral	71	23.7	23.7	72.0
	Agree	28	9.3	9.3	81.3
	Strongly agree	56	18.7	18.7	100.0
Total		300	100.0	100.0	

Table 4.21: Gaining competitive advantage

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	5	1.7	1.7	1.7
	Disagree	35	11.7	11.7	13.3
	Neutral	62	20.7	20.7	34.0
	Agree	108	36.0	36.0	70.0
	Strongly agree	90	30.0	30.0	100.0
Total		300	100.0	100.0	

Table 4.22: Need for information about emerging technology

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	.7	.7	.7
	2	19	6.3	6.3	7.0
	3	29	9.7	9.7	16.7

	4	91	30.3	30.3	47.0
	5	159	53.0	53.0	100.0
Total		300	100.0	100.0	

Table 4.23: Collaboration of all Stakeholders

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	23	7.7	7.7	7.7
	3	43	14.3	14.3	22.0
	4	86	28.7	28.7	50.7
	5	148	49.3	49.3	100.0
Total		300	100.0	100.0	

Table 4.24: Relationship with international SMEs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	8	2.7	2.7	2.7
	2	22	7.3	7.3	10.0
	3	65	21.7	21.7	31.7
	4	76	25.3	25.3	57.0
	5	129	43.0	43.0	100.0
Total		300	100.0	100.0	

Table 4.25: Global competitive advantage through emerging technology

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	6	2.0	2.0	2.0
	2	25	8.3	8.3	10.3
	3	67	22.3	22.3	32.7
	4	98	32.7	32.7	65.3
	5	104	34.7	34.7	100.0

Total	300	100.0	100.0	
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Table 4.26: Challenges such as finance obstacles and awareness of the benefits.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3	1.0	1.0	1.0
	2	14	4.7	4.7	5.7
	3	29	9.7	9.7	15.3
	4	85	28.3	28.3	43.7
	5	169	56.3	56.3	100.0
Total		300	100.0	100.0	

SECTION B

Test for associations

Table 4.2: Presentation of results

Questionnaire question/statement	Chi-square	Df	Asymp. Sig
a) 2. What type of manufacturing SMEs are you owning? (Please tick one). * 3. How many employees are in your company? Crosstabulation	10.975 ^a	12	0.531
b) 2. What type of manufacturing SMEs are you owning? (Please tick one). * 4. How many years have you been operating in this business? Crosstabulation	33.880 ^a	24	0.087
c) 2. What type of manufacturing SMEs are you owning? (Please tick one). * What is your gender? Crosstabulation	34.547 ^a	12	0.001
d) 2. What type of manufacturing SMEs are you owning? (Please tick one). * 6. Manufacturing SMEs owners at the eThekweni District	41.047 ^a	24	0.016

Municipality think emerging technology will replace their work Crosstabulation			
e) 2. What type of manufacturing SMEs are you owning? (Please tick one). * 7. SMEs at the eThekweni District Municipality have proper training offered to them by Government for growth regarding on how to adapt to emerging technology Crosstabulation	24.974 ^a	24	0.407
f) 2. What type of manufacturing SMEs are you owning? (Please tick one). * 8. SMEs in eThekweni District Municipality employees and owners need proper training regarding emerging technologies Crosstabulation	24.974 ^a	24	0.407
g) 2. What type of manufacturing SMEs are you owning? (Please tick one). * 9. There are socio-cultural factors such as beliefs and values affecting the eThekweni District Municipality SMEs to grow and adopt emerging technology Crosstabulation	21.852 ^a	24	0.588
h) 2. What type of manufacturing SMEs are you owning? (Please tick one). * 10. Financial factors are impacting the eThekweni District Municipality SMEs towards adapting emerging technology to grow and innovate Crosstabulation	24.814 ^a	24	0.416
l) 2. What type of manufacturing SMEs are you owning? (Please tick one). * 11. Technological factors are affecting the innovation of eThekweni District Municipality SMEs to adopt emerging technology. Crosstabulation	29.063 ^a	24	0.218
j) 2. What type of manufacturing SMEs are you owning? (Please tick one). * 12. There is a significant role that emerging technology may have towards the development of the SMEs in eThekweni District Municipality. Crosstabulation	30.833 ^a	24	0.159

<p>k) 2. What type of manufacturing SMEs are you owning? (Please tick one). * 13. The eThekweni District Municipality SMEs in manufacturing industry are prepared for emerging technology in terms of changing their operation strategies and business models to be in line with emerging technology Crosstabulation</p>	22.889 ^a	24	0.526
<p>L) 2. What type of manufacturing SMEs are you owning? (Please tick one). * 14. There are strategies such as digitalisation of business process and automation of machines that need to be employed to enhances SMEs at eThekweni DistrictMunicipalitytoadoptemerging technologies Crosstabulation</p>	23.266 ^a	21	0.504
<p>M) 2. What type of manufacturing SMEs are you owning? (Please tick one). * 15. There are business models such as traditional supply chain to digitalised supply chain that need to be restructured by SMEs in eThekweni District Municipality. Crosstabulation</p>	29.057 ^a	24	0.218

		p-value of Pearson coefficient statistic																									
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26		
2	1	.531	.087	.001	.016	.047	.047	.058	.041	.021	.011	.015	.015	.022	.011	.019	.019	.011	.010	.011	.010	.013	.012	.016	.010		
3		1	.126	.0285	.0805	.0498	.0773	.0832	.0896	.0760	.0702	.0946	.0966	.0763	.0932	.011	.0924	.0959	.0834	.0738	.0589	.0866	.0544	.0722	.0598		
4			1	.290	.0628	.0512	.0587	.0687	.0712	.0829	.0435	.0254	.0352	.0814	.0512	.0270	.0745	.0770	.0132	.0179	.0881	.0141	.0476	.0706	.0223		
5				1	.100	.0787	.0824	.010	.0506	.0593	.0267	.0222	.0763	.0100	.0933	.0100	.0326	.0473	.0101	.0103	.0149	.0676	.0456	.0424	.0579		
6					1	.000	.000	.000	.0004	.0095	.0346	.0222	.0429	.0198	.0165	.0100	.0168	.0123	.0100	.0116	.0286	.0113	.0149	.0109	.0127		
7						1	.000	.000	.000	.0011	.0006	.0001	.0001	.0001	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0172	.0104	.0199	.0101		
8							1	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		
9								1	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.0466	.0140	.0108	.0132		
10									1	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		
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													1	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		
														1	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		
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1										00	00	00	00	00	03	00	00	59	23	00	00	00	00	07
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2											00	00	00	00	00	00	00	53	00	00	00	00	00	00
1											1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3												00	00	00	00	00	00	00	00	00	00	00	00	00
1												1	.0	.0	.0	.0	.0	.1	.0	.0	.0	.0	.0	.0
4													00	00	00	00	00	93	00	03	00	01	12	03
1													1	.0	.0	.0	.0	.4	.0	.0	.0	.0	.0	.0
5														00	00	00	00	22	00	00	01	00	02	04
1														1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
6															00	00	00	01	01	00	00	00	00	00
1															1	.0	.0	.0	.0	.0	.0	.0	.0	.0
7																00	00	08	20	11	00	00	03	00
1																1	.0	.0	.0	.0	.0	.0	.0	.0
8																	00	00	00	00	00	00	00	00
2																	1	.0	.0	.0	.0	.0	.0	.0
9																		05	06	00	00	00	06	00
2																		1	.0	.0	.0	.0	.0	.0
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2																			1	.0	.0	.0	.0	.0	
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6																									

Factor analysis

Table 2: Factors loading at 1

PREPAREDNESS OF SMEs	1
The eThekwini District Municipality SMEs in manufacturing industry are prepared for emerging technology in terms of changing their operation strategies and business models to be in line with emerging technology	0.771
There is a significant role that emerging technology may have towards the development of the SMEs in eThekwini District Municipality.	0.736
Emerging technology will lead to high productivity to eThekwini District Municipality SMEs.	0.719
There are strategies such as digitalisation of business process and automation of machines that need to be employed to enhances SMEs at eThekwini District Municipality to adopt emerging technologies	0.705

Table 3 shows the factors loading on factor 2

SKILLS	2
SMEs at the eThekwini District Municipality have proper training offered to them by Government for growth regarding on how to adapt to emerging technology	0.813
Manufacturing SMEs owners at the eThekwini District Municipality think emerging technology will replace their work	0.800

ANNEXURE F

Turnitin Report

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ANNEXURE G

Editor's Letter

Helen Richter
Advanced Editing,
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feetieding@mail.com
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22 September 2021

To whom it may concern

CERTIFICATE OF EDITING & AUTHENTICATION

I have proofread and language edited the Master's thesis titled:

“The Influence of Emerging Technologies on Small and Medium Manufacturing Enterprises in Ethekewini District Municipality of Kwazulu-Natal”

by

Lindokuhle Senamile Ntuli

To the best of my knowledge, the work remains free of spelling, grammar, structural and stylistic errors and the contents are certified as the author's own work.

With thanks.

H. S. Richter
