A Roadmap to support SMEs in the SADC Region to Prepare for Digital Transformation

by

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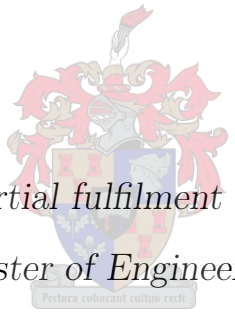

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Declaration

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Abstract

The limited industrialisation and the underdeveloped economic sector in the SADC create harsh business environments for SMEs to operate in. Illiteracy and low education levels among the population hinder the manufacturing sectors' productivity and its ability to absorb new technologies. This contributes to the creation of a negative impact on the diversification of manufactured goods in the entire economy. Further challenges that hinder industrial growth within the SADC include the restrained access to capital and skilled labour, a poor administrative system and access to markets, as well as significantly underdeveloped physical- and technological infrastructure.

A concept that shows great potential to address and improve SADCs current situation is Digital Transformation (DT). DT allows overall improvement of processes, faster and cost-efficient production of high-quality products, increases the product range by responding faster to market changes and enables the customisation of products. By adopting newer technologies and optimising business operations, companies gain a competitive edge, allowing them to re-position themselves within today's highly competitive market. However, due to limited knowledge, understanding, and guidance about transforming a business digitally, SME leadership tends to feel overwhelmed. SME leadership often does not know where to start and how to approach such a project. By identifying the challenges that contribute towards the underdeveloped economic sector in the SADC, it was found that the regions' SMEs show significant weaknesses within the following internal business areas: company strategy, employees, customers, organisational culture, and digital environment. These business areas are majorly influenced during and after a DT.

The purpose of this research revolved around developing a DT roadmap that enlightens SME leadership about the most important factors that must be taken into consideration during a DT endeavour. By providing a structured approach and incorporating management tools and techniques, SME leadership can break down a DT endeavour into

simple and manageable tasks. Industry experts and SMEs situated in the region were consulted to gain valuable feedback about the roadmap. By using an iterative development approach, the roadmap was adjusted to construct a more suitable roadmap version for SMEs in the SADC. It was, however, found that the underdeveloped skill level in the SADC is even worse than initially expected. This was highlighted when implementing the roadmap, where SME owners and managers expressed the need for additional support and assistance from a consultant to guide them. However, the need for and value of the roadmap was highly appreciated.

Opsomming

Die beperkte industrialisering en die onderontwikkelde ekonomiese sektor in die SAOG skep moeilike sakeomgewings vir KMOs om in te werk. Ongeletterdheid en lae onderwysvlakke onder die bevolking belemmer die vervaardigingsektore se produktiwiteit en die vermoë om nuwe tegnologieë op te neem. Dit dra by tot die skep van 'n negatiewe impak op die diversifisering van vervaardigde goedere in die hele ekonomie. Verdere uitdagings wat die nywerheidsgroei in die SAOG belemmer, sluit in die beperkte toegang tot kapitaal en geskoolde arbeid, 'n swak administratiewe stelsel en toegang tot markte, sowel as beduidend onderontwikkelde fisiese en tegnologiese infrastruktuur.

'n Konsep wat groot potensiaal toon om die huidige situasie van SAOG aan te spreek en te verbeter, is Digitale Transformasie (DT). DT laat die algehele verbetering van prosesse toe, bevorder vinniger en koste-effektiewe produksie van produkte van hoë gehalte, maak die aanpassing van produkte moontlik en verhoog die produkreeks deur vinniger te reageer op markveranderings. Deur die aanvaarding van nuwer tegnologieë en die optimalisering van sakebedrywighede, kry maatskappye 'n mededingende voorsprong, wat hulle in staat stel om hulself weer in die huidige sterk mededingende mark te plaas. As gevolg van beperkte kennis, begrip en leiding oor die transformasie van 'n onderneming, is KMO-bestuur egter geneig om oorweldig te voel. KMO-bestuur weet dikwels nie waar om te begin en hoe om so 'n projek aan te pak nie. Deur die uitdagings te identifiseer wat bydra tot die onderontwikkelde ekonomiese sektor in die SAOG, is bevind dat die KMOs van die streke beduidende swakhede toon binne die volgende interne sakegebiede: ondernemingstrategie, werknemers, klante, organisasiekultuur en digitale omgewing. Daar is verder bevind dat hierdie sakegebiede hoofsaaklik beïnvloed word tydens en na 'n DT.

Die doel van hierdie navorsing was om 'n DT-riglyn te ontwikkel wat die bestuur van KMOs bewus maak oor die belangrikste faktore wat tydens 'n DT-onderneming in ag geneem moet word. Deur 'n gestruktureerde benadering te bied en bestuursinstrumente en

tegnieke op te neem, kan KMO-bestuur 'n DT-poging opdeel in eenvoudige en hanteerbare take. Bedryfspraktisyns en KMOs in die streek is geraadpleeg om waardevolle terugvoer oor die riglyn te kry. Deur gebruik te maak van 'n iteratiewe ontwikkelingsbenadering, is die riglyn aangepas om 'n meer geskikte riglynweergawe vir KMOs in die SAOG op te stel. Daar is egter bevind dat die onderontwikkelde vaardigheidsvlak in die SAOG nog slegter is as wat aanvanklik verwag is. Dit is veral uitgelig tydens die implementering van die riglyn, waar KMO eienaars en bestuurders die hulp en assistensie van 'n konsultant nodig geag het om hulle te lei. Die noodsaaklikheid en waarde van die riglyn was egter hoog waardeer.

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List of Acronyms and Abbreviations

BM	Business Model
BSC	Balanced Score Card
CDO	Chief Digital Officer
CSF	Critical Success Factor
DT	Digital Transformation
FNB	First National Bank
GDP	Gross Domestic Product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
ICT	Information and Communications Technology
IoT	Internet of Things
IS	Information System
IT	Information Technology
KPI	Key Performance Indicator
NamLITS	Namibian Livestock Identification and Traceability System
RM	Risk Management
SADC	Southern African Development Community
SLITS	Swaziland Livestock Information and Traceability System
SME	Small Medium Enterprise
VAT	Value Added Tax

Chapter 1

Introduction

This chapter presents an overview of this research study's background and its need. Furthermore, the chapter defines the problem and summarises the objectives that are aimed to be achieved. The scope and limitations of the research are discussed and the approach and methodology are introduced. The chapter ends with the ethical implications that are involved in the thesis and how this document is structured.

1.1 Background

Being part of the Southern African Development Community (SADC) entails various advantages for the member states. The SADC is a close collaboration between 16 countries located in Southern Africa. It was founded in April 1980, where Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia, and Zimbabwe created the Southern African Development Coordination Conference (SADCC) (Fall and Gasealahwe, 2017), (Savela *et al.*, 2018). In 1992, the members decided to transform the coordination conference into a community, hence the new abbreviation, SADC (Fall and Gasealahwe, 2017). The membership increased to 16 when Namibia joined in 1990, South Africa in 1994, Mauritius in 1995, Seychelles and the Democratic Republic of Congo in 1997, Madagascar in 2005, and finally Comoros in 2018 (Fall and Gasealahwe, 2017), (Savela *et al.*, 2018) (Appendix A contains more detail about each member country's profile). The initial aim of the close collaboration was to reduce the economic dependence on South Africa and to deepen the regional integration between the participating countries. Fall and Gasealahwe (2017) claim that further economic integration within the economies may be beneficial for the SADC members, as it contributes towards a significant boost in economic growth. Deeper regional integration can be advantageous, especially for

the landlocked countries as they have access to neighbouring ports and harbours (Fall and Gasealahwe, 2017). Furthermore, greater integration offers the opportunity for larger markets, more jobs, increased trade opportunities, and higher productivity through better resource allocation across member countries (Fall and Gasealahwe, 2017). Another factor that plays a key role in supporting the region to attain economic growth is Small and Medium Enterprises (SMEs) (United Nations, 2018). Most members of the SADC have tried to improve their economies by adopting SMEs as an agent of change, with the main objective of economic growth and regional development (Shihomeka, 2017). The advantage SMEs offer is the fact that they create more job prospects for unskilled labour, as the work is more labour intensive (Van Zyl, 2019). Additionally, SMEs are claimed to be more innovative compared to larger firms (Ardic *et al.*, 2011). To compete within the market, SMEs follow strategies that aim to enhance their product quality, flexibility, and responsiveness to customers (Ardic *et al.*, 2011).

1.1.1 Definition of an SME

Most countries and organisations have a different understanding of the term "SME". In the European Union (EU), organisations are classified as an SME if between 10 and 250 people are employed at the firm and a turnover of less than 50 million Euro is generated annually (Bank of Namibia, 2010). The World Bank, however, classifies an SME as an organisation with less than 200 members. The most common criteria used to define an SME include: the number of employees, the turnover, and the capital employed or the organisation's asset size (Iguna and Sazita, 2018). This definition is illustrated in Table 1.1.

Table 1.1: World Bank SME Definition (Bank of Namibia, 2010)

Company Size	Employees	Asset Size ($)	Annual Sales ($)
Micro	< 10	$< 100\,000$	$< 100\,000$
Small	< 50	< 3 million	< 3 million
Medium	< 200	< 15 million	< 15 million

Following this, no universal definition of SMEs exists. Additionally, the definition is influenced by the industry, geographic location, and country-specific legislation (Iguna and

Sazita, 2018), (The Banking Assiciation South Africa, 2019), which also remains true for the SADC region. Since the region consists of 16 member states, it is easier to describe than to define an SME, as each country has its legislation. While researching each country's definition, it is observed that the majority of countries focus mainly on the number of employees, and omit the annual turnover criteria. Reasons for this include easier data collection, as well as eliminating the effects of currency fluctuations and inflation on the turnover comparisons over time (Darroll, 2012). Therefore, the SME definitions compiled and summarised in Appendix A, only include the number of people employed at such organisations within each country. Additionally, some SME definitions vary according to industry. For this thesis, the manufacturing sector will be the industry of interest.

1.1.2 SMEs and their Role in the Economy

SMEs play a key role in supporting the development and economic growth (Shihomeka, 2017). It is estimated that SMEs represent 90% of businesses and 50% of employment worldwide (The World Bank, 2020). Furthermore, in emerging economies, formal SMEs contribute up to 40% annually towards the Gross Domestic Product (GDP) (The World Bank, 2020). Since the informal sector largely consists of SMEs, these numbers would be significantly higher if informal SMEs were to be included. According to estimates reported by the Bank of Namibia (2010), the informal sector in developing countries accounts for up to 48% of the total labour force and 37% of the GDP. The contribution in developed countries, however, is found to be much lower (25% and 16% respectively). The report further states that SMEs create more jobs than large firms (Bank of Namibia, 2010). This has found to be true, as in South Africa for example, the SME sector is the biggest employer of unskilled labour and is also considered to be more labour intensive than bigger organisations (Van Zyl, 2019).

SMEs show great potential to enhance the SADC region's economic growth and development. Mauritius Business, Enterprise, and Cooperatives Minister considers SMEs as "... the first-stepping stone and an opportunity to realise industrialisation" (United Nations, 2018), where the term industrialisation refers to the transformation of an entirely agrarian-based society to highly mechanised production of raw materials (Madakufambe

and Ngwawi, 2015). Currently, the agricultural sector still plays a vital part in the SADC region, with roughly 70% of SADC's exports consisting of raw materials and agricultural products. These numbers remained relatively constant over the years (Fjose *et al.*, 2010). In other developing countries located in Latin America and Asia, this share has constantly fluctuated (Fjose *et al.*, 2010). Due to SADC's high availability and easy accessibility of natural resources, it is one of the strongest raw material exporters in the world (The Economist, 2017). Furthermore, SADC's resource abundance creates a competitive advantage for its manufacturing sector, as the raw material inputs such as minerals and agricultural products can be sourced locally (Signe, 2018). A developed manufacturing sector allows the possibility to add value to the raw material before being exported, however, most countries are found to be only within the early stages of industrialisation.

Despite SADC's competitive advantage in raw materials, most SADC countries remain among the poorest globally (Madakufambe and Ngwawi, 2015). SADC's manufacturing sector is underdeveloped and struggles to become competitive in today's market. Additionally, the region experiences various kinds of challenges that hinder the process of industrialisation. Examples of such obstacles include the underdeveloped economic sector and the limited downstream value addition of raw materials within the SADC. Illiteracy and low education levels among the population hinder an individual factory's productivity and its ability to absorb new technologies, creating a negative impact on the diversification of manufactured goods in the whole economy (Signe, 2018). Further constraints that challenge the economic sector to grow have been identified while reviewing the literature. Those include the restrained access to capital and skilled labour, a poor administrative system and access to markets, as well as significantly underdeveloped physical and technological infrastructure (McKinnon *et al.*, 2019), (Shihomeka, 2017). Chapter 3 summarises and discusses these challenges in more detail. Another reason that contributes towards SADCs struggles is the fact that more than half of its member states depend on the export of raw materials. For the region to achieve a higher profit margin, the SADC countries must focus on improving product diversification, which can be realised through industrialisation.

1.2 Industrialisation in the SADC

As previously described in Section 1.1, industrialisation is the transformation of an entirely agrarian-based society to highly mechanised production of raw materials (Madakufambe and Ngwawi, 2015). In today's market, customers have become more demanding and their requirements more fastidious. By adding more value to the raw material, this concept provides SADC with the opportunity to grow and become more sustainable. According to the African Development Bank Group (2019), further advantages provided by industrialisation, include:

- **Development:** Industrialisation plays a vital role in development, as it boosts economic activity along value chains while transforming raw materials into finished goods.
- **Trade Balance:** Industry would improve SADCs trade balance as goods would be created for export and would simultaneously replace imports.
- **Productivity:** New equipment and techniques will be introduced, increasing the capabilities of the workforce.
- **Social Stability:** Industry offers the opportunity to generate formal employment, increasing the region's social stability.
- **Education:** Education and training are required to handle new technologies and innovations, which will have a positive impact on the lower workforce.

Realising industrialisation, however, is not an easy task. There are many different aspects SADC must take into consideration throughout the transformation process. For example, as mentioned previously, customers and their expectations have become more demanding. It has become of more importance for companies to offer products and services, specifically designed to meet each customers' personalised expectation, offered at a certain speed and a reasonable price. Furthermore, business transparency has become an essential requirement, as nowadays, customers demand a certain degree of traceability of their purchased goods (Liere-Netheler *et al.*, 2018). One of the most current topics addressing

such requirements is Digital Transformation (DT). DT not only affects the operational value creation process but also enables new ways of conducting business and leads to fundamental changes within organisations (Liere-Netheler *et al.*, 2018). Therefore, it is proposed to make use of this concept to meet these demands and to support the process of industrialisation.

1.2.1 Supporting Industrialisation with Digital Transformation

DT has the potential to address and improve SADCs' current situation of limited downstream value addition and the underdeveloped economic sector (discussed in more detail in Section 3.1 and 3.2). For example, by making use of this concept, overall processes can be improved, as it allows faster and more cost-efficient production of high-quality products. It enables the customisation of products and the increase in product ranges by responding faster to market changes (Robinson, 2019). Furthermore, by adopting newer technologies and optimising business operations, companies gain a competitive edge, allowing them to re-position themselves within today's highly competitive market (Aleksandrova, 2019).

DT, however, is a broad and complex topic (see Chapter 2) and successful realisation and implementation are not always guaranteed. One of the main challenges of this concept is that several factors and complications remain unforeseen before and after the actual implementation. Yet, it is crucial to consider them during the planning phase. Currently, there are limited guidelines that could assist, guide, or support businesses throughout the preparation phase of the concept. Other critical factors include the available skill level of the employees and the capital expenditure required to implement such projects (Tortorella and Fettermann, 2017), (Luthra and Mangla, 2018). Additionally, SMEs do not have a comprehensive adoption strategy and also only a limited amount of resources are available. Furthermore, SMEs do not possess the same financial opportunities and security as large organisations.

Another critical factor is the shortage of skilled workers. SMEs experience difficulties in asserting themselves against larger companies to fill vacancies. This might be problematic for the SADC, as SMEs are of vital importance in supporting economic integration

and growth within the region. SMEs contribute significantly towards their country's GDP (The World Bank, 2020), as well as to job creation and also show a great potential in the move to industrialisation (United Nations, 2018).

Nevertheless, the high failure rate within SADC's SME sector is concerning (Van Zyl, 2019). Olawale and Garwe (2009) have found that 75% of all new businesses in South Africa will not survive beyond 3.5 years. Iguna and Sazita (2018) claim that insufficient managerial skills of the leadership in such organisations contribute significantly towards this failure rate. Therefore, SMEs are mainly focusing on survival rather than on attaining competitive advantage and so tend to lose sight of innovation opportunities and how to realise them (Iguna and Sazita, 2018). Many executives struggle to set and implement digital agendas because they are unsure about the process, topics and setup (Bumann and Peter, 2019). Bumann and Peter (2019) further state that management seems to lack understanding as to what should be investigated and covered when undertaking DT initiatives. However, managers are aware of the need and urgency to react, but they only have limited guidance to determine the right course of action for approaching DT (Barann *et al.*, 2019), (Hess *et al.*, 2019), (Bumann and Peter, 2019). This makes the overall industrialisation process more difficult.

1.3 Problem Statement

Within SADCs manufacturing sector, a need exists for SMEs to improve the region's level of industrialisation to address the issues of poor product diversification and the underdeveloped economic sector (see Subsection 1.2.1). Although DT could potentially address these issues, SMEs focus rather on survival than potential innovation opportunities (Iguna and Sazita, 2018). Furthermore, SME leadership tends to feel overwhelmed regarding DT, due to limited knowledge, understanding, and guidance about transforming a business digitally (Fischer *et al.*, 2020), (Bumann and Peter, 2019). To encourage pro-activity and to support SME leadership in approaching DT, a framework is required to support SMEs in the SADC to implement a DT endeavour in a scientifically valid way but also through pragmatic steps. At present, however, to the best of the researcher's

knowledge, this was found to be a gap in the field as no frameworks could be found that provide such guidance to SMEs in SADC's manufacturing sector.

1.4 Research Scope and Objectives

Based on the information discussed throughout this chapter it was found that the digitalisation of systems could potentially lead to a positive outcome. However, along with their battle for survival, SMEs face numerous challenges in the SADC that hinder their evolution. Due to limited knowledge, understanding, and guidance about transforming a business digitally, SME leadership tends to feel overwhelmed about DT (Fischer *et al.*, 2020). Even if the organisation aspires towards a potential DT endeavour, SME leadership often does not know where to start and how to approach such a project (Barann *et al.*, 2019), (Fischer *et al.*, 2020). Furthermore, they are unaware of the changes and challenges that should be expected throughout and after such an endeavour (Bumann and Peter, 2019).

This study focuses on supporting established SMEs in the manufacturing sector who possess the vision to engage in a DT endeavour. The study aims to develop an applicable framework that encourages pro-activity among SME leadership regarding DT and to support them in approaching this concept systematically. This framework aims to present a simplified procedure to approach DT and provides examples to demonstrate possible completion of each step of the framework.

To support SMEs who aspire towards a DT endeavour, the objective of this research includes to:

1. Identify the internal areas within an organisation that will be affected during a DT.
2. Research the factors contributing to the limited opportunities experienced by SMEs in the SADC region.
3. Identify frameworks and their corresponding models and elements that are required to develop a supporting framework to support SMEs in the SADC with DT.

4. Develop an applicable framework that supports SME leadership in:

    - Understanding the SMEs current business environment and strategy;
    - Determining whether the value gained by their envisioned DT endeavour is worth the effort required (in terms of time, money, etc.);
    - Establishing whether the DT endeavour creates more favourable conditions than experienced in the current situation;
    - Breaking down a DT endeavour into simple and manageable tasks;
    - Raising awareness among SME leadership about the most important factors that must be considered.

1.5 Research Limitations

The research is limited to the SADC context and will mainly be concerned with the different challenges SMEs experience within this region. Although the literature is based on the SADC region, the verification and validation of the actual model are only done by using industry experts and SMEs located in Namibia and South Africa. Additionally, due to the unfortunate situation caused by the COVID-19 pandemic, the validation of the framework was restricted. However, to prove the framework's concept, it was applied to a past digitalisation project that has been realised earlier in 2020.

The DT framework excludes start-up companies, as well as micro-businesses, and will, therefore, assume that the businesses utilising the model are operating for at least five years. Moreover, the DT framework is less suitable for more advanced SMEs. Furthermore, the developed framework does not solve any issues and, therefore, does not provide any recommendations to the user. It further does not aim to convince SMEs in engaging in a digital endeavour but to encourage those who do to follow a systematic approach.

The developed framework serves as a proof of concept, rather than a final product. Even though the framework developed in this research provided reasonable output after being applied and implemented to the case studies, it was found that it is not ideal to be used

by SME owners or managers without external help. Furthermore, the content included in the framework aims to demonstrate only one possible method of representing the data, whereby alternative information, tools, and techniques could be chosen that would be more applicable for a specific organisation.

1.6 Research Approach and Methodology

The research approach consists of three stages. The detailed steps of the different stages are demonstrated in Figure 1.1. The stages are as follows:

Stage 1: The first stage is the literature study. Here, research is conducted on DT, its principles, definitions, and requirements. Moreover, the different factors that lead to limited opportunities for SMEs in the SADC are identified and researched.

Stage 2: This stage follows both, a theoretical and a practical approach to developing an applicable framework. The theoretical approach includes reviewing existing frameworks and corresponding models that can assist SMEs to approach DT. The objective of this study, however, does not include to identify and analyse all possible existing DT frameworks and their corresponding models. However, it is required to gain an overview from a variety of designs and possibly to identify a DT framework or components of DT frameworks that could be used as input in developing an alternative framework that is suitable for SMEs in the SADC. Finally, the framework is designed.

Stage 3: The final stage includes the verification and validation of the developed framework. To check the correctness of the model, experts are consulted. To test the functionality of the framework, SMEs located in the SADC are consulted. Depending on the feedback from either the experts or the SMEs, Stage 2 is revisited to adjust the framework and make the necessary changes. After consulting the SMEs, the output and feedback derived from the process are verified again by consulting the industry experts. By updating the framework according to the received feedback, the design process of the framework can, therefore, be considered as an iterative process.

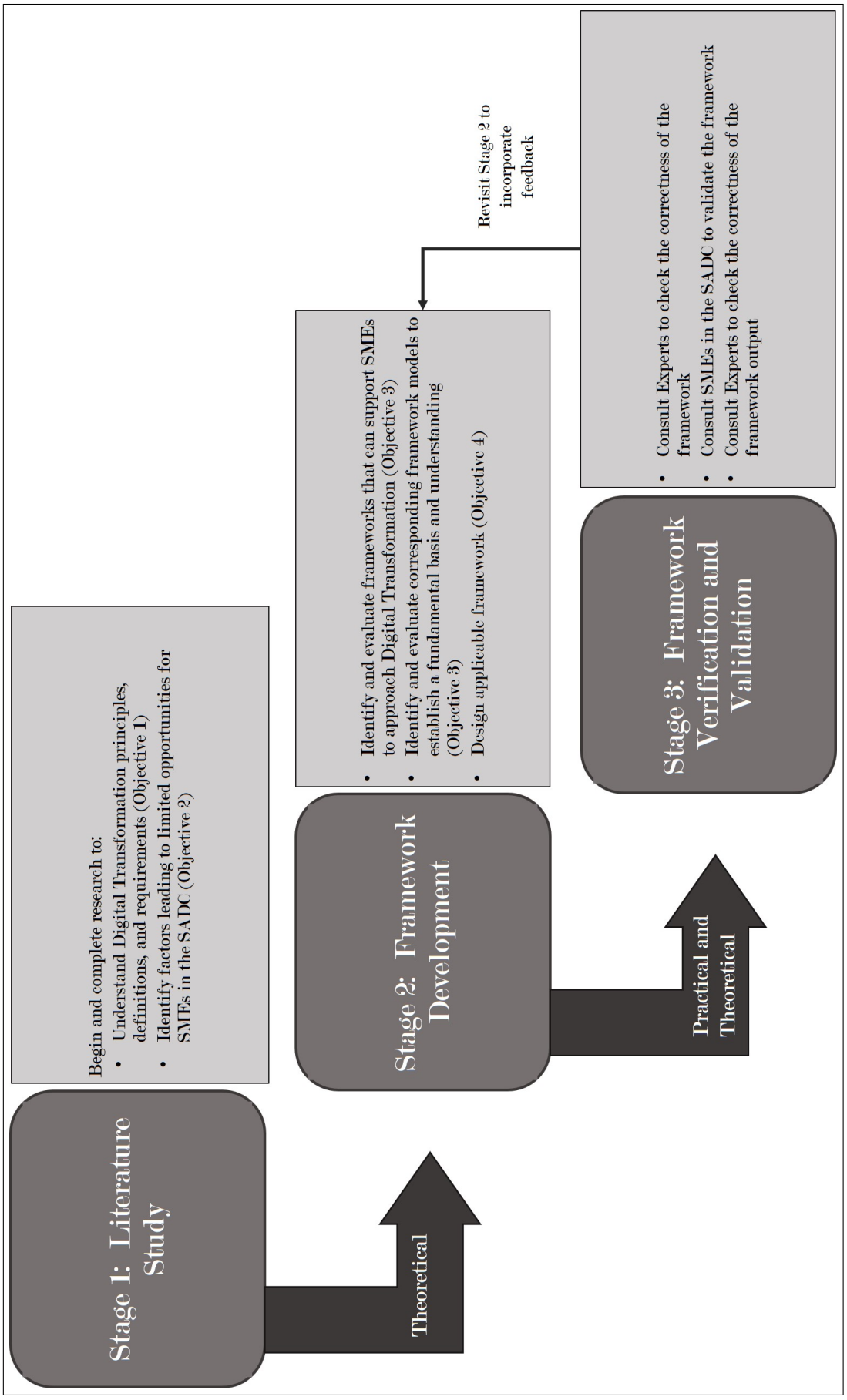

Figure 1.1 Methodology Roadmap

The first stage is mainly concerned with reviewing the literature. This is to create a fundamental basis in order to develop a thorough understanding of DT, what the concept entails and what obstacles most business encounter before and after realising the concept. Furthermore, the challenges experienced by SMEs in the SADC are examined in detail. Next, Stage 2 involves both, a literature review and a practical approach. Different DT frameworks, such as maturity models, readiness assessments, and roadmaps and corresponding models are investigated. The alternative framework is designed within this stage and validated in Stage 3. Using experts in industry and SME case studies, the framework is evaluated, verified, and validated to check the correctness and also test its functionality. According to the feedback from the industry experts and case study SMEs, the framework design was adjusted accordingly in case it was not found to be applicable for SMEs in the SADC.

1.7 Ethical Implications

The ethical implication of this research study is minimal to low. To complete this research study, data was collected from the public domain as well as from individuals working in the industry, and case study organisations. To obtain data from the industry experts and case study organisations, interviews were executed. The data collected includes information regarding the candidates' experience when utilising the model developed in this study. Furthermore, suggestions for improvement have been requested and obtained. To ensure good ethical practice, the project was investigated and cleared by the REC: Humanities department with the project number REC-2020-10557.

1.8 Structure of Thesis

The thesis consists of seven chapters in total. The first chapter summarises the need for the study, states the problem identified, establishes the objectives, scope and limitations, and introduces the methodology of the project. Chapter 2 provides a more expansive view on the concept of DT and identifies the internal areas within an organisation that will be affected during a DT as well as the most common obstacles that hinder businesses

from transforming (Objective 1). Chapter 3 includes research about the different factors that contribute towards the limited opportunities experienced by SMEs in the SADC and further identifies the challenges these organisations experience within the region (Objective 2). Chapter 4 introduces different frameworks and corresponding models that can be used to support businesses through a DT endeavour. Existing models are investigated to determine the content and scope of such a framework (Objective 3). The fifth chapter describes the development process of the final framework (Objective 4). The verification and validation of the framework are presented in Chapter 6. Finally, Chapter 7 highlights the contributions and limitations of this research, as well as possible opportunities for future research.

Chapter 2

Digital Transformation Principles, Definitions, and Requirements

This chapter aims to provide the reader with a fundamental background of DT. Relevant definitions are introduced, followed by a discussion explaining the critical need for DT. Focus is also laid upon the internal areas within the organisations that will be affected during such transformation. To demonstrate the potential of DT in the SADC, practical examples have been selected, researched, analysed, and discussed. The chapter closes with a summary mentioning the different obstacles that hinder businesses to transform successfully.

2.1 Digital Transformation Definition

Digitisation, Digitalisation, and Digital Transformation are the current buzzwords circulating through the global industry. Many different definitions exist and often these words are used interchangeably. Although these terms are closely related and have a lot in common, their definition and scope differ. The following paragraphs summarise the definitions of the previously mentioned terms.

Digitisation:
The process where analogue information is converted from a physical format to a digital one (Burkett, 2017).

Internet of Things (IoT):

The use of connectivity and software to connect a digitised product to the internet. IoT allows physical products to connect to the internet through a processor, modem, or software. This information transferred can be used to control the physical product remotely (Valdez de Leon, 2019).

Digitalisation:

The process of adopting digital technologies such as IoT to:

- Automate business operations or processes to achieve better business outcomes (optimisation) (Bloomberg, 2018).
- Change a business model and provide new revenue by transforming products or services to create new value-producing opportunities (Valdez de Leon, 2019).

A simple example would be storing digital documents on a cloud service, which allows the user to access the information from anywhere in the world. Digitalisation is mainly concerned with isolated projects and processes, where technology is the driver that brings change (Talin, 2020).

Industry 4.0:

Through the use of mechanisation, electricity, and IT systems, the past three revolutions resulted in high productivity increases and significant technical improvements (Müller *et al.*, 2018). However, these traditional manufacturing and production methods are going through a DT process (Deloitte, 2014). The reason for this is the fourth industrial revolution. The fourth industrial revolution, also referred to as Industry 4.0, was introduced in 2011 in Germany (Nunes *et al.*, 2017). By combining optimised industrial manufacturing systems and advanced digital technologies, new production systems have been created (Nunes *et al.*, 2017), (Deloitte, 2014). These production systems make use of cyber-physical systems (CPS), which allow the interaction between digital and physical workflows (Nunes *et al.*, 2017). To enable this interaction, traditional industrial machinery and products are equipped with sensors, microprocessors, ports, antennae, and software for data collection and analysis (Deloitte, 2014). This allows physical processes to be

accompanied by digital ones (Nunes *et al.*, 2017). These virtual processes allow machine-to-machine and human-to-machine communication, autonomous machine learning, and decision-making (Nunes *et al.*, 2017).

Industry 4.0, therefore, can be summarised as applying digital technologies and digitalisation of production processes to transform processes and operations in factories.

Digital Transformation (DT):

A holistic transformation process of an organisation that requires digitalisation as a fundamental basis (Safar, 2020), (Henriette *et al.*, 201). The word "transformation" relates to a fundamental change that takes place throughout an entire organisation, impacting its strategy, structure, and distribution of power (Teichert, 2019). DT is concerned with the consequences and effects of the change that is introduced by the digitalisation process (Burkett, 2017). It is an ongoing process where an organisation adapts to a constantly changing landscape to meet the digital expectations of its customers, employees, and other stakeholders (Teichert, 2019). Digital technologies can transform a company's business models, resulting in changed products or organisational structures, or the automation of processes (Hess *et al.*, 2019). It deals with the question of how companies can use digitalisation to realign corporate strategy and company culture, by focusing on the wishes, needs, and changing behaviour of customers (Safar, 2020). DT requires an organisation to deal with overall change, as the enterprise becomes customer-driven, end-to-end (Bloomberg, 2018). Furthermore, companies have to focus on reshaping customer value propositions and transforming operations using digital technologies for improved customer interaction and collaboration (Teichert, 2019). DT affects organisations' ability to apply new technologies, skills and knowledge to extract, exchange, analyse and convert data into actionable information that aids in decision-making (Williams *et al.*, 2019). Teichert (2019) defines DT as "... an evolutionary process that leverages digital capabilities and technologies to enable business models, operational processes, and customer experiences to create value".

Figure 2.1 summarises the information discussed throughout the previous paragraphs.

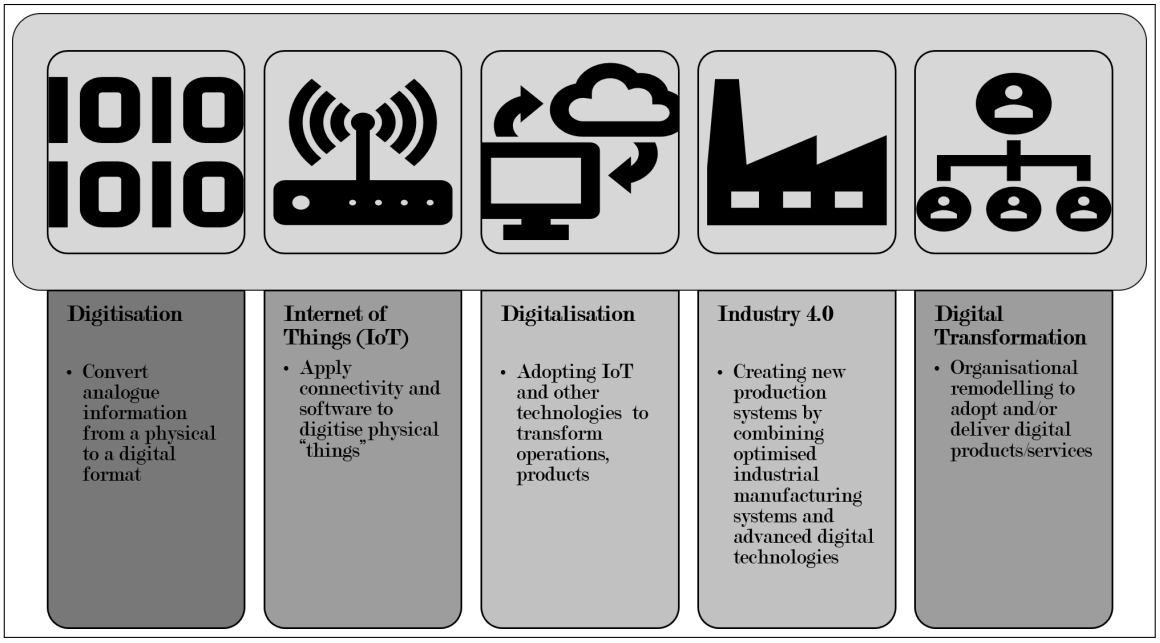

Figure 2.1 Definition Summary

2.2 Digital Transformation in Businesses

To put these definitions into context, recent examples of digitalisation will be used. Uber, Spotify, Facebook, Alibaba, and Airbnb are all cases that illustrate the disruptive power of digitalisation (Gimpel and Röglinger, 2015). These companies or platforms create value to their customers or users without generating or owning a single physical asset (eg. vehicles, music, information, physical products, or real estate). They have transformed their business models to respond to the changing behaviours of their customers by satisfying their individual needs. Not only the service industry is experiencing such drastic changes, however, the manufacturing industry is also currently exposed to numerous innovative disruptions, forcing companies to react quickly to maintain their competitive edge that can, therefore, help increase chances of survival (Schlaepfer *et al.*, 2017).

2.2.1 Critical Need for Digital Transformation

The global industry is currently experiencing substantial economic challenges (Ganzerain and Errasti, 2016). The insufficient availability of natural resources, the increasing energy prices, globalisation of markets, and the increasing age of employees are causing numerous problems for businesses worldwide (Ganzerain and Errasti, 2016). Along with these challenges, customers' expectations are continuously rising and require businesses to be agile and react responsively to attract new customers and satisfy existing ones (Ganzerain and Errasti, 2016), (Fischer, 2018). New technology and the continuously increasing fastidious customer demands cause the environments of organisations to change quickly and become more volatile, uncertain, and more complex (Teichert, 2019). Due to rapid changes in competition, demand, technology, and regulations, companies need to be able to respond and adapt to their environments (Teichert, 2019), (Fischer, 2018). Manufacturing enterprises are confronted with the challenge of moving from a cost-based to a high value-added advantage (Issa *et al.*, 2018). To remain competitive in today's market, companies are required to offer product-service innovation, higher product variety, improved quality standards and support services, and immediacy of satisfaction (Ganzerain and Errasti, 2016).

To tackle these challenges successfully, while simultaneously optimising processes, enterprises need to be capable of managing entire value-chains in an agile and responsive manner (Ganzerain and Errasti, 2016). The fourth industrial revolution makes all of this possible (Ganzerain and Errasti, 2016). Industry 4.0 can change an entire organisation as it affects the design, manufacturing, operation and service of products and production systems (Ganzerain and Errasti, 2016). It optimises the resource and energy efficiency by enabling continuous resource productivity and efficiency (Ganzerain and Errasti, 2016). Industry 4.0 has the characteristic to adapt and respond to the variety and complexity of future products while maintaining a low cost and low environmental impact (Ganzerain and Errasti, 2016). Especially in today's world of production and manufacturing, Industry 4.0 is declared to be relevant and important. The reasons for this assertion stated by Schmitt (2013), include the following:

1. **Mitigating the current challenges within the manufacturing sector:**
   Due to the increase in market volatility and product complexity, as well as the decrease in product life cycles, companies experience difficulties regarding flexibility and responsiveness. The concept of Industry 4.0 aims to decrease the burden of such challenges.

2. **Industry 4.0 enables innovation and transformation of modern economies:**
   By making use of modern technologies such as the industrial internet, smart items, and digital chains, it is expected that businesses increase their productivity and accelerate innovative developments.

3. **Humans become one of the main focus points in production:**
   Time-consuming and repetitive manual tasks can be automated and be completed faster and more accurately. Therefore, simple manual tasks within the production line will disappear, and the demand for higher workforce skills will increase significantly. Employees will be expected to manage more complex projects, solve problems successfully and self-organise. The work will become more flexible, as workers will be assigned where help is needed.

4. **Responding to customer requirements and demands rapidly and accurately:**
   Automated tasks enhance customer experience, as DT enables customers to access services and support via their preferred method of interaction. Automated tasks also allow staff to respond quickly to customer enquiries. Additionally, current consumers' demand focuses on affordable customised products. By employing digitisation, products can be designed faster and produced without incurring extra costs.

5. **Modern technology enables sustainable prosperity:**
   Industry 4.0 and modern technologies offer the opportunity to find solutions to the challenges of reducing energy consumption, resource replenishment and negative environmental impacts.

Furthermore, it provides the possibility to create an intelligent, networked, and agile value chain, by integrating physical objects, human actors, intelligent machines, production lines, and processes across the entire organisation (Ganzerain and Errasti, 2016). Due to this interconnectivity and interaction, Ganzerain and Errasti (2016) claim that a production system can run 30% faster and 25% more efficiently, which can strengthen mass customisation at peak levels (Ganzerain and Errasti, 2016). Real-time data collection creates transparency within the business and allows easier identification of improvement opportunities within the business. The new digital technologies can profoundly transform an organisation's strategic context in terms of competition, satisfying and predicting customer expectations and behaviour, and the way products are manufactured and services delivered (Teichert, 2019).

2.2.2 Digital Transformation Key Components

Although Industry 4.0 is already a big step forward for businesses, it does not mean that DT has been achieved. Not only the processes and operations inside an organisation will change (which relates to Industry 4.0), but also internal areas within the organisation need to be transformed to realise the DT process successfully. Those would include Company Strategy, Employees, Customers, Organisational Culture, and Digital Environment.

2.2.2.1 Company Strategy

A company's strategy can be defined as the long-term direction of an organisation (Wahlin and Karlsson, 2017). It typically involves the management of people, relationships, and resources (Wahlin and Karlsson, 2017). The authors consider a strategy as a key ingredient for success, not only for individuals but also for organisations. A strategy is not only concerned with detailed planning but also guides and assists organisations to move in the right direction and identify and exploit the sources of superior profitability (Wahlin and Karlsson, 2017). For a strategy to be successful, it should embody the following four elements:

1. Clear definition of long-term goals,
2. Full understanding of the external environment,

3. Approval of internal resource and capabilities, and
4. Effective implementation.

The main purpose of a strategy is that it differentiates a company from its competitors by choosing a different set of activities to deliver a unique mix of value (Wahlin and Karlsson, 2017). By creating a unique and valuable position, the company has the opportunity to outperform its rivals (Wahlin and Karlsson, 2017). Therefore, a strategy can also be considered as a set of management decisions that aim to balance the firm's trade-offs between being efficient (eg. reducing cost while being effective, creating and capturing value, resource investments, pricing tactics) (Wahlin and Karlsson, 2017). The main components that are present in the majority of the strategy definitions are the decisions and actions to capture, create, or deliver value by creating or taking a unique position in relation to competitors and to sustain that profitable difference over time (Wahlin and Karlsson, 2017). In summary, a strategy defines what the business wants to achieve and how.

A digital strategy is simply defined as an organisation's strategy executed by leveraging digital resources to create differential value (Wahlin and Karlsson, 2017). It further aims to plan the long-term management of the impact of information in the form of information systems (IS), as well as information technologies (IT) (Wahlin and Karlsson, 2017). Organisations should consider IT as essential in the framing of the overall business strategy itself (Wahlin and Karlsson, 2017). A digital business strategy is, therefore, a dynamic synchronisation between business and IT to gain competitive advantage (Wahlin and Karlsson, 2017).

Digital technologies are altering and transforming current business strategies, capabilities, and processes (Wahlin and Karlsson, 2017). This results in an increased set of strategic opportunities and value-creation alternatives (Wahlin and Karlsson, 2017). Investments in IT have become essential for firms to achieve a competitive advantage or enhance their overall performance (Wahlin and Karlsson, 2017). Investments in IT can help in improving existing capabilities and establish completely new digital capabilities. These can in turn increase the total value creation of the company (Wahlin and Karlsson,

2017). Such new technologies enable companies today to have an increased set of strategic opportunities and value-creation alternatives (Wahlin and Karlsson, 2017). IT has become of significant importance for increasing the value creation, as well as enhancing the performance and competitive advantage. Companies, therefore, need to align their IT strategy with business strategy, or even merge them into one digital business strategy (Wahlin and Karlsson, 2017).

However, business owners need to be aware of the fact that an IT strategy and a digital strategy are not the same things. If a business has an IT strategy that includes digital technology, it does not immediately mean that this can be referred to as a digital strategy. According to Hess *et al.* (2019), the difference between an IT strategy and a digital strategy is that IT strategies tend to focus solely on technology, like application systems and infrastructure. While IT strategies usually define the operational activities and the management of the IT infrastructure within a firm, digital strategies are the ones crossing the company borders. They focus on improving processes and organisational aspects and include interfaces with customers and suppliers (Wahlin and Karlsson, 2017).

This allows the introduction of strategic alignment and the concept refers to the merging and integration of digital and IT strategies with business strategies (Wahlin and Karlsson, 2017). Organisations' decisions and actions need to be aligned so that they support the achievement of strategic goals. Wahlin and Karlsson (2017) further suggest that the people who are most suitable to initiate the strategic alignment are typically the organisation's CEO or senior technology executive (CIO). However, other authors argue that this task should be done by making use of the bottom-up approach. They argue that people in the lower levels of the organisation have the exposure of all operational tasks and know exactly how the processes work. The leadership team, though, needs to clearly articulate the goals to ensure that the activities are aligned with the organisation's strategy. The individuals need to determine what each action or decision will contribute towards the strategic goals. This means the contribution of each alternative or decision (for example projects, vendors, sites for a factory) needs to be evaluated. This activity is important, since strategic goals have an impact on the innovation outcome in an SME and also help

to establish which decision is best aligned to the strategic goals (Barann *et al.*, 2019). For open innovation to take effect, this step needs to be sustainable (Barann *et al.*, 2019).

According to Apac CIO Outlook (2020), 70% of DT projects fail to reach their stated goals, and this is mostly due to the inefficient generation of ideas or inadequate definition of company goals. To successfully transform a business digitally, the right approach will be required (Bouhdary, 2018). Different approaches exist to generate ideas and alternatives and these approaches are important drivers for digitalisation projects (Barann *et al.*, 2019). Some authors argue that the top-down approach is most effective, while others are convinced that the bottom-up approach is more practical and realistic. Barann *et al.* (2019) suggests that a combination of these approaches would be a better technique. There is no right or wrong approach, but it depends on a company's organisational maturity and DT goal to determine which approach would be most suitable (Bouhdary, 2018). Therefore, companies need to be able to identify which approach is most suitable for their needs. The next paragraphs will discuss the different approaches, when they are most suitable to be used, and what their advantages and disadvantages entail.

Top-Down Approach

The top-down approach is initiated by the leadership team who will be responsible for the organisational change (Budd, 2016). Therefore, especially when drastic changes are required, such as a change in the business model, changes across the companies value chain and -proposition, as well as revenue model, the DT should be mandated by the leading sector of the company (Bouhdary, 2018). Smaller businesses, however, do not have formal executive officers. This can be an advantage, as these companies have the opportunity to respond faster and be more agile due to shorter lines of communication (Apac CIO Outlook, 2020). According to Apac CIO Outlook (2020), having one person in the company who is in charge of the overall process of the transformation, was found to work well, especially in smaller companies.

The top-down approach builds upon the organisations existing business model and underlying strategy and might, therefore, assist in uncovering disruptive changes and business

model sophistication opportunities (Barann *et al.*, 2019). The main purpose of this task is to define the project goal or final deliverable and break it down into smaller planning chunks (Makar, 2018). Each "chunk" can then be refined into greater detail, and work items can be assigned to team members (Makar, 2018). The transformation is most commonly led by a central team who is responsible for the quality of the outcomes, including the process models or suggestions for redesign (Fischer *et al.*, 2020). Bouhdary (2018) also mentions that the responsibilities and influence of such individuals are not limited to innovation through technology, but also include business strategy decisions like new acquisitions, new products, and service introductions.

This approach works well when there is a clear insight into the details of a project, and the leading project manager has a high-level view of how the project contributes to the organisation (Makar, 2018). The advantage of this approach is that the major tasks can easily and quickly be identified and the details can be defined by the project team in later stages. Furthermore, this approach can be useful when planning the next year's project portfolio and estimating the number of resources required while developing a rough project timeline and cost estimate (Makar, 2018). A fully detailed scope is not known, but an overview can be achieved to identify the resources and figures required to initiate and complete the project (Makar, 2018). This is fine, however, the review by the project team needs to be done carefully, as details might be missed (Makar, 2018). The industries that most commonly make use of this approach include consumer-facing industries like retail, insurance, banking, media, and automotive equipment manufacturers (Bouhdary, 2018).

Bottom-Up Approach

This approach is mainly used by companies to help identify the "low hanging fruits". This design builds upon a system of mutual control implemented by distributed employees collaborating within a project (Fischer *et al.*, 2020). By starting at evaluating the existing business processes, new business models and technologies can be identified that may optimise or simplify the process, or improve the customer experience (Barann *et al.*, 2019), (Bouhdary, 2018). Different from the top-down approach, this technique relies

on the entire project team who needs to brainstorm all the actions required to conduct the change by identifying the tasks and later organise them into specific groups or work chunks (Makar, 2018). This approach results in a more detailed schedule but is, therefore, more time-consuming compared to the top-down approach (Makar, 2018). This approach emphasises "quick wins" such as predictive maintenance, automating repetitive tasks, or using modern technology to improve the operating environment safety of employees (Bouhdary, 2018). The industries that most commonly make use of this approach include asset-intensive industries like mining, chemicals, oil, and gas (Bouhdary, 2018).

Combined Approach

Another option would be to make use of a combination of both the top-down and the bottom-up approach. The techniques depend on the specific planning goal and should be chosen accordingly. Barann *et al.* (2019) state that for effective idea generation and project planning, a combined approach would be useful. By first making use of the bottom-up approach, the "low hanging fruits" of the existing processes can be identified. This allows the project team to identify the action areas and helps determine the timeline of the project as well as the budget assumptions (Makar, 2018). The top-down approach will then help identify further disruptive changes by considering the businesses' existing business model and underlying strategy.

When generating ideas, however, Baumgartner (2009) suggests putting a diversified planning team in charge, consisting of employees from different departments, as well as individuals from leadership. Through this, the expertise of each individual can be fully utilised to optimise processes and operations (employees), while the ideas can be aligned to the company strategy simultaneously (leadership). Makar (2018) claims that DT starts with people. The author claims that the people involved in the project need to understand the purpose and values of agility. It is, therefore, suggested by the author to include people as much as possible in the transformation process. This refers to the leadership team of the company, as well as the project team who is involved in the project (Makar, 2018). Once the necessary people are involved, the teams will start to organise themselves and work autonomously, as well as learn and share their experience. Furthermore, once

management is included in the transformation and supports and joins the changes, the employees know that that management perceives small mistakes and failures as lessons rather than losses (Makar, 2018).

2.2.2.2 Employees

Employees can be considered as the most important factor to help companies realise their DT. They are most affected by the changes in the digital workplace, as their working environment is altered, and their skill requirements and qualifications are changing. Therefore, companies need to prepare their employees for these changes using appropriate training and continuous education. In today's job market, employees are expected to be willing to undergo a lifelong learning curve, and also develop higher IT skills (Fischer, 2018).

To transform an organisation digitally, a company needs to be positioned within digitalisation, and a planning team needs to be established. Effective DT requires people, processes, and technology to work collaboratively (Maheshwari, 2019). Barann *et al.* (2019) suggests that the planning team comprises of the SME's CEO and the members involved in the DT. However, sometimes it is not easy to choose the people with the right skills or capabilities for the team. Therefore, before building project teams, certain aspects need to be considered. Regarding the people aspect, Maheshwari (2019) suggests that it would be useful to appoint a digital visionary leader who drives the approach. This enables cross-functionality and brings in collaboration to achieve the vision. Next, the systems processes need to be evaluated to identify those that would influence the system most, once changes are introduced (Maheshwari, 2019). This can also help to identify manual processes or older technologies that can be replaced by new technologies to make the business more agile and efficient (Maheshwari, 2019). Finally, the information aspect also needs to be considered. The data that is generated should turn into useful information that could be used to improve products and services (Maheshwari, 2019).

To build a high-performing DT team, there are three main areas to consider according to Werkema (2018): Internal resources, partner resources, and vendor resources.

1. **Internal Resources:**

   The internal resources consist of three parts. Executive leadership plays a role, as well as the core DT team and the extended DT team (Maheshwari, 2019). DT initiatives require complete support from management. While large companies have an extensive selection of executives, SMEs would rely strongly on the business owner, manager, or the project team. Since some SME owners or managers usually have the big-picture perspective of the business and industry, they play a vital role in making the transformation successful. They need to appoint an individual who fully understands the business to support the cultural change that is required for the transformation. Furthermore, this person needs to have some level of authority to make decisions (Werkema, 2018). Maheshwari (2019) suggests that if no such person is internally available, someone from the similar industry and experience of driving business changes should be hired. Since SMEs usually experience problems to attract qualified people and also do not possess the finances to hire a new staff member, they should consider a different option. Alternative options would include consulting industry experts or educating their internal staff and will be discussed in more detail at a later stage.

   The person responsible for driving the change should possess the following skill:

   - A thorough understanding of the business and its customers,
   - Understanding alternative possibilities such as new technologies and how to include those in the business model,
   - People management skills to manage people and cultural change, and
   - Communication skills to convince the board- and staff members about the new ideas and opportunities (Maheshwari, 2019).

   The core DT team and the extended DT team simply consists of existing employees who are re-skilled or educated to handle the new system or technologies (Maheshwari, 2019). In larger companies, these two teams would be separate, but due to the resource constraints experienced in SMEs and numerous intersection areas between the teams, it was decided to merge these two teams into one. The employees have to be exposed and familiarised with the new initiatives.

The organisation, therefore, needs to focus on training and educating their employees, as well as supporting them if a change in their career course will be required (Maheshwari, 2019). It is often advantageous to choose the people who are not too busy and heavily engaged in the business, as they can devote all the energy and focus to this project (Werkema, 2018). The core team members need to be committed and attend project status updates and meetings, as well as give timely input during review cycles (Werkema, 2018). The core team should meet at least once per week during the active project to stay up to date about all recent activities and to review the status of the project (Werkema, 2018). They can then report to the individual appointed by the leadership team, mentioned in the previous paragraph, to make the necessary decisions. The skills required for these individuals depends on the tools and technologies that enable the DT (for eg. working with cloud technologies, machine-learning, etc.) (Maheshwari, 2019).

2. **Partner Resources:**

   Broad results can be achieved by exchanging ideas with business partners, as they may see situations and opportunities from a different perspective. Being open to new suggestions can bridge the gap between technology and its deployment (Werkema, 2018). To choose which partner to leverage, the rules of engagement and dedication should be specified to clarify what is expected from that team (Werkema, 2018). Furthermore, the skills and capabilities that are required should be listed to simplify the resume review and selection process (Werkema, 2018).

3. **Vendor Resources:**

   It would be helpful to also engage the technology partner during the deployment. Often, vendors have some kind of project support and can help in the case that problems arise (Werkema, 2018). The vendors have experience with the implementations of their technologies and can, therefore, be considered as experts in the specific product or technology (Werkema, 2018). Furthermore, by maintaining a loyal relationship with the vendor and being frequently engaged with them allows certain benefits. Some vendors offer to help with the implementation, give rec-

ommendations about the products, conduct regular maintenance of the technology or systems, provide discounts, or provide an extended guarantee of the product (Werkema, 2018).

Since innovation activities in an organisation are carried out by people, Zinder and Yunatova (2016) argue that DT development and integration can only be successfully achieved by engaging the people of the organisation. The authors are convinced that the attitude of the employees plays a major role in the successful transformation of a business. They emphasise multiple times the importance of an individual's motivation. They believe that a person's motivation is the winning component in ensuring the individual's successful acquisition of digital knowledge and effective utilisation of skills.

In their research, they have evaluated the barriers and problems hindering the successful realisation of the DT and have found that the human factor and culture are the main barriers to changes (Zinder and Yunatova, 2016). Some people tend to behave more conservatively and are, therefore, more reluctant to change (Zinder and Yunatova, 2016). The authors, therefore, claim to improve employee engagement throughout the company, the organisation needs to focus on transforming their workers' mindsets and building a culture of collaboration within the workforce.

Workforce Strategy

Christidis *et al.* (2017) propose an integrative model (see Figure 2.2) where the workforce strategies and the business strategies are directly related. The model aims to prepare the workforce for new technologies by continuous and multidimensional training. Workers and managers merge their technical and business knowledge and apply it directly to business operations. This strategy develops and builds employee engagement, other than the original approach that has been utilised in the past. The approach that is employed by companies originally is the traditional sequential approach. In this approach, vendors of the technology sell their product to the upper management. Upper management commences negotiations with the vendor and decides to invest in the technology. The problem with this approach, however, is that the upper management often lacks knowledge and understanding about the technical needs of their organisation and its processes. Since they

are not directly involved in the process itself, they are unaware of the possible problems that may arise once the new technology has been implemented in the existing process of the organisation. The problem with this reactive approach is that the workforce is only retrained after the technology has been introduced and implemented. Furthermore, operational managers and the workforce often struggle to integrate the new technology in the organisation's existing system (Christidis *et al.*, 2017).

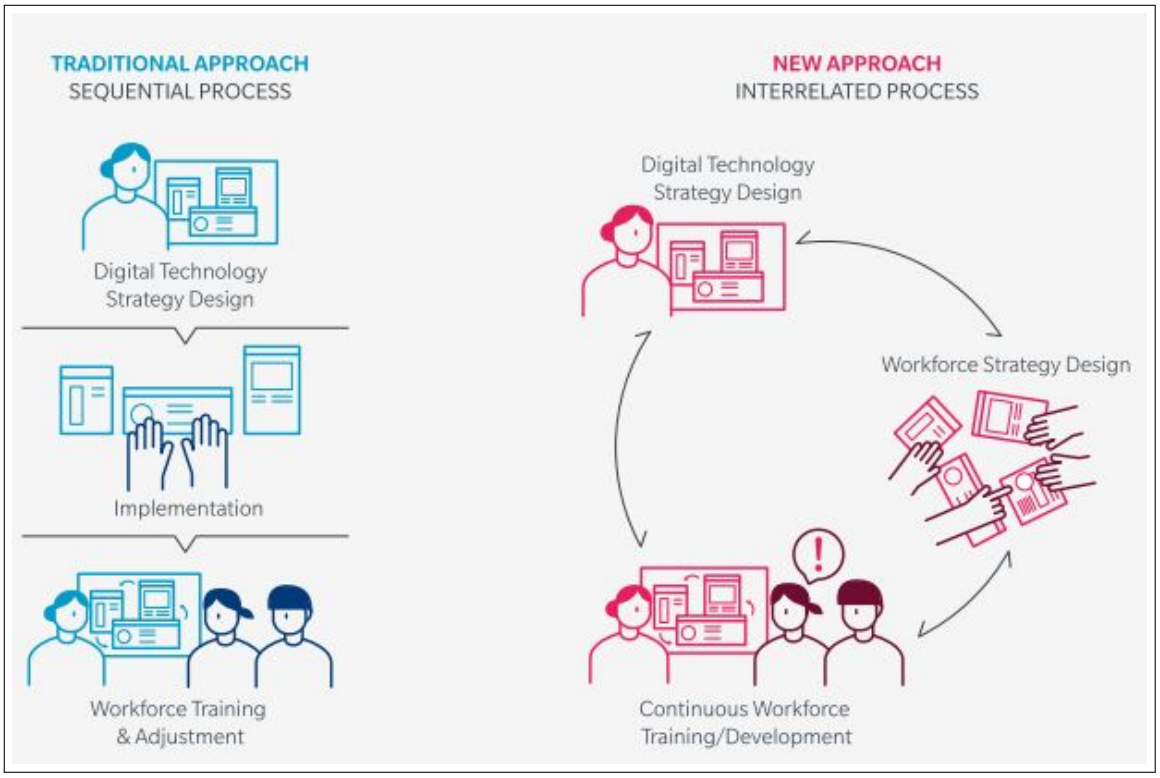

Figure 2.2 Sequential Workforce Strategy Versus a Circular Interrelated Process (Christidis *et al.*, 2017)

Education and Training

Waiting until a new technology is being introduced to retrain the workforce is often too late (Christidis *et al.*, 2017). The employees need to understand the reason and need for the change (Newman, 2017). The workforce needs to have a clear picture of what will improve once the DT has been carried out and how it will influence them (Newman, 2017). Therefore, to encourage an organisations pro-activity, Christidis *et al.* (2017) suggest that management should pay attention to educate and train employees continuously to enhance their analytical and social skills. These skills allow the workforce to add value to

discussions about how to use digital technologies to improve operations and change work processes, and changing the skills required to work productively with new technologies (Christidis *et al.*, 2017).

The insufficiency in advanced training and retraining of the workforce hinders the workforce in preparing for technology implementations. Since training and retraining is considered too late, or even neglected by some businesses, continuous re-skilling and up-skilling of the organisations' workforce would help to eliminate this challenge and help the employees to withstand the fast-paced and dynamic environment (Christidis *et al.*, 2017), (Newman, 2017). Since some companies only have limited staff available and rarely have the money available to hire new staff, up-skilling may be a more feasible option (Howells, 2019). Also, employees need to be closely observed and analysed to determine their strengths and abilities. This enables management to possibly redeploy their staff and allocate them to more appropriate tasks (Howells, 2019).

Communication and No-Error-Culture

Businesses also need to encourage open communication between the workforce and leadership. Since the employees eventually become the end-users of the newly implemented technologies and innovations, management needs to focus on acquiring feedback from their workforce (Christidis *et al.*, 2017). Leaders should actively communicate with their employees and involve them in deciding what digital improvements are required for the business (Newman, 2017). By involving the workers' feedback, the system can be created to be more user-friendly, fit-for-purpose, and customised for the organisation's needs (Christidis *et al.*, 2017). Communication does not necessarily have to be verbal, but can also be done by means of actions. It is easier for employees to accept and handle change if they see their senior partners acting the same way as they expect their staff to participate in the transformation (Howells, 2019). Furthermore, organisations should encourage their workforce to experiment with the technologies and innovations, without fearing consequences of mistakes (Newman, 2017). According to Newman (2017), employees who have the opportunity to experiment often discover new and faster ways of doing everyday tasks. This can have a positive impact on efficiency and, therefore, productivity.

Employee Empowerment

Another key enabler of DT proposed by Christidis *et al.* (2017) is to assign an individual who will act as a system integrator and change process facilitator. Christidis *et al.* (2017) refers to such an individual as the Chief Digital Officer (CDO). The CDO needs to have technical expertise about the project to select the best and most suitable technology for their organisation and needs to have a clear understanding of the operational and organisational considerations. The CDO will be the person in charge to negotiate with the vendors or internal development staff to determine whether the product meets the organisation's requirements, and how it could be integrated into the organisation's system. Furthermore, it is the CDO's responsibility to manage the change process involved in introducing the technology. The CDO has to communicate with the staff and understand how the workforce interacts with the digital technologies, identify the skills required, and the challenges involved technology-human interactions Christidis *et al.* (2017).

It is possible to have more than one CDO to commence these tasks. By appointing the frontline staff with greater autonomy, information sharing, decision-making power, and training enables organisations to benefit from their unique role (Newman, 2017). A study conducted by consulting company McKinsey & Co found that companies without input from line managers and frontline staff reported 3% success in their transformation, whereas those that engaged and empowered both saw success rates closer to 28% (Howells, 2019). Their roles and responsibilities need to be clearly defined, so that management, as well as the individuals, are fully aware of their specific job description (Newman, 2017).

In summary, according to Christidis *et al.* (2017) and Newman (2017), organisations should focus on the following key points to integrate their workforce successfully for the DT:

1. Appoint CDO(s) to act as a system integrator(s) and change process facilitator(s).
2. Encourage and invest in sufficient workforce training proactively to ensure that the workforce has the skills and the cultural willingness to work effectively with digital technologies.

3. Collaboration between vendors, internal firm managers, and the workforce to define the problems/opportunities that digitisation might address.

4. Include the workers, managers, and professionals who are closest to the work that will be affected by the DT and ensure that they are brought into the design and implementation process right from the start. Communication plays a vital role in this regard and leadership also needs to lead by example (communicate verbally and by means of actions).

5. Allow the workforce to experiment with the new products or system and create a no-error culture.

2.2.2.3 Customer

Another important factor an organisation should pay attention to is to improve its responsiveness to its customers (Goran *et al.*, 2017). The authors suggest, by empowering their front-line workers who are in direct contact with the customer, issues can be resolved faster. This can be achieved by providing the employees with both the information (such as segment and purchase history) and the authority to make decisions (Goran *et al.*, 2017). Faster customer attendance can save the organisation money and has a positive impact on the satisfaction of the customer (Goran *et al.*, 2017).

Customer satisfaction plays a vital role in today's business environment. Consumers expect businesses to deliver individualised products or services quickly and easily (Goran *et al.*, 2017), (Goerzig and Bauernhansl, 2018) and they demand business transparency and product traceability (Goran *et al.*, 2017), (Liere-Netheler *et al.*, 2018). Therefore, organisations have to provide easy and fast access to the information that is requested by the customer and a customer-centric organisational culture became a mandatory building block for businesses to survive. Goran *et al.* (2017) state that by keeping the customers close, the risk of experimentation can be reduced, as they often help co-create products through open innovation. Moreover, a customer-centric culture can help an organisation to anticipate emerging patterns in the market by analysing and integrating data (Goran *et al.*, 2017). Data is useful to enhance the understanding of specific customers - how

they interact and what problems they experience (Goran *et al.*, 2017). Furthermore, data also provides new possibilities for product and process improvements, including machine optimisation or predictive maintenance (Goerzig and Bauernhansl, 2018). This, in turn, can provide a useful concept to the customer as they, in the modern era, do not only want to buy a product but also receive a service system along with the product (Goerzig and Bauernhansl, 2018).

2.2.2.4 Organisational Culture

To handle DT effectively, cultural change within an organisation is inevitable and needs to evolve constantly (Teichert, 2019). An organisation that can change and continuously reinvent itself has a critical attribute in the realisation of transformation. The primary perspective of an organisation needs to change. Companies need to develop an appetite for risk to ensure growth and further development (Goran *et al.*, 2017). As mentioned earlier, employee empowerment, open communication, and a no-error culture play a significant role in employee management. By encouraging creativity throughout the workforce and allowing for ongoing mistakes, the organisation has the opportunity to learn from its mistakes (Schlaepfer *et al.*, 2017). Open communication needs to be promoted to ensure that leadership, as well as the employees, can learn from one another and their mistakes (Schlaepfer *et al.*, 2017). If employees have the necessary information and authority to make decisions, valuable time can be saved and higher customer satisfaction can be achieved. Customers have become the focal point in an organisation. The pace at which new markets emerge, corporate environments and customer demands change, and new competitors are rising. For this reason, organisations have to learn to react more rapidly and to demonstrate that they are capable of adaptation (Schlaepfer *et al.*, 2017). This can be achieved by including the workforce in the innovation processes effectively. By encouraging continuous learning opportunities and promoting employee engagement, innovative opportunities can be identified and realised at a faster rate (Schlaepfer *et al.*, 2017), (Teichert, 2019). To summarise, the cultural attributes required by organisations to approach and implement DT are as follows:

1. Changeability: Open/willing to change ways of work, constantly reinvent itself,
2. Risk Tolerance: Taking risks,
3. Organisational learning: Learning from failures, test and learn, experimenting,
4. Failure Tolerance: No blame culture,
5. Open Communication: Transparency,
6. Knowledge Sharing,
7. Collaboration: Collaboration across company boundaries, cross-company/ functional collaboration
8. Employee Empowerment: Decentralised decision-making,
9. Customer Centricity: Customer focus and alignment,
10. Agility and Flexibility: Flexible working, speed, agility, quickly sensing/responding to changes in the environment, external orientation, flexibility, and
11. Ideating new digitalised working methods and services: encouraging employees to ideate new digitalised working methods/services, trust in processes and systems.

2.2.2.5 Digital Environment

Another crucial element contributing to the future competitiveness of manufacturing companies is incorporating a digital environment (Schlaepfer *et al.*, 2017). Digital trends include smart units, such as smart factories, smart operations, and smart products (Schlaepfer *et al.*, 2017). The use of intelligent technologies, advanced sensors, smart machines, artificial intelligence, and advanced robotics allow active interaction between the business and its employees, customers, and suppliers (Schlaepfer *et al.*, 2017). Furthermore, these technologies produce and capture large amounts of data. Collaborative robots and advanced sensors, for example, capture relevant data which can be analysed to increase production efficiency, agility, and quality control (Schlaepfer *et al.*, 2017). The data captured in these systems can be analysed by advanced analytics (Schlaepfer *et al.*, 2017). This data can further provide the organisation with additional insights regarding product pricing

or predicting new opportunities for customer acceptance, which can lead to a potential increase in sales (Schlaepfer *et al.*, 2017).

According to Schlaepfer *et al.* (2017), SMEs show increasing potential to react more rapidly to implementing digital infrastructure compared to larger firms. The reason for this is that larger companies need to re-calibrate their extensive existing IT infrastructure. These smart technologies make use of technology-based interaction models, for which companies are required to adapt their existing IT infrastructure to a great extent (Schlaepfer *et al.*, 2017). Furthermore, companies that are undergoing such transformation, experience challenges in terms of optimising processes and harmonising systems for the Internet of Things, services, data and people (Schlaepfer *et al.*, 2017). Many companies are sceptical towards this revolution, as they do not know where this digitalisation journey will lead their organisation, employees, and customers (Schlaepfer *et al.*, 2017). Due to the dynamic business environment, companies need to continuously monitor their environment and respond to changes rapidly (Schlaepfer *et al.*, 2017). The substantial investment costs of these digital technologies are the overall limiting factor for companies, regardless of size (Schlaepfer *et al.*, 2017).

To successfully transform a business digitally, organisations require a wide-ranging digital change approach that encompasses organisational, cultural, personal and technological aspects (Schlaepfer *et al.*, 2017).

2.2.3 Practical Digital Transformation Examples in the SADC

To demonstrate the potential of DT in the SADC, practical examples have been selected, researched and analysed. For each example, the DT objective is stated and a shortlist is provided summarising the value achieved through the DT. Although these examples are not SME specific, they demonstrate the typical challenges businesses in the SADC are struggling with in general.

2.2.3.1 Digital Land Registry in Mauritius

Most countries in the SADC are still relying on paper-based systems where administrative information such as land registration needs to be entered manually (Halkhoree, 2019), where these Hard copies are susceptible to damages and often difficult to be located in case of unorganised storage. In 2011, the Registrar General Department of Mauritius, which is the central repository of all documents that are registered within the country, successfully transformed from a paper-based system to a paperless one (Halkhoree, 2019). The system allows automatic population of information on registered properties and enables different branches of the Registrar-General's Department to share information, increasing efficiency (World Bank, 2019). The system also allows users to copy information from scanned deeds (World Bank, 2019). The Registrar General and its stakeholders (including the general public) have access to an electronic dashboard allowing the user to carry out registry searches, submit documents for registration, pay the registration fees online, and receive their registered documents in electronic form (Halkhoree, 2019). After four years, Mauritius was able to reduce the time for registration from 210 days to 14 (World Bank, 2019). In summary:

Objective:
Mauritius' Registrar General Department aimed at transforming the department into an e-service body to decrease the processing time and to create a digital record of their data.

Value Added:

- Data optimisation: Decreasing the storage of duplicate information.
- Improved data storage and processing: Computerised systems can handle large amounts of data, and can process and compile information much faster in ways not possible with manual systems.
- Data accuracy: Each transaction entered in the system is captured and updated. Automatic registration of the data also decreases the possibility of errors.
- Data transparency: Information is shared throughout the department and is accessible to all stakeholders.

- Data back-up: Information is less susceptible to physical damage as digital copies of the data can be made and saved in different locations.
- Process optimisation: Streamlining workflows, making a system more efficient. Throughout the registration processes, individuals have the opportunity to apply for mortgages immediately, saving time.
- Performance analysis: The computerised system assesses the system's overall performance to further improve its services to customers.
- Quality Control: Staff can perform consistency checks and verify data instantly.

2.2.3.2 Livestock Traceability Systems in Swaziland and Namibia

The strict regulations and legislations of Europe's food industry have forced developing countries such as Swaziland and Namibia to revolutionise their meat exporting procedures (Prinsloo and de Villiers, 2017). Livestock traceability systems have become a mandatory export prerequisite due to recent food scares (eg. mad cow disease), but also people have become more aware of what they are eating and where it comes from (Prinsloo and de Villiers, 2017), (New Era, 2019). This forced these two countries to improve on the effectiveness of their traceability systems (Prinsloo and de Villiers, 2017). In 2005, Namibia introduced the Namibian Livestock Identification and Traceability System (NamLITS) to trace the health status of animals north and south of the veterinary cordon fence (New Era, 2019). In 2010, Swaziland also upgraded from a paper-based system to a modern computerised system called the Swaziland Livestock Information and Traceability System (SLITS) and Namibia expanded their system to trace the movement of the cattle of communal farmers in the Northern Communal Areas (Prinsloo and de Villiers, 2017). Both systems were implemented successfully in 2014. The systems capture information about the movement of each animal, contain unique identification details for each farmer as well as animal, and the animal's state of health for more effective disease control (Prinsloo and de Villiers, 2017). In summary:

Objective:

Managing and controlling animal diseases and improving overall animal health to ensure better market access for the countries.

Value Added:

- Accurate Animal Tracking: Exact tracing of the animal and its products from the original farm to the final consumer.
- Data optimisation: Unique identification information decreases the possibility for duplicate storage of information.
- Traceability: Monitoring of animal health; allowing disease control.
- Quality Control: Managing nutrition and yield of meat products.
- Entry to new markets.

2.2.3.3 Mobile Money (eWallet)

In the SADC, the eWallet concept developed by the First National Bank (FNB) has shown immense growth since 2009 (Phakathi, 2013). The concept was first launched in South Africa and adopted by other countries, including Botswana, Namibia, Zambia, and Lesotho (Phakathi, 2013). The concept is simple: Money can be sent to anyone who has a valid cellphone number within a domestic range, but cross border eWallet transactions have not been enabled yet (FNB, 2020). The advantage of the concept is that this payment method is suitable for any cellphone model and also, the recipient does not need to have a bank account (FNB, 2020). This makes this concept ideal for consumers who have minimal transaction requirements, have limited access to banks, or do not own identification documents. It is often the case that people born in rural areas do not own any kind of identification document which is necessary for opening a bank account (The Southern Times, 2018). Furthermore, banks are not necessarily located in the villages, but rather in larger towns or big cities, limiting their accessibility (The Southern Times, 2018). Since the use of cellphones continues to grow, this concept could be adopted successfully (The Southern Times, 2018). The money sent is instantly available in the eWallet and the recipient can access the money immediately at an FNB ATM without needing a bank card

(FNB, 2020). Furthermore, the recipient can check the balance, get a mini statement, and buy prepaid airtime or electricity (FNB, 2020). In summary:

Objective:

Simplifying paperless money transfers (transactions)

Value Added:

- Increase Efficiency: eWallet allows the instant transfer of funds, speeding up the payment process.
- Improve Security: No cash handling is required.
- Enhance Customer Experience: The system is simple, fast, and convenient. Furthermore, the user does not require a bank account to send or receive money.

2.2.3.4 Precision Farming in South Africa

Only 13.7% of South Africa's total area is arable and used for intensive agriculture (Jacobs *et al.*, 2018). The unreliable rainfall and unpredictable weather changes, high input costs, and increasing global competition put South Africa's crop production under pressure (Jacobs *et al.*, 2018). Precision farming has become a popular practice among the farmers, for them to intensify their production and make optimum use of available resources (Jacobs *et al.*, 2018). This method promotes sustainability and is a strategy where farmers can vary inputs (eg. application of fertilisers, pesticides, cultivars, as well as cultivation and harvesting techniques) and practices using applicable technology and principles (Jacobs *et al.*, 2018). By making use of advanced technologies, information can be derived which allows the farmer to apply inputs, such as fertilisers or seeds, at variable rates exactly where they are needed. In practice, data is entered, interpreted, and analysed (Jacobs *et al.*, 2018). Furthermore, management strategies for specific times and scales can be developed and implemented (Jacobs *et al.*, 2018). The most beneficial outcomes derived from the use of this practice is that major costs can be saved with the variable fertiliser application (Jacobs *et al.*, 2018). In summary:

Objective:

Maximising the agricultural output using intelligent technologies.

Value Added:

- Resource Efficiency: Efficient use of fertilizers, chemicals, water, fuel, etc.
- Increase Output.
- Improve Output Quality.
- Increase Yield.
- Decrease environmental footprint.
- Data capture: Can be used for predictions.
- Data sharing: Sharing captured data on online platforms with other users.
- Assist farmer in decision-making process.

2.2.4 Obstacles Hindering Businesses to Transform

DT is a broad and complex topic that can affect an organisation in numerous areas. According to Issa *et al.* (2018), many manufacturing companies have started to realise Industry 4.0 concepts with the main objective of harvesting the benefits of DT. However, these implemented concepts are based on pilot projects that resemble feasibility studies rather than a full DT (Issa *et al.*, 2018). The disadvantage of these pilot projects is that they cannot show the full potential of DT, as they ignore key aspects such as structure and culture (Issa *et al.*, 2018). Moreover, these projects often fail to meet the promised benefits or actual needs of the organisations (Issa *et al.*, 2018).

Unfortunately, especially SMEs struggle with adopting and implementing Industry 4.0 solutions (Issa *et al.*, 2018). One factor contributing to this struggle includes the lack of awareness of the link between the business and technological worlds on the strategic and tactical levels within the organisation (Issa *et al.*, 2018). Moreover, business owners, managers, or staff members often lack sufficient expertise in certain technologies and tools and, therefore, struggle to evaluate the possible impact of new technologies on

the business (Bulanok and Khizhniak, 2017). It is of crucial importance to understand which dimensions of an organisation might be affected during and after such transformation. Currently, managers often do not possess sufficient knowledge and understanding about the elements, different options, and unexpected outcomes that require consideration during a DT endeavour (Hess *et al.*, 2019), (Issa *et al.*, 2018). Limited resources are another factor hindering DT in SMEs. Either businesses lack financial resources to pursue disruptive opportunities or initiatives, or they do not have staff available who could identify specific use cases to focus on (Bulanok and Khizhniak, 2017). Therefore, activities aimed at improving the quality of services and products delivered to end-users, optimising workflows to automate business processes or to minimise the human factor, creating new product niches for a business to grow and expand may be missed or not identified (Bulanok and Khizhniak, 2017). As a result, important elements or solutions that might have been more favourable to a company's specific situation may have been disregarded (Hess *et al.*, 2019). However, it is not only necessary for management to understand the DT concept, but stakeholders must also be actively involved in defining the transformation strategy of the organisation (Teichert, 2019). This is to ensure that common ground and understanding is established regarding the relevant areas that need to be addressed, as well as about the prioritisation of transformation activities required (Teichert, 2019). Additionally, clear guidelines that assist managers throughout the preparation and implementation phase are lacking (Hess *et al.*, 2019). Since managers often lack a clear understanding about their organisation's current state concerning DT, it is of importance that managers clearly define the action items required for the endeavour, prioritise between these activities, and develop a strategic transformation roadmap (Teichert, 2019).

Along with these challenges, by creating a digital environment through DT, organisations are exposed to numerous risks. The following list has been compiled by Deloitte (2018) and mentions some of the most important risks to consider in the following areas:

- Technology: Technology-related risks may impact systems, people, and processes and may contribute to potential losses in case of technology failures. Further key risk areas may include scalability, compatibility, and accuracy of the functionality of the implemented technology.

- Cyber: The digital environment needs to be protected from unauthorised access/usage of confidential data.
- Strategic: DT needs to be aligned with the organisation's goals and objectives as it forces a change in the strategic direction of the organisation. Possible impact areas include customer experience, brand value, reputation, and competitive advantage in the market place.
- Operations: Operational risks may arise due to inadequate controls in the operating procedures.
- Data Leakage: Data is constantly being transmitted throughout the digital ecosystem and may, therefore, be intersected by external sources if not encrypted properly.
- Third party: Refers to risks arising due to inappropriate controls at vendors/third party operating environment. Factors including data sharing, technology integration, operations dependency, or vendor resiliency may play a key role in this area.
- Privacy: Personal or sensitive data may be handled inappropriately within an organisation, which may impact the privacy of the individual (customer or employee).
- Regulatory: Companies need to adhere to statutory requirements including technology laws, sectoral laws, and regulations.
- Resilience: High dependency on technology causes business operations or services to be interrupted or unavailable in case of technology failure. Organisations need to work on concepts including IT/Network disaster recovery, cyber resiliency, and crisis management.

Another issue causing difficulties is the existing company culture (Teichert, 2019). To handle DT effectively, cultural change within an organisation is considered to be a prerequisite and needs to evolve constantly (Teichert, 2019). Many businesses are reluctant to change due to undefined risks and unplanned obstacles. Ineffective communication between the different teams (eg. business owner/manager and staff members) has been found to be another major concern resulting in redundant resources or projects going in completely different directions than planned initially (Bulanok and Khizhniak, 2017). Furthermore,

vague definitions of different responsibilities may cause confusion if not communicated correctly by the manager or business owner (Bulanok and Khizhniak, 2017).

2.3 Chapter Summary

In this chapter, it was discovered that the terms Digitisation, Digitalisation, and DT are used interchangeably, as they have numerous things in common. However, their definitions and scope differ. While Digitisation refers to the process where analogue information is converted from a physical to a digital format, Digitalisation includes the adoption of IoT and other technologies to transform operations and products. DT, on the other hand, includes the remodelling of an organisation to adopt and or deliver products and services. A critical need for DT exists, especially within the manufacturing industry. It can help mitigate the current challenges experienced within this sector and enables innovation and transformation of modern economies. Furthermore, the concept allows companies to respond to customer requirements and demands rapidly and accurately. For a business to realise the concept successfully, however, it is important to focus on the following business areas: company strategy, employees, customers, organisational culture, and digital environment. From the practical examples discussed within this chapter, it was derived that DT in the SADC adds significant value. The digital land registry in Mauritius allows numerous opportunities for process optimisation, performance analysis, quality control, and effective data management. Data is optimised, stored, processed, accurate, and transparent. The livestock traceability system permits accurate tracking, optimisation of data, tracking and tracing, quality control, and entry to new markets. The mobile money (eWallet) introduced by FNB increases efficiency, improves security, and enhances customer experience. Finally, the precision farming technique utilised in South Africa allows effective use of resources, increased output and yield, improved output quality and reduced environmental footprint, and lastly, effective data management. However, although the advantages do seem enticing, numerous challenges and risks do exist and have to be considered.

Chapter 3

Operational Environment for SMEs in the SADC

The aim of this chapter is to provide an overview of the challenges that are experienced by SMEs in the SADC region. The region is currently battling with an underdeveloped economic sector and limited downstream value addition of its products. The factors that contribute towards this situation include the region's small market size, its underdeveloped physical and technological infrastructure, the limited access to financial resources and skilled human capital, and finally the inefficient administrative processes. These challenges are examined and discussed in more detail throughout this chapter.

3.1 Economic Sector

In terms of industrialisation, SADC ranks relatively well compared to other regions in Africa, but very poorly globally (Madakufambe and Ngwawi, 2015). Due to limited industrialisation, almost all SADC countries' manufacturing sectors lag far behind. The countries in the SADC region participating in the export of finished manufactured goods include Lesotho, Mauritius, and South Africa (Nunuhe, 2018). To further illustrate the underdevelopment of SADC's economic sector, a graph of the region's GDP per capita has been generated to compare Sub-Saharan Africa (which also includes the SADC region) to other emerging economies, such as Latin America or China (see Figure 3.1).

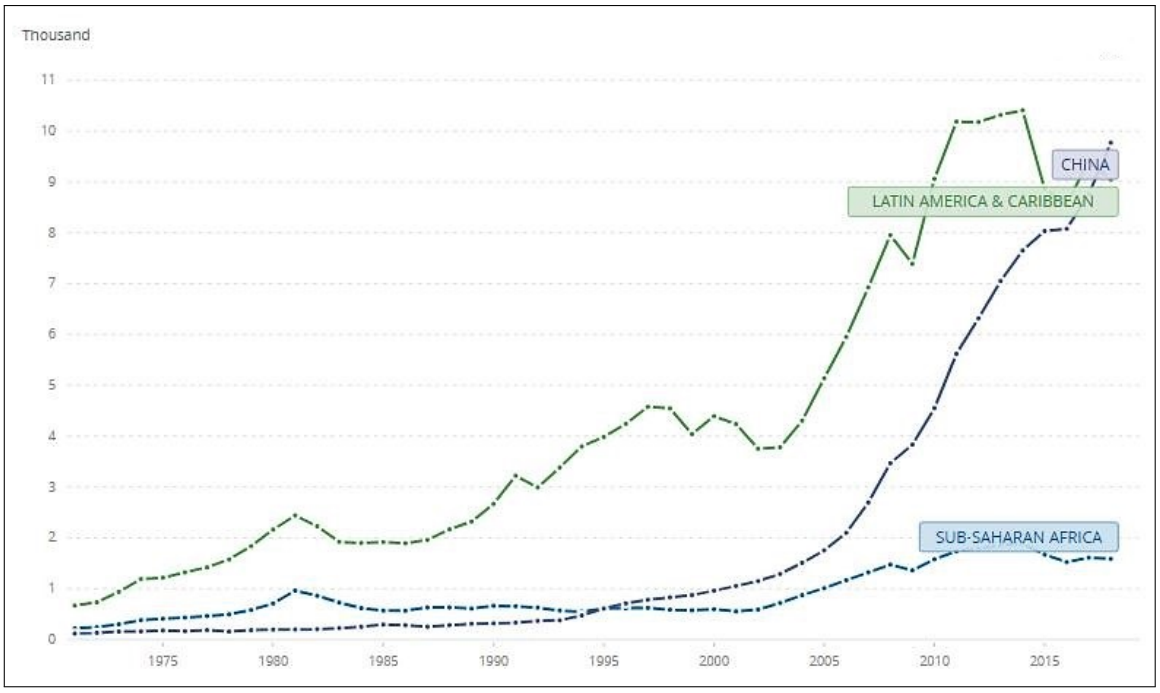

Figure 3.1 GDP per Capita (current US$): Sub-Saharan Africa, Latin America & Caribbean, China (The World Bank, 2019)

As previously indicated, the graph illustrates the GDP per capita of the different regions. The GDP per capita represents the economies measure of total production in monetary values of all goods and services produced in one year within this region divided by the region's total population (Roser, 2020). From the graph, it can be derived that the Sub-Saharan region's GDP per capita is significantly low compared to Latin America and China. Moreover, not only the manufacturing sector is lagging, but also little attention is paid to the services in the value chains. According to McKinnon *et al.* (2019), countries that can offer a good quality service derive a better position in the value chain. Studies conducted in Europe, Asia, the USA, and Africa have shown that the manufacturing sector has become increasingly dependent on service inputs (McKinnon *et al.*, 2019). The advantage of services is that they can lead to greater value creation, and encourage the shift towards more customer-centric models, where value can be co-created with customers (McKinnon *et al.*, 2019). So far, only a limited amount of the SADC countries, including Botswana, Mauritius, Seychelles, and Namibia, shifted towards service-centred economies. This caused services to emerge as a key sector within these countries, while simultaneously taking some pressure off the agricultural sector (Madakufambe and Ngwawi, 2015). The number of countries that shifted is limited, however, due to the region's underdevelopment

of the manufacturing- and the service sector. Reasons for this underdevelopment include:

1. **Access to capital:** Limited financial support offered by the government regarding research or technological opportunities for industrialisation (McKinnon *et al.*, 2019), (Shihomeka, 2017).

2. **Infrastructure:** The infrastructure available to perform certain services or to implement new technologies is relatively poor (Diop, 2017), (Deloitte, 2014).

3. **Education and Human Capital:** Insufficiently trained or educated staff are available who could potentially perform services to handle or manage innovation or industrialisation (Shihomeka, 2017).

4. **Legal System:** The lack of legal enforcement for contract law and the weak legal and regulatory frameworks within the SADC show major areas for improvement (Ramos, 2014), (Vrgovic *et al.*, 2014).

3.2 Downstream Value Addition

The key economic factors contributing significantly to the SADC countries' economies include mining, fishing, and agriculture (see Appendix A: Main Industries for all member countries). However, due to the increase in mining costs, over-fishing and the continued absence of rain, these sectors have reached the limits of expansion (Mukata and Swanepoel, 2017). The low-level of industrialisation discussed previously leads to poor product diversification, which means that most of these countries rely on exporting primary commodities or semi-processed products (Madakufambe and Ngwawi, 2015) (see Appendix A: Top Export Products). Currently, raw materials are exported for further production and purchased back as the final product at a higher price. It would be beneficial to increase the value of the raw materials before exporting (manufacture in-country), to achieve a higher profit margin (Namibia Economy 2019, 2019), (Economic Commission for Africa, 2017).

Another problem is that the economic integration within the SADC region was moving rather slowly within the past few years. The market size remained small, the availability of skilled labour was insufficient, mechanisation and infrastructure remained rather limited, the economies have been undiversified, while strict policies make trading a relatively tedious process (Fall and Gasealahwe, 2017). The small market size and limited value-addition processes resulted in SADC becoming more dependent on international trade, exposing the raw material prices to external price fluctuations (McKinnon *et al.*, 2019). Figure 3.2 represents the trend in SADCs trade balance ranging from 2008 to 2018. It represents the difference between exports and imports in monetary values.

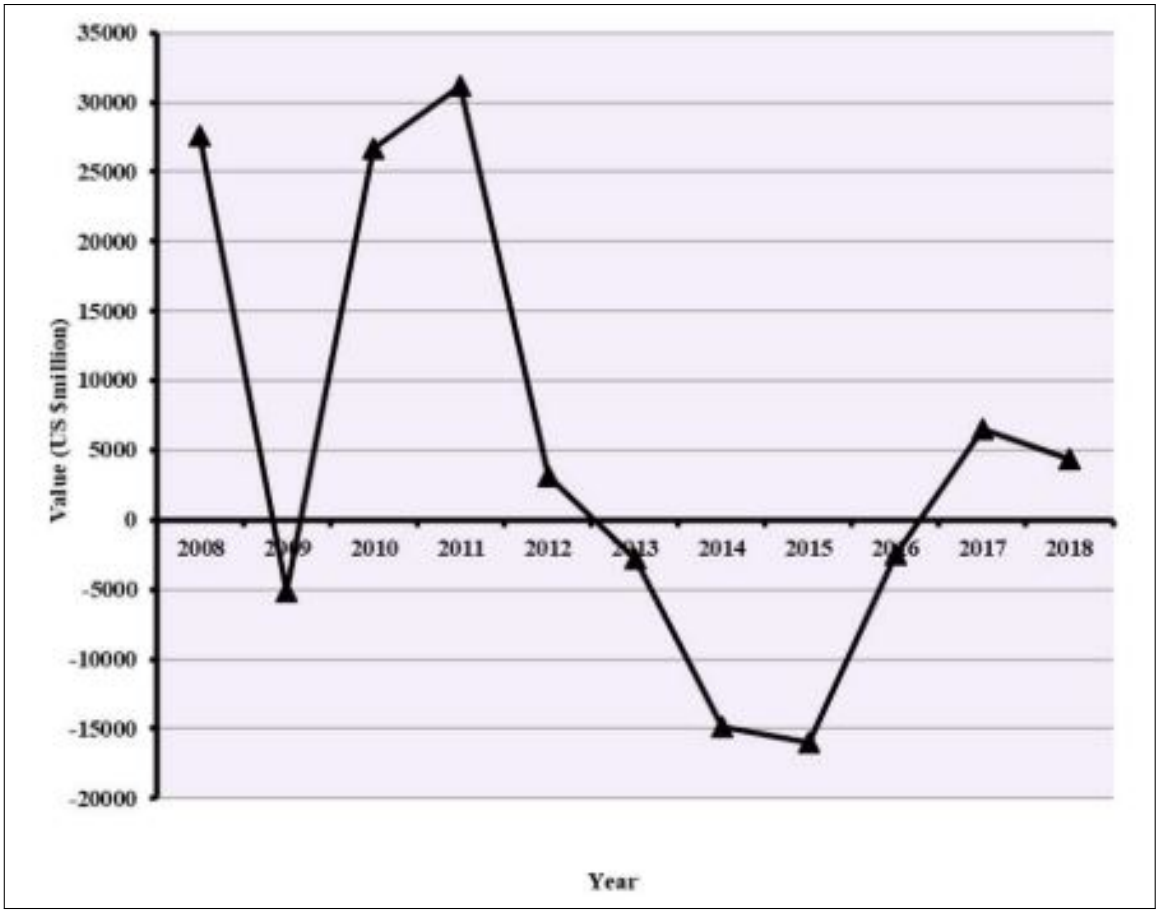

Figure 3.2 Trends in SADC Trade Balance for the Period 2008-2018 (Jere, 2018)

From Figure 3.2 it can be seen that between 2008 and 2011, SADC performed relatively well, as the exports exceeded the imports (excluding 2009 which was a result of the global financial crisis). After 2011, the numbers started to decrease drastically, resulting in

the region's trade balance reaching a deficit in 2013. At this stage, the imports started exceeding the exports. The numbers started to increase again after 2015, as SADC reduced global imports, and instead encouraged the trade between the member states (Jere, 2018).

3.3 Challenges experienced by SMEs in the SADC

Although DT offers companies a great opportunity to innovate and improve on its processes and efficiency, the realisation of the concept remains one of the biggest challenges companies currently face (Hess *et al.*, 2019). Especially SMEs seem to face numerous challenges when it comes to DT, which hamper their development and realisation of their full potential (Bank of Namibia, 2010). Numerous resources have been reviewed to identify the most common challenges experienced by SMEs in general and it was found that the challenges identified also apply to SMEs located in the SADC (Bank of Namibia, 2010). Nevertheless, additional resources must be reviewed, as it was found that some obstacles SMEs face are region-specific. Those resources comprise partially of research conducted on the public domain, and also include informal conversations with SME owners discussing challenges they have encountered over the past years while running an SME in the SADC region. The information derived from these conversations was researched in more detail and verified using articles as well as web sources available on the public domain and the Stellenbosch University's library. Since the focus of this research lies on SMEs located within the SADC region, this section discusses the challenges within this region's context.

The information discussed throughout the chapter is summarised in Figure 3.11. The diagram is illustrated in the Chapter Summary at the end of this chapter. For selected subsections, pieces from the diagram have been extracted to show their interrelationships and impact by means of arrows. The blocks in the diagrams have been colour coded according to their specific category:

- Yellow: Markets,
- Green: Physical and Technological Infrastructure,

- Blue: Financial Resources,
- Pink: Human Capital,
- Purple: Administration Processes.

3.3.1 Markets

The launch of new and innovative technologies in the past years has led to an increase in competition throughout the market. Companies who do not embrace new technologies and innovations tend to fall behind the global market standards and struggle to remain competitive (Liere-Netheler *et al.*, 2018). Organisations feel increasing pressure coming from markets, competitors, and technologies. The challenges caused by the increase in market pressure will be discussed in more detail throughout this subsection.

3.3.1.1 Poor Market Access

Current markets are substantially influenced by competition, speed and change. New technologies and innovation opportunities have given rise to new market possibilities and an increase in the level of customer demands. Due to their flexibility, SMEs have the opportunity to respond faster to changing market requirements than larger firms. Nevertheless, Mukata and Swanepoel (2017) have found that SMEs struggle to obtain sufficient marketing information. This limited support reduces the time these firms have to prepare for their responsibility towards the changing markets. Moreover, SME owners and managers in the SADC face various marketing problems. Those include a limited customer base, limited marketing activities, and the lack of knowledge and understanding about the marketing process and what impact it has on a company's success within the market economy (Iguna and Sazita, 2018). These authors further state that the marketing done within the SADC region is limited to a geographical frame. One factor contributing to this limitation includes the administrative issues associated with cross-border trade (Chilala, 2009). If an organisation launches a new product and aims to trade across borders, certain standards and certifications need to be met. This action is required in order for the good to be cleared for exporting and also to become competitive in the international market. Depending on the product type (eg. consumer product, technology, etc.) and the

risks or hazards accompanying it, certain precautions and guidelines need to be followed by the organisation (Chilala, 2009). This results in additional paperwork, which requires time, as well as financial investments to meet these standards.

3.3.1.2 Ad-hoc decisions

As a result of the previously discussed lack of marketing information, SMEs only have limited time to respond to changing market requirements. Additionally, due to limited financial resources, these organisations have limited resources and opportunities to experiment with newer and innovative technologies (Mittal *et al.*, 2018). For this reason, managers often take ad-hoc decisions and investments to respond to changes in time (Albayrak and Gadatsch, 2018). These decisions are often based on the business leadership's gut feeling and may, therefore, lead to uncertainty and low confidence in the decision distributed throughout the entire organisation (Mittal *et al.*, 2018).

SMEs have been found to be rather more reactive than proactive (Neneh and Van Zyl, 2017). The primary problem with reactive management is that managers only act once the challenges or crisis surface, which may cause the problems to escalate beyond the point of being able to be addressed and before you become aware of them (Kokemuller, 2018). This may lead to lost customers and low employee morale (Kokemuller, 2018). A manager's performance may also be affected, as the individual will focus on fixing the problems at hand and may lose sight of alternative opportunities. Proactive management, on the other hand, encourages long-term planning and addresses strategies and processes that help protect against potential calamities (Kokemuller, 2018). Kokemuller (2018), therefore, argues that proactive management is usually much more effective in the long run. Managers can gain a greater sense of control which allows them to identify the best way to do things before a problem arises (Kokemuller, 2018). This technique permits greater time to implement best practices and risks can be managed with careful planning and execution (Kokemuller, 2018).

3.3.1.3 Difficult to Attract Customers

To succeed in today's competitive market, businesses need to continuously generate and attract new customers while maintaining a high-quality product or service (Willmett, 2019). Attracting customers, however, has found to be a difficult task (Kolowich, 2018). Especially SMEs struggle to remain competitive against larger companies who have strong brands or historic success behind them (Willmett, 2019). It is often the case that the businesses do not invest enough time and money in attending relevant networking events, or mastering various marketing techniques to create awareness about their products and services (Willmett, 2019).

Figure 3.3 summarises the information discussed throughout the previous paragraphs.

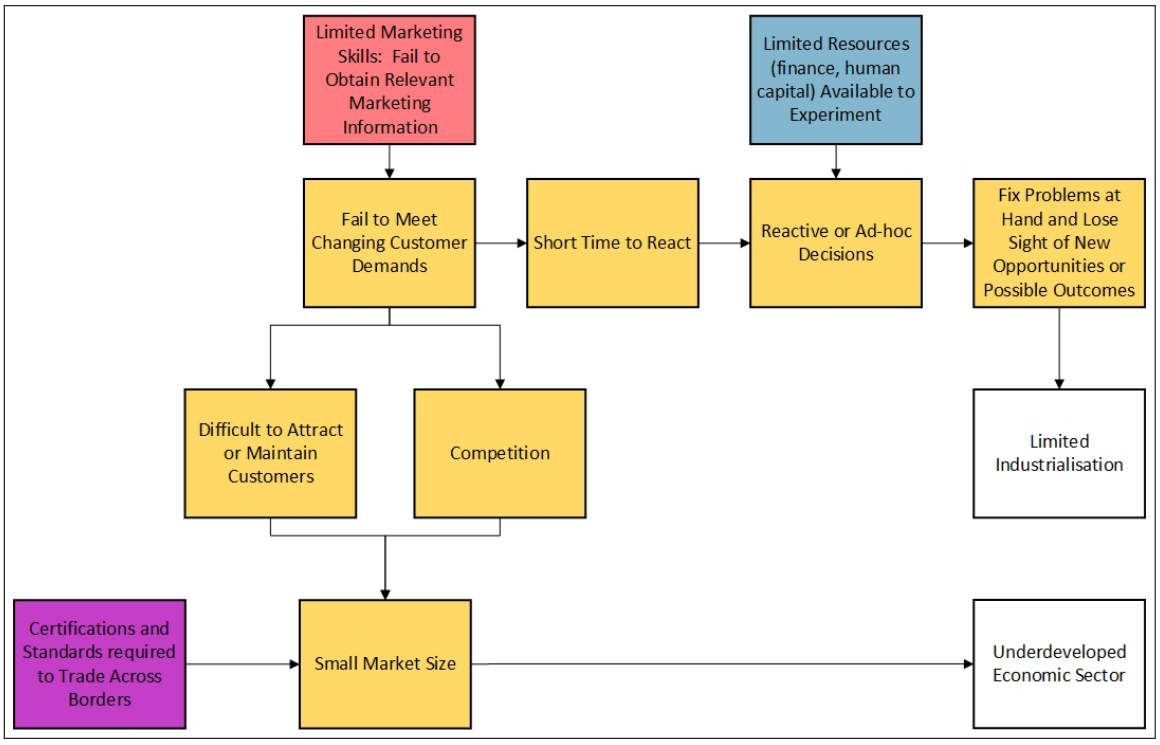

Figure 3.3 Factors Contributing Towards a Small Market Size

3.3.2 Physical and Technological Infrastructure

Another major constraint towards industrialisation and DT in the SADC is the inadequate physical and technological infrastructure. Although this inadequacy is not a recent problem and has existed for many years, minimal action has been undertaken to improve the current situation. A large infrastructure deficit mainly exists within the following sectors: power and water supply, transport and logistics, and internet access (Economic Commission for Africa, 2017), (Fjose *et al.*, 2010).

3.3.2.1 Unreliable Electricity Supply

Reliable and stable electricity supply is critical in ensuring continuous production to reduce waste of materials (Economic Commission for Africa, 2017). The power deficit in the SADC is currently a major constraint to industrial development and industrialisation (Economic Commission for Africa, 2017). In countries such as Angola and Mozambique, the unreliable power supply plays a large role in hindering any prospects for industrial take-off (Economic Commission for Africa, 2017). South Africa is also experiencing significant losses due to the interruptions caused by load-shedding. The concept of load-shedding is very expensive - not only for the electricity provider but also for the businesses in the country. Particularly small businesses are affected, as they struggle to carry extensive costs associated with this situation. Many businesses have to decrease operating hours, which in turn reduces production output. Others, such as farmers within the agricultural sector, whose operations are energy-intensive, encounter substantial losses. Those who would like to minimise such losses need to invest in alternative electrical infrastructures such as generators or solar panels, which also require an investment that some smaller businesses cannot carry. Further implications of load-shedding include the increase in food prices as the production of consumer goods will increase due to these circumstances (Omarjee, 2019).

Figure 3.4 summarises the effect on SMEs caused by the unreliable electricity supply.

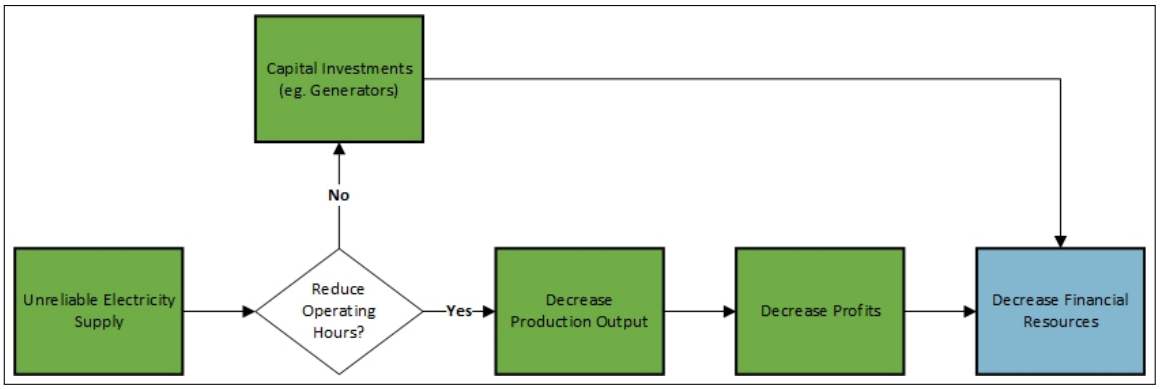

Figure 3.4 Unreliable Electricity Supply Effects

3.3.2.2 Inadequate Road Infrastructure

Adequate transport infrastructure has a large impact on the population and businesses. It provides access to health, work, education, and market opportunities (Ramos, 2014). As most countries within the SADC region are relatively spacious, large distances need to be travelled to deliver goods and services within the countries. Moreover, landlocked countries such as Zambia, Zimbabwe, or Botswana, are subject to even larger distances in obtaining access to international markets, as they have to transport their goods for exports to countries with harbours and ports. It is estimated, that the cost of such long-haul transport increases the final product's value by 40% (Economic Commission for Africa, 2017). Due to the lack of railway safety and economic regulations, the train network within the SADC is not utilised to its full potential and only transports 15% of the total freight trade volumes (The Southern Times, 2020). Therefore, SADC's logistic system is largely dependent on trucks, causing pressures on the road network. The conditions of the roads are in many countries very poor and certain key locations still miss road links (eg. Angola and the Democratic Republic of Congo) (SADC, 2012). The transport of goods also takes relatively long, as delays are often caused by the border posts (The Southern Times, 2020).

3.3.2.3 Limited Internet Access and ICT Illiteracy

Another challenge within the SADC region is the insufficient telecommunication infrastructure causing limited internet access, especially in rural areas (Vrgovic *et al.*, 2014). Some countries do have a reasonably developed telecommunications system, including

Botswana and South Africa, but the slow internet and high data costs remain a constraint to many businesses (Vrgovic *et al.*, 2014). Since most digitalisation technologies required for DT demand internet access, this obstacle must be addressed by companies to realise industrialisation and DT.

New information and communication technologies (ICT) play a significant role in supporting stronger regional integration and economic development of the SADC region (Savela *et al.*, 2018). SADC has recognised the need for ICT development. Unfortunately, the region faces challenges, such as limited skills and investments in ICT, the high telecommunication costs, and limited internet access in rural areas. These obstacles hinder the successful ICT adoption and development (Kyobe, 2011), (Vrgovic *et al.*, 2014). The low levels of computer literacy in the SADC often hamper the successful adoption of new technologies and innovations (Kyobe, 2011). However, due to the COVID-19 crisis, the use of ICTs has been majorly promoted. Most learning institutions, such as schools and universities have been forced to adopt E-Learning modules and many businesses have shifted towards a "home office setup" (New Era, 2020). Therefore, it can be derived that a great potential exists within the SADC confirming that greater ICT adoption and literacy is possible.

3.3.2.4 Low Technology Maturity Level

Although SMEs are said to be the main drivers of innovation, rapid technology changes can hamper such company's growth (Iguna and Sazita, 2018). Due to high investment and installation costs, many SMEs are not able to adopt new technologies or upgrade existing ones. Above all, SMEs are frequently challenged with the financial and technical constraints to upgrade or adopt innovation opportunities (Mittal *et al.*, 2018). This also contributes to SMEs' low performance within the research and development field, as well as the limited integration of IT services (Mittal *et al.*, 2018). Additionally, new technologies are often designed to meet the needs of larger companies and, therefore, do not suit the requirements of SMEs (Iguna and Sazita, 2018). Due to insufficient knowledge and understanding, many SME owners or managers are not well prepared to face and plan for the changes that may arise before and after a technology adoption (see Figure 3.5)

(Iguna and Sazita, 2018).

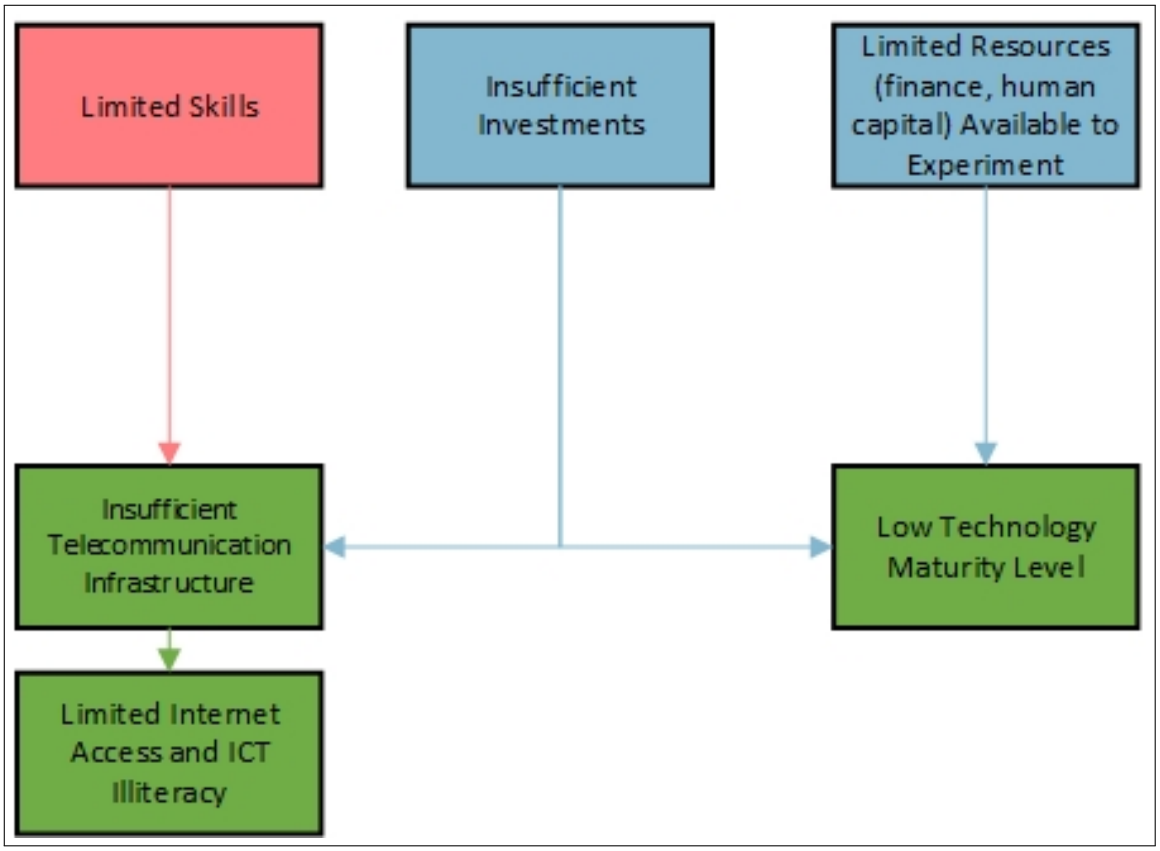

Figure 3.5 Limited Technological Infrastructure

3.3.3 Financial Resources

To realise industrialisation, capital investments are required. However, compared to larger firms, SMEs experience more difficulties in receiving external financing. They often struggle to obtain overdraft facilities, such as long-term loans, as they struggle to meet most lending conditions specified by commercial banks (Iguna and Sazita, 2018). The most common reasons for this include: lack of collateral (due to small asset base), difficulties in proving creditworthiness, small or lack of cash flows, inadequate credit history, high-risk premiums, underdeveloped bank-borrower relationships, and high transaction costs (Ardic *et al.*, 2011).

The lack of liquidity and cash flow affects SMEs greatly. Liquidity refers to the amount of cash an organisation has to cover its immediate and short-term obligations and is, therefore, important for SMEs (Gual, 2018). Low liquidity or unavailable cash may hinder SMEs in reacting to the changing markets or customer demands. Additionally, cash availability has a direct impact on how fast a company can reach its financial objectives and how long the business can stay afloat for (Gual, 2018). Limited cash flow results in SMEs to be greatly affected by the delayed VAT (Value Added Tax) returns (See Figure 3.6). Furthermore, late payments received by SMEs from customers hinder business owners to invest in their business (Wright-Whyte, 2020). This restricts a company's ability to invest in new infrastructure and technologies that are required for a transformation. The lack of cash flow and liquidity may, therefore, lead to an increase in the company's risk profile, which may affect its opportunity to receive a bank loan (Wright-Whyte, 2020). Therefore, lenders find SMEs riskier than larger organisations and, therefore, tend to allocate their funds to larger firms (Iguna and Sazita, 2018).

Additionally, businesses are often unaware of the financial benefits that could result from the DT due to the lack of successful business cases that justify the investment (Mohamed, 2018). The deficiency in sufficient financial funds may lead to the absence of standards such as the ISO standards (Mittal *et al.*, 2018). Capital investments and human resources are required to prepare and pass the certifications (Mittal *et al.*, 2018).

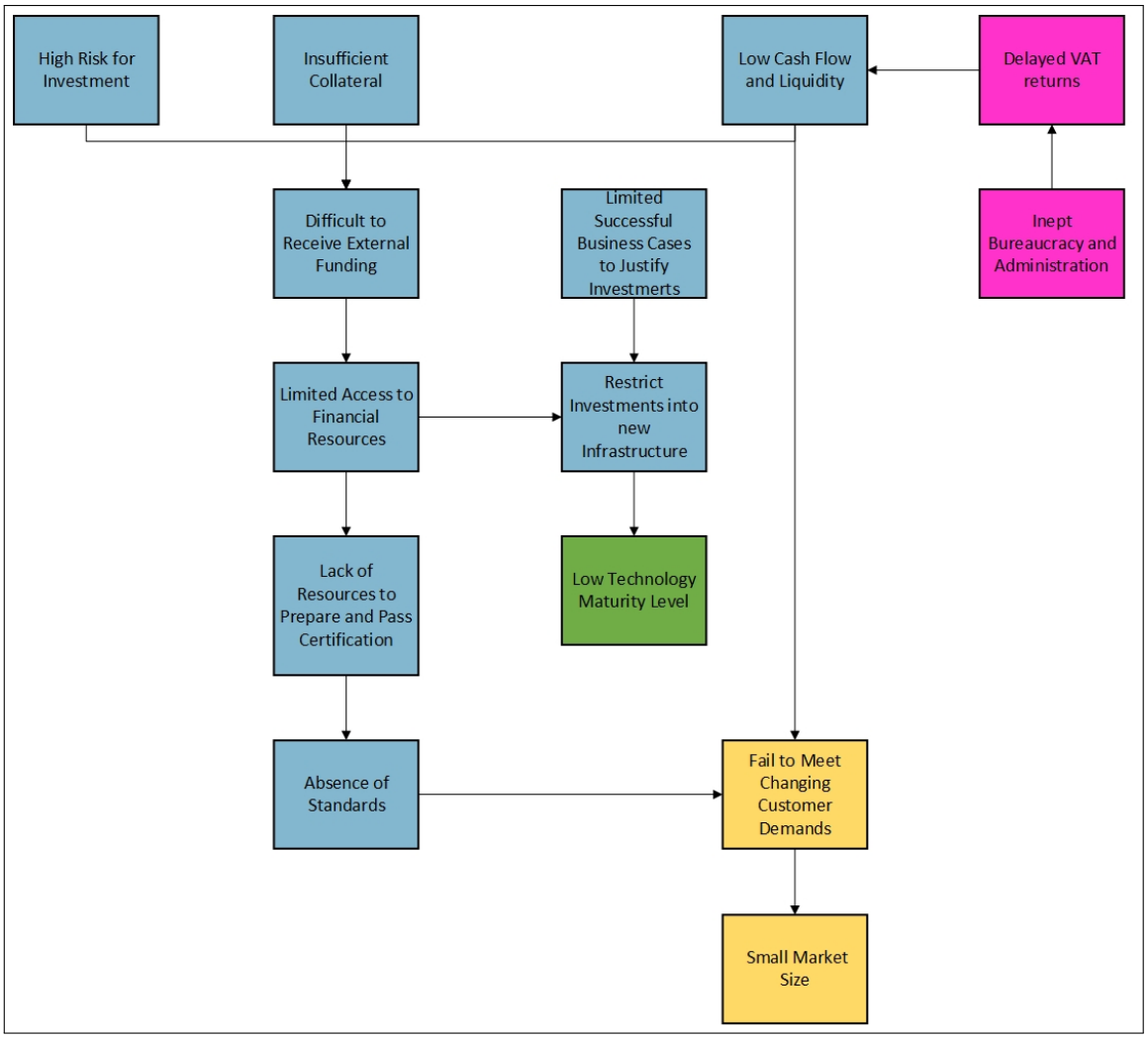

Figure 3.6 Factors Affecting Financial Resources

3.3.4 Human Capital

Education, skills, language, and culture play a major role within a working environment. Managers must be aware of the cultural differences and language barriers when trying to manage change successfully within a company.

3.3.4.1 Lack of Education and Skilled Labour

Education in Southern Africa remains a challenge towards development and growth. High illiteracy rates in South Africa have a significant impact on the SME sector (Kyobe, 2011). The education sector in Angola also shows various business opportunities, as approximately 80% of its population is illiterate (Savela *et al.*, 2018). In Windhoek, the capital

city of Namibia, many SMEs are run by primary school leavers (includes the informal and formal sector) (Iguna and Sazita, 2018), and in Madagascar, only 3% of the total population have completed secondary education (Economic Commission for Africa, 2017). The insufficiency of education largely impacts SADC's potential to industrialise and transform digitally. Although e-learning has become a popular tool for the education sector in light of the COVID-19 pandemic, only the minority of SADC's population is able to take full advantage of the possibility.

On account of industrialisation, most simple manual tasks within the production line will disappear, which leads to an increase in the demand for higher workforce skills. Employees will be expected to manage more complex projects, solve problems successfully, and self-organise. The work will become more flexible, as workers will be assigned where help is needed (Schmitt, 2013). Nevertheless, the SME sector in the SADC is the major employer of unskilled labour due to its labour intensity (Van Zyl, 2019), and therefore, a critical insufficiency of skilled or trained labour exists (European Central Bank, 2019). SMEs often experience difficulties in asserting themselves against larger companies to fill vacancies (Schröder, 2016). They struggle to attract skilled labour, as they cannot offer similar kinds of benefits to what larger companies may offer (Shihomeka, 2017). Therefore, employees of larger companies are more likely to be highly specialised and thus considered experts in specific areas, such as automation technology (Mittal *et al.*, 2018). Employees at SMEs, on the other hand, are more likely to be "Jack of all Trades" and less likely to develop a high level of expertise in a particular field (Mittal *et al.*, 2018). Consequently, SMEs lack skilled staff who may be able to identify, implement, operate, and manage the new technologies offered by DT. Due to financial constraints, SMEs also cannot afford to consult external experts to realise the transformation.

SADC does not only experience a lack in skill level throughout the workforce but also the majority of SME managers or owners have insufficient managerial skills and technical know-how (Iguna and Sazita, 2018). Iguna and Sazita (2018) show that owners or managers with a secondary and/or tertiary level of education and skills are more likely to run a business successfully. Furthermore, to utilise innovations effectively, users need to pos-

sess relevant skills and have to be educated and trained to apply these skills successfully (Kyobe, 2011). Currently, those who run micro and small enterprises in the SADC are often self-made men, whose educational background or managerial routines are mostly poor (Iguna and Sazita, 2018). One reason contributing to the situation is the relatively low basic wage in the SADC. Many skilled individuals who are employed wish to earn more money than the minimum wage and, therefore, decide to become independent and open their own businesses. This causes two main problems: Firstly, this weakens the workforce pool for any organisation who wishes to hire a skilled employee, and secondly, they often do not possess business management or entrepreneurial background. This contributes to why most SMEs lack a long-term vision and strategy (Shihomeka, 2017). Entrepreneurs can only increase employment if they can make effective use of their entrepreneurial skills to drive growth (Bank of Namibia, 2010). Currently, SMEs in the SADC rely on traditional management practices, which in many cases leads to a lack of information and inadequate in-house expertise (Iguna and Sazita, 2018). Due to insufficient skills or low level of education or training, SME leadership is often incapable of constructing and presenting feasible business plans (Mukata and Swanepoel, 2017). The low level of financial education may contribute towards the previously discussed constraint - lack of financial access. Financial illiteracy can cause difficulties in managing a firm's finances effectively (Bank of Namibia, 2010).

3.3.4.2 Language and Cultural Differences

As a result of the colonialism in the late 1900s, most SADC countries remain deeply racialised in cultural and social terms (Mazibuko and Govender, 2017). For most countries, it remains a challenge to manage this cultural diversity and multiculturalism. Tensions and conflicts between diverse groups are common within the workplace. Such conflicts often arise due to race, gender, ethnicity, and language (Mazibuko and Govender, 2017).

Cultural differences play a major role in the business environment. Many businesses in Africa have adopted (or have tried to adopt) the western business culture, which distinctly focuses on company profits and stakeholders (Van Zyl, 2019). In the SADC however, the majority of the population is only familiar with the African culture, which focuses more

on the needs of the community (Van Zyl, 2019). This can make it difficult for companies to handle change, as management often struggles to convey the western business culture to the native and often uneducated workforce.

Another factor to consider is the SADC's linguistic diversity. It is estimated that 72 different languages are spoken within this region (depending on the complexity of defining or delimiting a language or dialect) (Kamwendo, 2009). South Africa alone has 11 official languages spoken within the country (Van Zyl, 2019). To ensure a common understanding between the different member countries, SADC has announced English, French, and Portuguese as the official languages of the region (SADC, 2019). However, the majority of the region's population, especially when located within the rural areas, does not speak these official languages fluently (Kamwendo, 2009). This causes a major challenge for communication within organisations where linguistic diversity exists within the workforce.

3.3.4.3 Change Reluctant

According to Gimpel and Röglinger (2015) findings, DT has an impact on the entire value chain and most companies fear its disruptive nature. The process of DT does not only influence the business processes, but also the employees. Therefore, change management plays a significant role in DT. Management has to ensure that employees understand the concept of digitalisation as well as the changes involved. DT affects the way they work and so they also need to adapt their way of thinking. Nevertheless, workers tend to be reluctant towards the possible changes that occur during and after the implementation of DT (Gimpel and Röglinger, 2015). Not only the operational workforce experience resistance towards change and digital technologies, but management may also experience some issues with the changes caused by DT (Liere-Netheler *et al.*, 2018). Currently, SME managers in the SADC are not well prepared to face changes in the business environment or to plan appropriate changes in technology. The reason for this is their poor education and managerial background (Iguna and Sazita, 2018).

3.3.4.4 Risk Averse

Innovation or adopting new technology involves risk and uncertainty. Taking risks plays a vital role in a company's performance and growth profitability (Neneh and Van Zyl, 2017). A study conducted by Neneh and Van Zyl (2017) has shown that risk-taking has a significant impact on an organisation's employment and asset growth. Entrepreneurs who are more inclined towards risk-taking continuously take action for growing and expanding their businesses. Thereupon, SME owners in the SADC need to increase their aptitude for risk-taking to achieve success (Neneh and Van Zyl, 2017). Due to financial and human capital constraints, however, SMEs in the SADC have found to be more risk-averse than larger companies (Schröder, 2016). Along with these constraints, SMEs in the SADC also face the problem of the high failure rate, which causes SME leadership fearing failure (Van Zyl, 2019). A new concept such as DT, therefore, needs to be implemented successfully the first time because they cannot account for any losses.

To summarise the information previously discussed, Figure 3.7 shows how all factors regarding Human Capital influence one another.

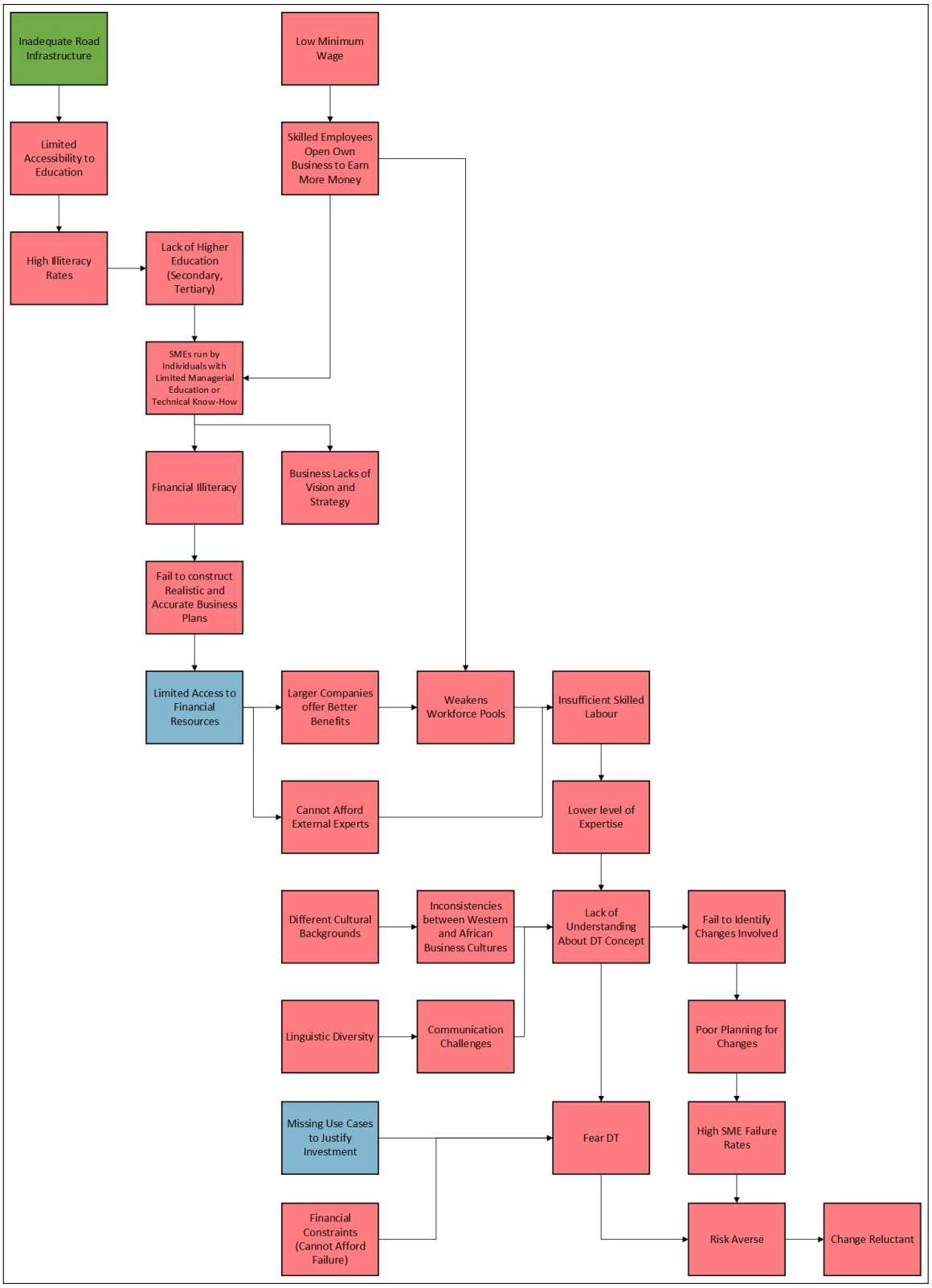

Figure 3.7 Effects of Insufficient Skilled Labour on SMEs

3.3.5 Administration Processes

Besides the financial and human capital challenges, SME owners frequently encounter difficulties with the tedious administration process, rigid labour regulations, and non-tariff barriers, such as licenses or customs clearance at borders. These factors cause major delays within such organisations, which are often not taken into account by managers.

3.3.5.1 Rigid labour regulations

The labour regulations in Southern Africa can be a major constraint for new employment. In South Africa, the inflexible labour legislation and Black Economic Empowerment (BEE) are frustrating small business growth (fin24, 2011). In South Africa, companies that earn an annual turnover of between R10m and R50m are expected to comply with every aspect of BEE, from ownership through to socio-economic development (Jeffery, 2015). Furthermore, the codes of BEE require such companies to raise black ownership to 25% and black management control to between 50% and 60%. Even though these regulations aim to create race-based fairness within the corporate sector, it will be difficult for family-owned firms to meet these requirements without losing control of businesses they have laboured to build up (Jeffery, 2015). Not only South Africa has such policies in place, but Namibia has also created a similar concept. The New Equitable Economic Empowerment Framework (NEEEF) represents a subset of the policies required to achieve greater equity in society. NEEEF aims to promote more equitable and balanced ownership and management control of businesses in Namibia for racially disadvantaged individuals (Government of the Republic of Namibia, 2015). Along with these regulations, businesses in the SADC are also required to meet the stipulations set by governments to meet gender equality. Managers are expected to ensure that gender considerations are built into all planning, implementation, monitoring, and evaluation (SADC Secretariat, 2009).

From the paragraph above it can be observed that SMEs in the SADC region are largely affected by rigid labour regulations. For individuals who run such businesses, hiring employees is found to be a major challenge. Besides, the fact that insufficient skilled labour is available, other policies such as BEE or NEEEF as well as gender equality minimise

the potential labour pool.

3.3.5.2 Inept Bureaucracy and Over-regulation

According to a report published by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, a major constraint for businesses in the SADC is the inefficient bureaucracy system (Makokera *et al.*, 2012). The bureaucratic burden within the SADC hinders the growth of many businesses. Too much time is wasted on administration issues. One example is the tedious process of obtaining work permits for foreign employees. The process is bureaucratically burdensome and very time-consuming (Savela *et al.*, 2018). The delay in the issuance of work permits for individuals with critical skills, that are not available domestically, can lead to significant losses in output and can cost companies a substantial amount of money (McKinnon *et al.*, 2019).

To put this argument into context, a study was conducted by the World Bank Group to measure the number of procedures and the time required for SMEs to start up formally and operate in an economy's largest business city. The following figures summarise the results found, which will also be discussed in more detail.

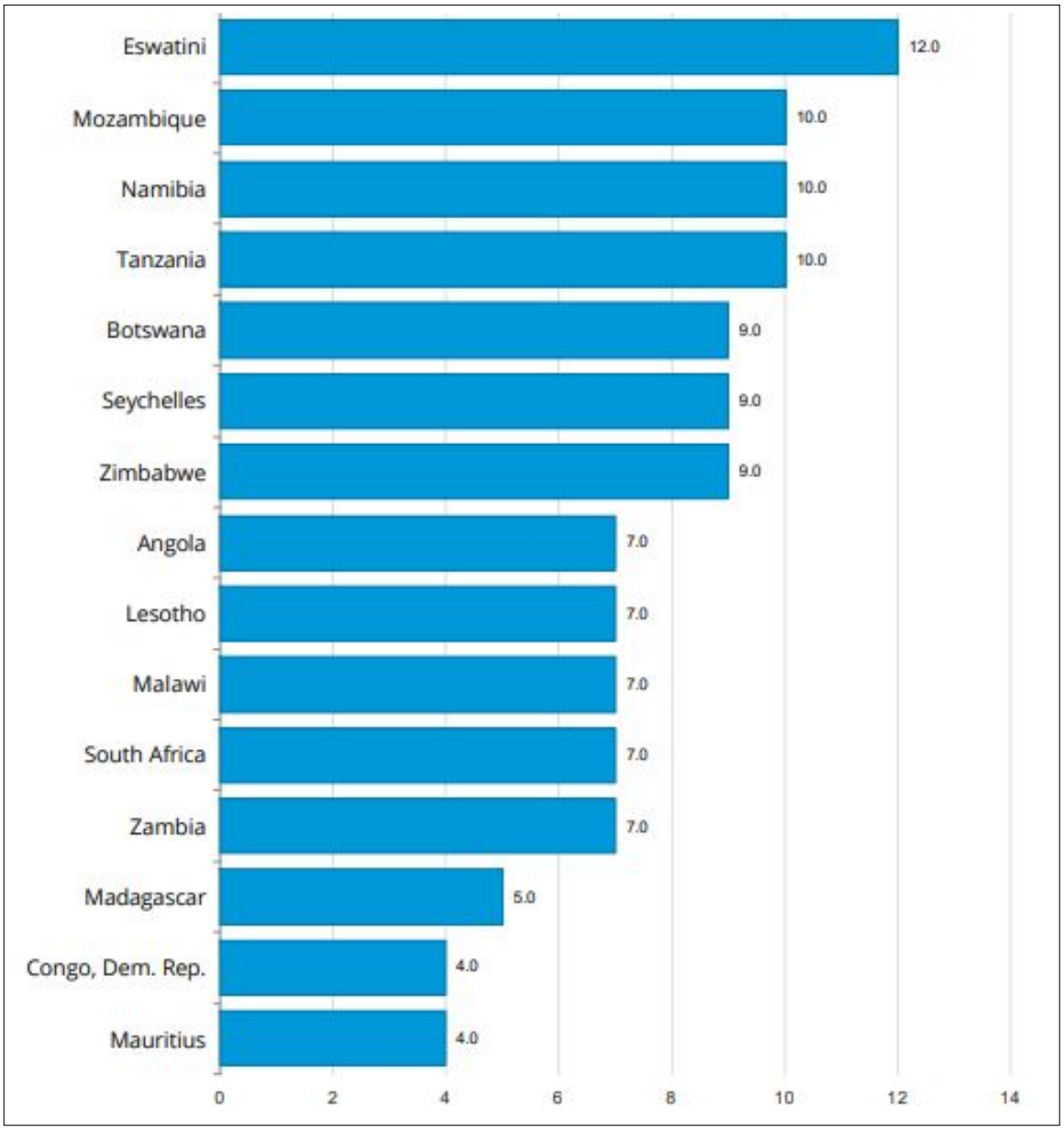

Figure 3.8 Number of Procedures to start a Business in SADC Economies (World Bank Group, 2019)

The indicators in the study measure the number of procedures required by businesses to legally start and formally operate a company. This includes the procedures that are required for preregistration (eg. name verification), registration in the economy's largest city, the post-registration (eg. social security registration), and obtaining other specific documents required for the company registration (World Bank Group, 2019). The SADC region's average number lies at 7.9, which is higher than East Asia & the Pacific (6.8) and the Middle East & North Africa (7.2) (World Bank Group, 2019).

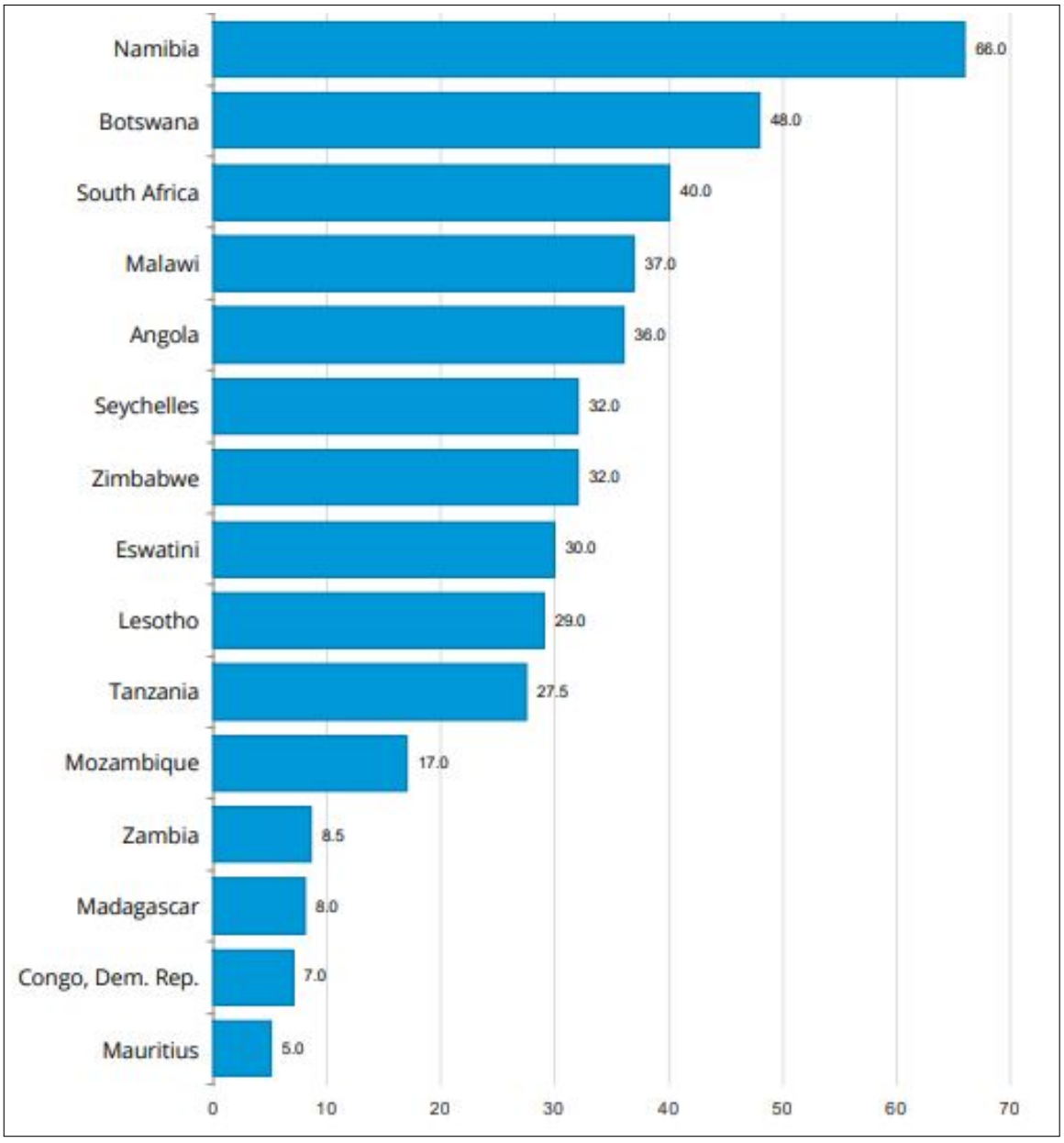

Figure 3.9 Number of Days to start a Business in SADC Economies (World Bank Group, 2019)

The average number of days it takes to start a business in the SADC is 27.4. According to the study, SADC leads with its regional average (East Asia & the Pacific: 25.9 days, Middle East & North Africa: 20.5 days) (World Bank Group, 2019). This measure does not include the time that is spent on gathering information and also assumes that no official staff is contacted before the start of the procedure (World Bank Group, 2019). From Figure 3.9 it can be seen that even South Africa, which is one of the more developed countries compared to the rest of the SADC, ranks third.

The excessive bureaucratic procedures and the time investment causes the informal SME sector in the SADC to grow. Unskilled or uneducated SME owners or managers are often discouraged from undergoing such a tedious process of registering their businesses formally. Informal businesses create competition for formally registered businesses and can also hinder the region's growth and development.

3.3.5.3 Customs Regulations

In 1910, the Southern African Customs Union (SACU) was established between the Union of South Africa and the three, so-called, High Commission Territories of Bechuanaland (now Botswana), Basutoland (now Lesotho) and Swaziland. In 1990, Namibia joined as well, upon its independence from South Africa (Fall and Gasealahwe, 2017). According to the authors, the features SACU aimed for were:

- The free movement of goods and services between member countries,
- The common external tariff, and
- Revenue sharing of the common pool of duties and trade taxes.

In 2008, after long negotiations, SADC finally completed a free trade area with tariffs eliminated on 85% of traded goods among 13 of the 16 members. Angola and the Democratic Republic of Congo are still outside the free trade area (Fall and Gasealahwe, 2017). However, the intra-regional trade exports in the SADC is only 10%, which is relatively low compared to other regional communities (25% in the ASEAN or 40% in the European Union) (Savela *et al.*, 2018). The weak performance of SADC's intra-trade can be explained by the similar economic structures of its members. For instance, ten out of the fifteen countries are exporting natural or cultured pearls, precious or semi-precious stones, and precious metals in their top ten export products. Only a few countries are exporting manufactured or sophisticated industrial goods (Fall and Gasealahwe, 2017). Another obstacle to SADC's intra-regional trade is the non-tariff barriers and the high external tariffs (see Figure 3.10) between the countries.

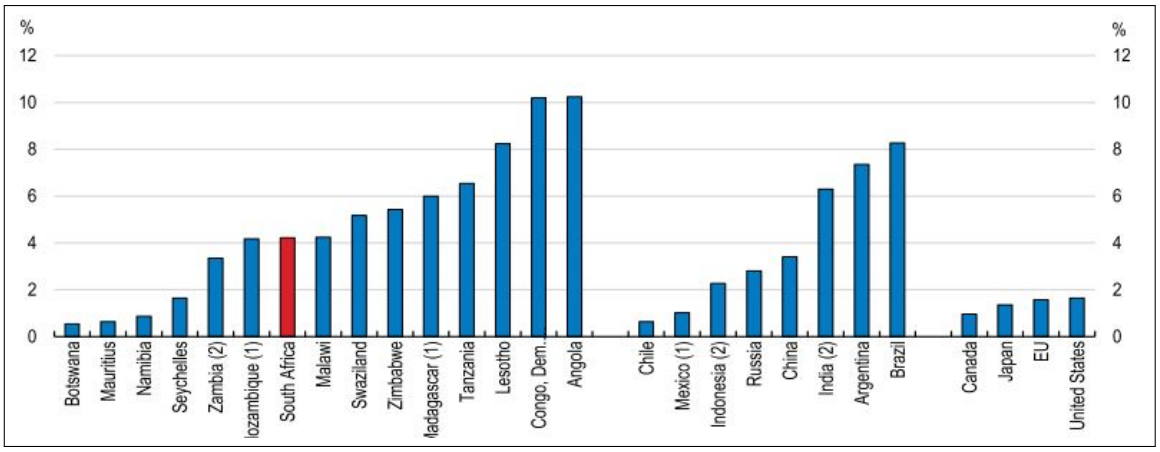

Figure 3.10 SADC Tariff Rates Compared to Other Countries (Fall and Gasealahwe, 2017)

Non-tariff barriers (NTBs) include licences, quotas and bans, price controls, competition policies, rules of origin and technical barriers to trade (Fall and Gasealahwe, 2017). NTBs restrict the opportunities for regional sourcing, as it is complex and expensive. In Zambia for instance, Shoprite needs to pay US$20,000 per week on securing import permits to distribute meat, milk, and plant-based goods to its stores. In all countries Shoprite operates in, approximately 100 (single entry) import permits are applied for every week; this can rise to 300 per week in peak periods. As a result of these and other documentary requirements (e.g. ROOs), there can be up to 1,600 documents accompanying each truck Shoprite sends with a load that crosses a SADC border. It can be seen that the customs procedures within the SADC are hindering the intra-regional trade (Gillson, 2013). These procedures are rather complex compared to other regional communities. Not all SADC countries are in the same free trade areas. Some SADC members are part of the SACU, while others belong to the Common Market for Eastern and Southern Africa (COMESA) (Madakufambe and Ngwawi, 2015). The multiple memberships of Regional Economic Communities (RECs) cause issues in the SADC. It creates difficulties for customs officers to establish the precise preferential tariffs applying to each product (Fall and Gasealahwe, 2017). Other problems hindering intra-regional trade include the delays experienced at the borders. Some borders do not operate on a 24-hour basis due to electrical and technical shutdowns and incompatibility of customs systems between countries (Fall and Gasealahwe, 2017). The average time it takes in the SADC region to export across borders is 84.9 hours (World Bank Group, 2019). This includes the time

required to gather all relevant documentation (licences, clearances), the inspection and customs clearance of the goods, as well as the domestic transport (loading/unloading, traffic delays) (World Bank Group, 2019). The Democratic Republic of Congo leads by far with 296 hours, raising the regions average significantly. In comparison to high-income countries, the average time lies by 12.5 hours which is significantly lower than SADC's average (World Bank Group, 2019).

Customs regulations can play a major role in businesses in the SADC. Businesses need to be aware of the complexity involved in trading regarding the documents and regulations. Also, if they plan to import or export products, they need to take into account possible time delays.

3.4 Chapter Summary

Throughout this chapter, it has become clear that SMEs in the SADC face multiple challenges and tend to lose focus on innovative opportunities that would drive their competitive advantage. The challenges they are facing include the small market size, the underdeveloped physical and technological infrastructure, the limited access to financial resources and skilled labour, and finally the ineffective administration processes. It was found that all factors contribute towards the limited industrialisation experienced in the SADC, which eventually leads to the underdeveloped economic sector. To summarise the information discussed throughout this chapter and to show the interrelationships of the challenges, Figure 3.11 has been compiled. The blocks have been colour coded according to their specific category (market, infrastructure, finance, skills, and administration). Yellow includes the factors that have been discussed throughout the small market size subsection, while the green blocks correspond to the underdeveloped physical and technological infrastructure. Blue indicates the challenges that are of financial nature, pink represents the human factor, such as skills, education, and culture, and finally, purple corresponds to the challenges resulting from the ineffective administration processes.

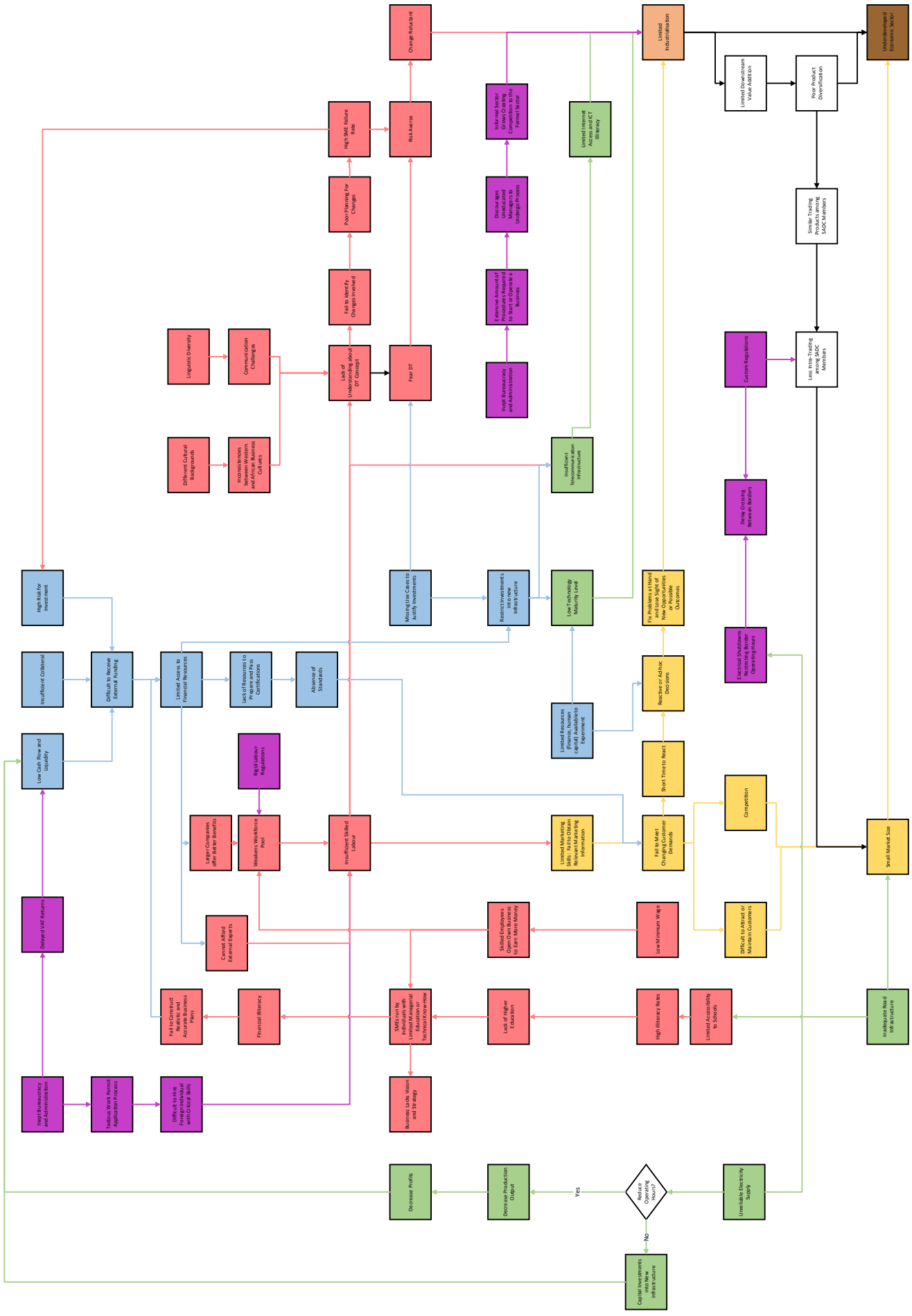

Figure 3.11 Detailed Overview of the Challenges SMEs experience in the SADC

Chapter 4

Framework Design to Support SMEs with Digital Transformation

This chapter aims to provide a fundamental background about the frameworks that are available to support SMEs for approaching DT. These options include maturity models, readiness assessments, and DT roadmaps. Those are analysed and discussed in more detail throughout this chapter. The option that is found to be most suitable to support SMEs in the SADC is chosen, in this case, a DT roadmap. An alternative framework is designed to support these specific organisations. To provide a fundamental understanding of the content and scope of such roadmap, three models of the chosen option are discussed and compared. The models are evaluated to identify specific elements that should be addressed by researchers or entities who aim to develop a roadmap. Finally, the chapter closes with management tools and techniques that can potentially be used to achieve the specific objective of selected elements to make the roadmap ready for application.

4.1 Available Frameworks

DT is a broad and complex topic that can affect an organisation in numerous fields. From the literature discussed in Chapter 3, it has become clear that the lack of skills and education among SME owners and managers contribute largely towards SADCs underdeveloped economic sector. Managers may not possess sufficient knowledge and understanding about the elements and different options that require consideration during a DT endeavour (Hess *et al.*, 2019). Without this knowledge, management struggles to properly evaluate the current and future requirements for DT (Williams *et al.*, 2019). As a result, important elements or solutions that might be more favourable to a company's specific situation may

have been disregarded (Hess *et al.*, 2019). Furthermore, SMEs often fear investing in the wrong technologies or adopting inapt practices (Mittal *et al.*, 2018). Therefore, before conceptualising digital initiatives, such as digital business models, new innovative products and/or services, or digital business processes, Williams *et al.* (2019) advise companies to first assess their current capabilities and their future requirements. Clear guidelines that assist managers throughout the preparation and implementation phase are, however, lacking (Hess *et al.*, 2019). Therefore, it is crucial to understand which dimensions of an organisation might be affected to anticipate the possible outcomes of such transformation.

To obtain an overview of available DT approaches for SMEs, existing frameworks have been identified and analysed. By analysing existing frameworks, the author had the opportunity to gain an overview of the different approaches to DT and to determine which would be most suitable for SMEs in the SADC. This study, however, does not include the objective to analyse all possible existing DT frameworks that may be suitable for SMEs. By using different keywords or phrases, as well as backward and forward searches on the basis of relevant articles, three frameworks were selected for analysis: maturity models, readiness assessments, and roadmaps. The keywords/phrases used in the search include:

- Steps to Digital Transformation in SMEs,
- Practices for assisting SMEs with Digital Transformation,
- Digital Transformation Process in SMEs.

4.1.1 Maturity Models and Readiness Assessments

The term "maturity" has multiple definitions in the literature. Teichert (2019) defines maturity as "a state of being complete, perfect, or ready". A maturity model helps organisations to assess the strengths and weaknesses of the business processes without any external help from consultants (Albliwi *et al.*, 2014). One of the formal definitions found in the literature states that a maturity model is "... a structured collection of elements that describes the characteristics of effective processes at different stages of development. It also suggests points of demarcation between stages and methods of transitioning from

one stage to another" (Albliwi *et al.*, 2014). A closely related tool to maturity models is readiness assessments. Their goal is to capture the starting point and allow for initialising the development process (Schumacher *et al.*, 2016). The main difference between readiness assessments and maturity, according to the authors, is that readiness assessments take place before engaging in the maturing process. They are tools that are used to evaluate, analyse, and determine the level of preparedness of the system's conditions, attitudes, and resources required to achieve the goal(s) (Mittal *et al.*, 2018). Maturity assessments, however, aim to capture the as-is state throughout the maturing process (Schumacher *et al.*, 2016). Furthermore, they aim to assist individuals or organisations to reach a more sophisticated maturity level in terms of people, culture, processes, structures, and technologies (Mittal *et al.*, 2018).

"Digital maturity" on the other hand can be seen as a systematic way of how an organisation prepares to adapt to the increasingly digital environment to remain competitive (Teichert, 2019). Additionally, it reflects the status of a company's DT and describes what a company has already achieved in terms of performing transformation efforts (Teichert, 2019). For organisations to reach the highest level of maturity, their digital foundation must be strong, and they must understand how to leverage this foundation and use it to their advantage (Teichert, 2019). The areas maturity models are mostly used in include digital government, IT management, knowledge management, or business process management (Pöppelbuß and Röglinger, 2011). However, since DT in SMEs is one of the main objectives, this research will focus on digital maturity models.

Digital maturity models act as a tool to aid management or business owners to determine the baseline level (as-is state) of a company's digital maturity, and also indicates a potential, anticipated, or typical development path to the desired target state (to-be state) (Williams *et al.*, 2019), (Teichert, 2019). Therefore, they can provide guidance on how organisations can approach their transformation systematically to ensure improvement, a certain quality, and help avoid errors (Teichert, 2019), (Wendler, 2012). Digital maturity models consist of dimensions and criteria which describe areas of action and measures in various levels and which indicate the evolution path towards maturity (Te-

ichert, 2019). Models that only refer to one criterion are called one-dimensional, although more recently, most models are designed to be multi-dimensional and include affected processes, organisational units, and problem domains (Wendler, 2012). A dimension is "a specific, measurable and independent component which reflects a major, fundamental and distinct aspect of digital maturity and describes an area of action" (Teichert, 2019).

Such models usually consist of a sequence of levels (or stages) that form an anticipated, desired, or logical path from an initial state to maturity (Pöppelbuß and Röglinger, 2011). These stages are usually sequential in nature and should be closely connected to organisational structures and activities (Wendler, 2012). Each stage is characterised by certain requirements that need to be achieved by an entity on that level (referring to a human being, process, organisation, etc.) (Khoshgoftar and Osman, 2009). Businesses commonly make use of such models to assess the as-is situation of the organisation, concerning a specific class of entities they want to assess (Pöppelbuß and Röglinger, 2011). By deriving the as-is situation, businesses can derive and prioritise improvement measures, and also control progress (Pöppelbuß and Röglinger, 2011). Teichert (2019) compared and analysed 22 different digital maturity models, and identified the digital maturity areas addressed by these models (note that no model contained all areas). These areas are listed and briefly discussed below:

1. Digital Culture: Attributes that enhance DT efforts (risk-taking, R & D, no-blame culture, agile, employee autonomy, open to change).

2. Technology: ICT, IT architecture/systems and new digitalisation-based IT systems, agility of supporting systems, digital data processing.

3. Operations and Processes: Digitisation and automation of processes, process flexibility/agility, bringing processes to an industrialised standard, operations excellence.

4. Digital Strategy: Development/execution of a strategy using digital technology to do business in fundamentally new ways, bold long-term orientation, align to existing business strategy.

5. Organisation: Management structure/practices supporting digital business, cross-functional collaboration, digital skills embedded throughout the organisation, roles/tasks related to digitalisation defined, adequate resource allocation, cross-functional teams to implement digital business priorities, flexible communities, agile management.

6. Digital Skills: Digital skills, expertise, experience and interest, personnel dedicated to DT, ICT competencies of employees, data empowered decision making, openness to new technologies, employees have access to digital skills/expertise as needed.

7. Innovation: Capabilities enabling a more flexible/agile way of working, development of disruptive business models, using agile methods, involving customer into innovation process, funding innovation, innovation conducted regularly.

8. Cost Insight and Experience: Customer benefit from digitisation, personalisation of products/services, utilising digital services to engage customers, focus on customer value, digitisation of customer touchpoints, creating value out of data, customer participation and empowerment.

9. Governance: Ensuring comprehensive/reliable execution of digital strategy, everyone has a mandate to think creatively and innovate, systematic approaches are taken to innovation/change management, engagement on different hierarchical levels, standards and regulations, adequate resource allocation.

10. Vision: Organisation has defined an initial digital vision, digital technology realises the vision of the organisation; all staff work in sync with the digital vision.

11. Digital Ecosystem: The organisation works as a part of a digital ecosystem; digitisation/integration of vertical/horizontal value chains, digital connection with the business network (e.g. through API), interoperable technology platforms enable new/highly customizable solutions configured by end-users.

12. Leadership: Leadership team learning new technologies, leaders have a compelling long-term vision, leaders actively identify and realise new opportunities, foster collaboration, existence of central coordination for I4.0 or DT.

13. Compliance and Security: IT security, digital security, IT compliance within organisation and towards stakeholders, assessing risk factors, risk management, IP, optimising value-chain network for compliance, avoid unauthorised access.

14. Products and Services: Smart products/services, digitisation of product/service offerings, data analytics deployed for individualisation, data-based services, digital features.

15. Business Model: Development of new and disruptive business models, integrated customer solutions across supply chain, digital product/service portfolio with SW, network (M2M) and data as key differentiator, digital initiatives are generating value, business models are expanding.

Maturity models can have different application-specific purposes of use. They can be of descriptive, prescriptive, or comparative nature which will be discussed in more detail below (Pöppelbuß and Röglinger, 2011):

1. **Descriptive:** The model is used as a diagnostic tool where the as-is situation of an organisation is assessed by investigating the entity's current capabilities concerning given criteria. Through this, a maturity level will be assigned and can be reported to internal and external stakeholders.

2. **Prescriptive:** Such models indicate how to identify the desired maturity level (to-be state) of the organisation, and provides guidelines (suggests specific and detailed courses of action) on improvement measures.

3. **Comparative**: The model allows for internal or external benchmarking and provides the opportunity to compare the maturity levels of similar business units or organisations.

4.1.2 Digital Transformation Roadmaps

One major advantage larger firms have over SMEs is the fact that they usually have the funds and human resources available to experiment with different innovation projects (Barann *et al.*, 2019). SMEs often lack the resources and courage to move outside their

comfort zones and look at new avenues outside of their core competencies (Mittal *et al.*, 2018). Smaller companies, however, must learn and adapt quickly about the new, emerging technologies and digital practices, and to do this, SMEs require a more practical approach. This approach should focus on feasible and tangible goals and should assist to recognise and break down the underlying complexity of DT projects into manageable and easily understood action items (Barann *et al.*, 2019). SMEs are often overwhelmed by strategic and operational decisions (what, why, when, where, who and how) regarding the adoption or implementation of Industry 4.0 technologies or DT in general (Mittal *et al.*, 2018). There are numerous studies available on holistic models, including organisational, business, and technological aspects (Mittal *et al.*, 2018).

These holistic models can be referred to as DT roadmaps. Roadmaps define the strategy milestones that have to be achieved by the organisation to realise and implement DT successfully (Zaoui and Souissi, 2020). Furthermore, roadmaps can help businesses to match their short-term and long-term goals with specific technology solutions that can be used to achieve these goals (Mittal *et al.*, 2018). A roadmap can assist business leaders to plan for coordinating and driving the change that results in an organisation from the transformation (Mainville, 2020). According to Mainville (2020), a roadmap should consist of the following core elements:

1. Goal: Clear articulation of the DT goal.
2. Strategy: Defined strategy stating the DT approach.
3. Key Activities: Identification of the key activities (eg. technology projects, organisational restructuring, changes to the supplier ecosystem or modifications to business processes) that are critical for the transformation.
4. Milestones: Description of the intermediate target states that have to be achieved to progress. Milestones help to ensure that the organisation is still on-course with the transformation.

DT can be both expensive and risky (Mainville, 2020). Roadmaps can, therefore, assist organisations in planning the endeavour, and help determine if the transformation effort

is moving in the right direction (Mainville, 2020). Furthermore, roadmaps break down complex DT projects into separate, and manageable tasks (Mainville, 2020). This can help the business to identify what projects and initiatives are necessary, and who will be responsible for each task or project (Mainville, 2020). Furthermore, leaders can make more informed decisions and it also increases the team's focus (Mainville, 2020). The roadmap helps the team to differentiate the important tasks that require immediate attention from the distracting ones that tend to overwhelm the workforce (Mainville, 2020). The author further claims that organisations can significantly increase the likelihood of success in their DT endeavour by making use of DT roadmaps.

A roadmap, however, should not be seen as a set of instructions that have to be followed to achieve the goal, but rather as a guideline or reference that ensures that the organisation is moving in the direction of the DT goal (Mainville, 2020). They merely describe an approach that could be followed by organisations to approach DT. Organisations, therefore, have to adjust the scope of the roadmap and match it with their existing strategy.

4.1.3 Framework Selection

In Subsection 2.2.2, different organisational areas are identified that are affected by DT. These areas have been referred to as key components and include company strategy, employees, customers, organisational culture, and digital environment. All these factors play a vital role in a DT endeavour, and businesses must be aware of the possible changes that may occur. However, SMEs in the SADC are showing significant gaps within these areas. The reason for this includes the insufficient knowledge and understanding SME leadership possesses about the elements that require consideration during a DT endeavour. In Chapter 3 it is shown that the lack of skills and education among SME owners and managers contribute largely towards SADCs underdeveloped economic sector. The insufficient management and entrepreneurial background contribute to the lack of a long-term vision and company strategy in SMEs. SME leaderships' lack of awareness and understanding about the DT concept contributes towards the failure of identifying and planning for the changes that are involved in a DT endeavour. Furthermore, due to limited marketing skills, the

organisation fails to meet the rapidly changing customer demands, which makes it difficult to maintain or increase its customer base. Financial illiteracy among management contributes towards the organisation's failure to obtain financial support, which limits the opportunity to invest in new infrastructure (physical and technological). Therefore, SMEs in the SADC require assistance and guidance in planning for a DT endeavour. Awareness must be created amongst SME leadership about the changes that are involved, and what possible steps should be followed to transform successfully. Correspondingly, for organisations with limited skills and financial opportunities available, it would be useful to determine what value can be achieved for the effort invested in the DT endeavour.

As mentioned, readiness assessments are utilised before engaging in the actual maturing process to determine and capture the organisation's potential for digital change. Readiness assessments, therefore, do not support businesses throughout their DT endeavour. The same applies to most maturity models. Teichert (2019) find that the majority of the digital maturity models available are descriptive in their nature. Although this is very useful to determine the organisation's current level of digital maturity, guidance or clear roadmaps of how to achieve a higher maturity level (prescriptive) are lacking (Teichert, 2019).

Although no roadmaps exist to the researcher's knowledge that assist SMEs in the SADC to transform digitally, roadmaps offer a more practical approach. In the previous subsection, it was clarified that roadmaps should not be considered as a list of instructions, but rather as a guideline. The guideline ensures that businesses can break down complex projects into separate and manageable tasks. This can assist SMEs in the SADC to tackle DT in pragmatic steps, adhering to the peculiarities posed by the nature of SMEs. The guideline can further raise awareness to the under-qualified SME business owner or manager about the concept of DT and assist in the decision-making process. Compared to maturity models and readiness assessments, roadmaps can help businesses to match their short-term and long-term goals with specific technology solutions that can be used to achieve these goals (Mittal *et al.*, 2018). Roadmaps encourage the user to articulate the DT goal clearly, align it to the organisational strategy, and help to identify the key

activities and milestones involved in the transformation process. Roadmaps can also assist organisations in determining whether the transformation is moving in the right direction and whether it is worth the investment.

Based on the research discussed in Chapter 3, it can be argued that factors such as the low skill level, the financial constraints, or the low technology maturity level experienced by SMEs in SADCs current operational environment lead towards favouring roadmaps, rather than maturity models or readiness assessments. If maturity models or readiness assessments would be selected, one can assume that the target group for this research would not score past level 0 or 1. Furthermore, Teichert (2019) states that maturity models are rather descriptive than prescriptive, which does not directly align with the objective of this study. This research targets SMEs in the SADC who aim to engage in a DT and to support those throughout the process. This study, therefore, rejects maturity models and readiness assessments. These frameworks, however, could still be considered as a useful step in a roadmap, as they can indicate the current maturity level of an organisation.

The objective of this research, therefore, is to design a roadmap that can assist SMEs in the SADC to tackle DT in systematic and pragmatic steps by adhering to the peculiarities posed by the nature of SMEs. The roadmap will be developed by researching existing roadmap models to create a fundamental basis of the content and requirements. The objective of the roadmap is to educate and support management about DT and the corresponding challenges in SADC's business environment. The roadmap does not aim to make recommendations or to eliminate challenges or problems, but it aims to create awareness among SME leadership and to guide and simplify the DT approach.

4.2 Existing Digital Transformation Roadmaps

Similar as to Section 4.1, the objective of this research is not to analyse all possible existing DT roadmaps, but to gain an overview from a variety of designs and possibly to identify a DT roadmap or components of DT roadmaps that could be used as input in developing an alternative roadmap that is suitable for SMEs in the SADC. For a framework to be

considered as applicable, the relevant authors had to provide an elaborate description of the roadmap. Moreover, the roadmap either had to stem from researchers or organisations with a sound reputation, such as international consultancy firms. Again, using keywords and backward and forward searches based on relevant articles, three independent existing approaches to DT have been selected. This allowed the author of this research study to obtain fundamental knowledge and understanding of the content required in a DT roadmap.

The procedure model from Barann *et al.* (2019) consists of two phases, each consisting of different steps and sub-steps. The model introduces the aspects and topics that should be addressed by researchers or support units who aim to develop a roadmap for DT projects in SMEs. The second model represents a DT approach, developed by Stich *et al.* (2020). This model defines four levels that aim to assist SMEs to build an individualised roadmap for DT. Finally, Cognizant's DT framework compiled by Krishnan *et al.* (2015) provides manufacturing companies with a systematic approach towards successful DT. The framework consists of three different phases, whereby each phase embodies different steps. The selected models are summarised throughout the section of this chapter, followed by a discussion of all models.

4.2.1 Procedure Model

Since SME owners or managers in the SADC are often uneducated regarding digitalisation, innovation potentials, and new emerging technologies, they require systematic guidance to prioritise goals and identify the potential organisational changes (Barann *et al.*, 2019). Using procedure models to tackle DT systematically has become a common method in the respective research domain. Barann *et al.* (2019) have researched and compared different procedure models and have found that most existing models are conceptual in nature. The steps described in the models are described in an ideal-theoretic way, which are hardly aligned to the actual and practical needs of SMEs.

Barann *et al.* (2019) have designed their procedure model in such a way that the model includes two important phases that must be considered for a DT. The first phase is the "Orientation Phase", and the second phase is the "Iterative Transformation Phase". The

phases and their corresponding steps and sub-steps are summarised and illustrated in Figure 4.1.

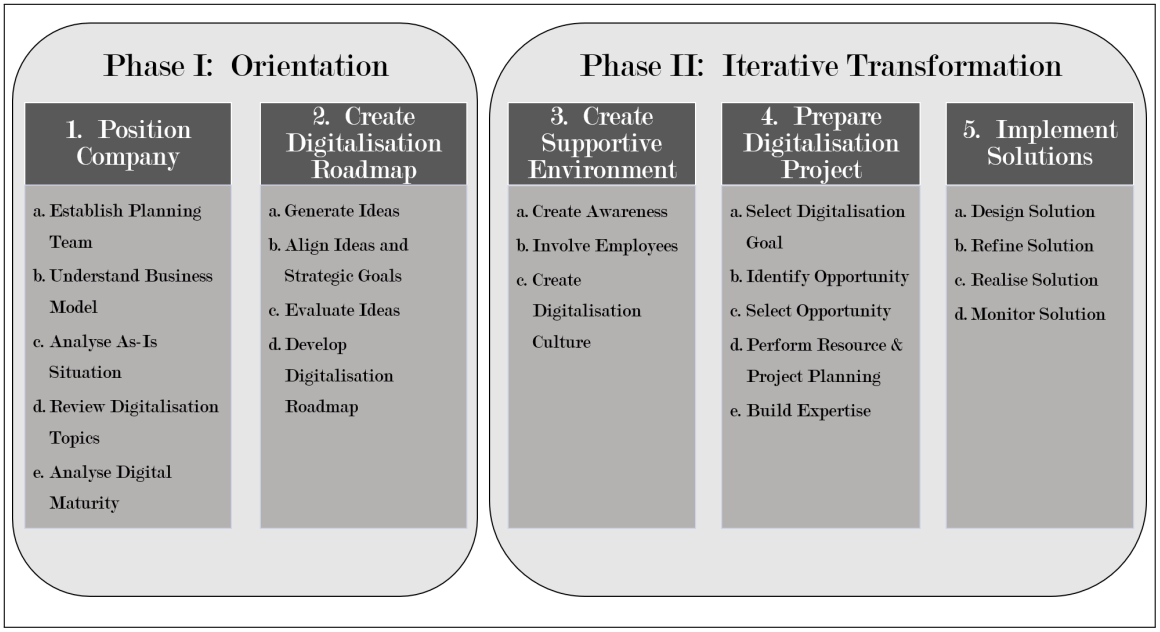

Figure 4.1 A Procedure Model to Enable Digital Transformation in SMEs (Barann *et al.*, 2019)

The Orientation Phase comprises of two detailed steps: Step 1 "Position Company", and Step 2 "Create Digitalisation Roadmap". The first step aims to help the company position itself within the digitalisation by gaining an understanding of the current business model and identifying the organisation's digitalisation potentials. Its sub-steps include: "Establish Planning Team", "Understand Business Model", "Analyse As-Is Situation", "Review Digitalisation Topics", and "Analyse Digital Maturity". Step two involves the creation of a roadmap, defining the business goals for DT, based on the current situation of the organisation and its strategic goals. It consists of four sub-steps: "Generate Ideas", "Align Ideas and Strategic Goals", "Evaluate Ideas", and "Develop Digitalisation Roadmap".

The second phase is the "Iterative Transformation Phase" and involves three detailed processes: "Create Supportive Environment", "Prepare Digitalisation Project", and "Implement Solution". As the name suggests, it is an iterative process and is designed in such a way that one iteration might implement one or several progressively enabled goals by

considering complementary opportunities. Once a goal has been implemented, it can be placed back to a new position on the roadmap if the implementation has been completed earlier than scheduled. The roadmap created in the first phase will constantly be reviewed and adjusted accordingly.

Step 3, "Create Supportive Environment" includes sub-steps "Create Awareness", "Involve Employees", and "Create Digitalisation Culture". This step ensures that the organisation raises awareness about creating a digital culture within the organisations and what changes are involved in the transformation. It further aims to involve employees and integrate the necessary people in the DT process. Step 4, "Prepare Digitalisation Project" consists of five sub-steps including: "Select Digitalisation Goal", "Identify Opportunity", "Select Opportunity", "Perform Resource and Project Planning", and "Build Expertise". Finally, the last step involves the implementation of the solution. The solution is first designed, refined, realised, and lastly, monitored.

Barann *et al.* (2019) created an approach that breaks down the underlying complexity of DT projects into manageable and easy tasks or action items. The model introduces the aspects and topics that should be addressed by researchers or support units who aim to develop a roadmap for DT projects in SMEs. Furthermore, the aim and objective of each step are presented. The methods or techniques required to achieve these objectives, however, need to be determined independently from the research from Barann *et al.* (2019).

4.2.2 Digital Transformation Approach

Stich *et al.* (2020) created an approach that aims to assist SMEs to build an individualised roadmap for DT. Figure 4.2 summarises the steps that are included in this roadmap.

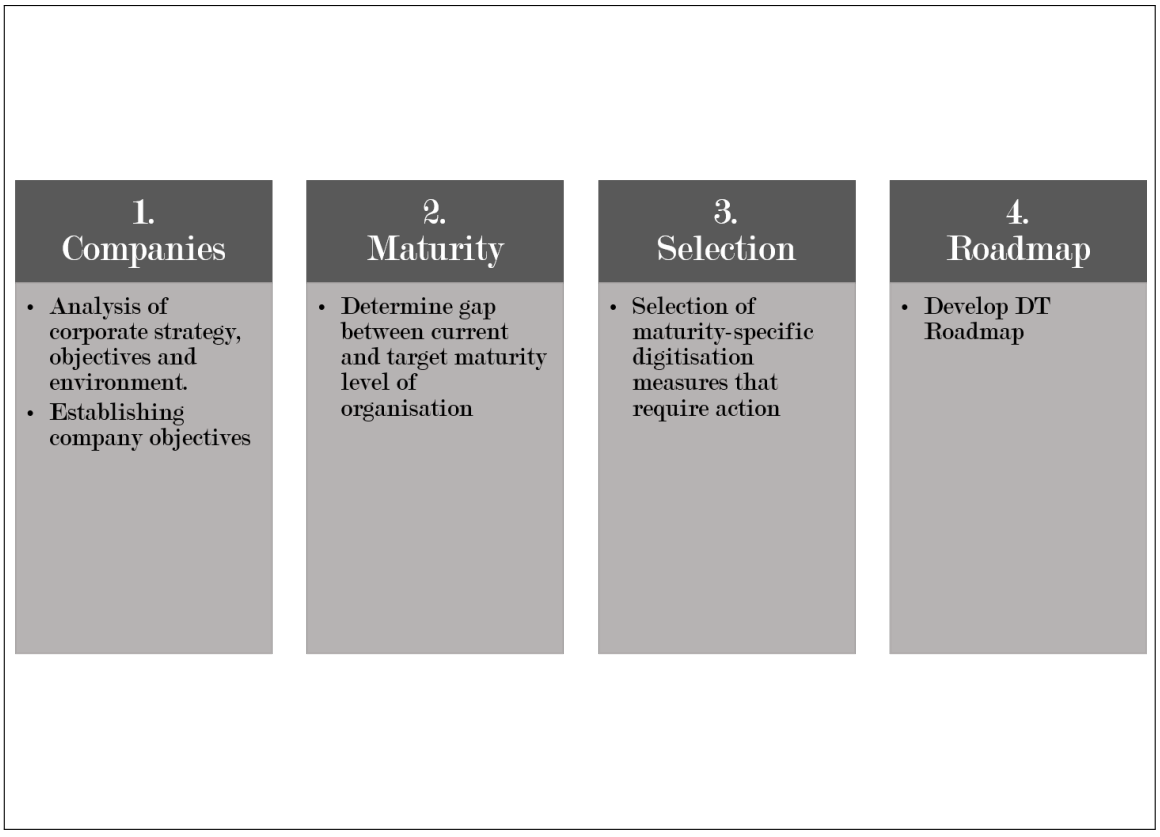

Figure 4.2 Digital Transformation Approach for SMEs (Stich *et al.*, 2020)

To complete the first step, the organisation must analyse its corporate strategy, objectives, and environment. The company has to define its core objectives and must establish how DT will contribute towards achieving these objectives efficiently and effectively.

The second step is concerned with establishing the organisation's current maturity level as well as its target state. The current status quo will serve as a baseline and will be compared against the organisation's target maturity level. This helps to identify the gaps present between these two states.

Depending on the gap analysis results, the third step involves the selection of maturity-specific digitisation measures that require action. These measures have been classified by the roadmap developers into four so-called forces, namely: resources, information system, culture, and organisation structure.

The final step requires the organisation to assign the previously established measures to its objectives. The matched measures and objectives need to be placed into chronological order, as they may build on one another. The organisation, however, needs to make sure that the measures are suitable for the existing company structure and align with its strategy. The chronologically ordered objectives, therefore, represent the SME with its roadmap for DT.

4.2.3 Cognizant's Digital Transformation Roadmap

Cognizant is a company based in America that provides digital IT services such as digital technologies, consulting, and operation services (Cognizant, 2020). The organisation is experienced in guiding other companies through the process of DT (Cognizant, 2020). Thus, a framework has been developed by the organisation that provides manufacturing companies with a systematic approach towards successful DT. The framework is summarised in a report, compiled by Krishnan *et al.* (2015). It consists of three different phases, whereby each phase embodies different steps. Figure 4.3 illustrates the framework.

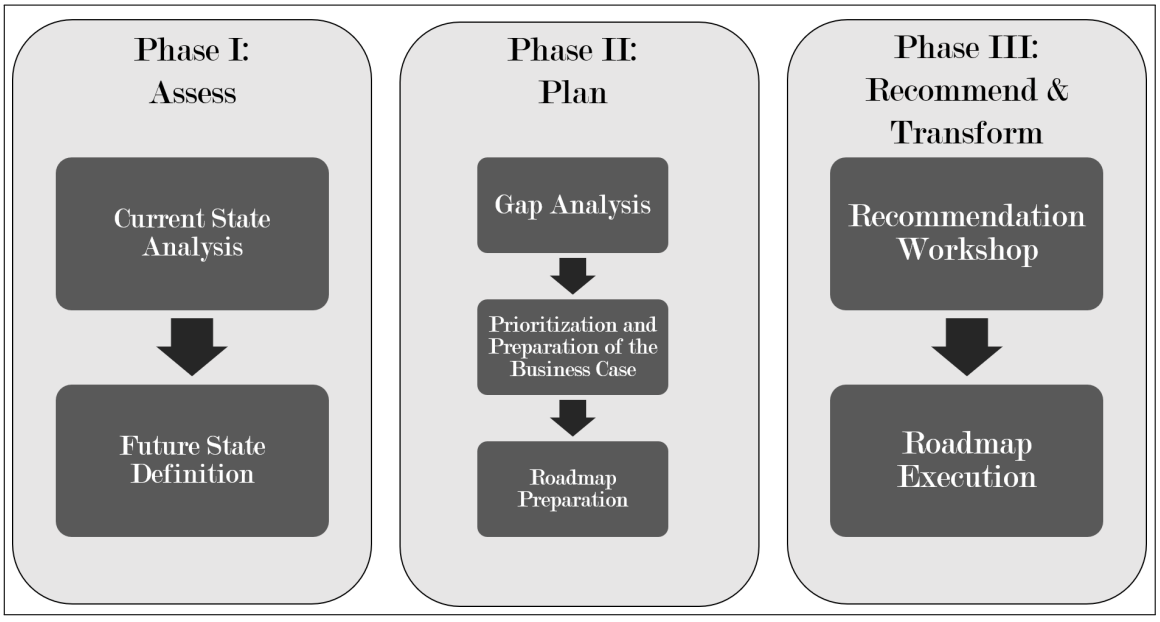

Figure 4.3 Cognizant's Digital Transformation Framework for Manufacturing Companies (Krishnan *et al.*, 2015)

The first phase is the "Assess" phase. This phase consists of two steps. In the first step, the organisation's as-is state is established. This is important, as the company has

to understand its strengths as well as weaknesses and limitations. To achieve this, the current systems and processes have to be understood and documented. Once the current state has been derived, the organisation's to-be state is defined to determine where the organisation wants to be, which is the second step of the first phase.

The "Plan" phase is the second phase of the framework. Within this phase, the gaps between the current and future state of the organisation are analysed further to identify gaps. From this, limitations can be identified and a list of initiatives can be compiled. These initiatives refer to the actions, tasks, or goals required to address the previously identified limitations. The next step in this phase is the prioritisation of these initiatives. For each initiative, the relative importance in terms of cost, benefit, and risk is determined, and the estimated Return on Investment (ROI) is calculated. Depending on the results, the initiatives are ranked and presented to senior leaders for approval. After the approval, the organisation can start preparing their roadmap which is a detailed plan.

The third and final phase is the "Recommend and Transform" phase. To complete this phase, a recommendation workshop should be held by the organisation where a detailed business case is compiled. The business case should include all revenue- and cost-related metrics. Those can be used to calculate the implementation cost and also to determine if the transformation will improve the current situation. The workshop serves as the final validation of the DT project before actual implementation. Lastly, the initiatives are implemented according to the roadmap previously prepared and the progress is monitored.

4.3 Discussion of Existing Roadmaps

Although each approach makes valuable contributions, they are not designed to accommodate the challenges SMEs experience in SADCs harsh business environment. To design a roadmap that can assist SMEs in the SADC to tackle DT in pragmatic steps, this section aims to identify what elements are important to be included in DT roadmaps, based on the existing approaches previously examined. Barann *et al.* (2019), Stich *et al.* (2020), and Krishnan *et al.* (2015) all present an approach that can be used by individuals or

entities to develop a DT roadmap. After examining the three existing DT roadmaps, it was found that they correlate in specific aspects, but also differ in others. These similarities and differences are referred to as "Roadmap Elements" and will be discussed in more detail.

4.3.1 Correlating Roadmap Elements

Each approach makes unique contributions, but they correlate in specific aspects. To consider a roadmap element as "correlating", it needs to be present in at least two of the three models.

The Barann *et al.* (2019) procedure model and the DT approach from Stich *et al.* (2020) both emphasise the importance of determining the SMEs' vision, strategy, and objectives. Next, all three models require the completion of a current state analysis. This is necessary to identify the weaknesses and limitations of the current state. To establish the gaps between the current situation and the future situation of the business after the transformation, two different approaches are used. While Stich *et al.* (2020) DT approach and Cognizant's DT framework determine the target state of the businesses' situation, Barann *et al.* (2019) analyse the digital maturity of the organisation to determine its DT potential. This can be achieved by making use of existing maturity models, which will indicate the business areas that are lacking potential and require action. After the gaps or action areas have been determined and analysed, potential solutions are generated to bridge these gaps. Barann *et al.* (2019) refers to them as ideas, Stich *et al.* (2020) calls them digitalisation measures, while Cognizant's model mentions them as initiatives. Barann *et al.* (2019) and Stich *et al.* (2020) recommend aligning these solutions to the company objectives and strategy. Along with the strategic alignment, the solutions need to be evaluated and prioritised. Once this has been completed, a roadmap can be developed that helps prepare the business for the implementation of the project or transformation. Another important element that is included in the Barann *et al.* (2019) procedure model is "Create Supportive Environment". This element ensures that the organisation raises awareness about creating a digital culture within the organisations and what changes are involved in the transformation. It further aims to involve employees and integrate

the necessary people in the DT process. Cognizant's framework also supports this aspect partially. This framework suggests holding a workshop where the detailed project is compiled. All costs and changes are discussed in this workshop and ensures that all individuals are on the same level of understanding regarding the project. Finally, Barann *et al.* (2019) and Cognizant's framework both address the execution or implementation of the developed roadmap. This, however, is not within the scope of this thesis and will, therefore, not be considered as a relevant roadmap element. Table 4.1 summarises which correlating elements are present in which roadmap. The full circles represent whether the element is present, the half-circle indicates if it is partially available, and no circle means that the element is excluded from the roadmap.

Roadmap Element	Barann et. al.	Stich et. al.	Krishnan et.al.
Strategy and Objectives	●	●	
Analyse As-Is Situation	●	●	●
Gap Analysis	◖	●	●
Generate Solutions	●	●	●
Strategic Alignment of Solutions	●	●	
Solution Evaluation	●	●	●
Roadmap Development	●	●	●
Create Supportive Environment	●		◗

Table 4.1 Roadmap Comparison

4.3.2 Additional Roadmap Elements

From Table 4.1, it can be seen that the different DT approaches are similar in numerous ways, but they do not cover all elements previously identified. While all roadmap steps from Stich *et al.* (2020) and Cognizant's framework have been addressed in the previous subsection, the Barann *et al.* (2019) procedure model includes additional elements.

Compared to Stich *et al.* (2020) and Cognizant's framework, the procedure model from Barann *et al.* (2019) is more detailed and complex. The procedure model also includes sub-steps such as "Establish Planning Team" and "Understand Business Model". Furthermore, it also suggests sub-steps to successfully create a DT plan, such as "Perform Resource and Project Planning" and "Build Expertise" to develop and sustain a project.

4.4 Elements and Tools to Consider for Roadmap Design

To develop an alternative roadmap for manufacturing SMEs in the SADC, the corresponding and additional roadmap elements will be used to create a fundamental basis to design an alternative roadmap. The roadmap aims to educate and support management about DT and the corresponding challenges in the SADC. Although the roadmap cannot eliminate challenges, it can raise awareness that allows management to be prepared for possible obstacles and changes that may occur during or as a result of the transformation.

The existing roadmaps introduce the aspects and topics that should be addressed by researchers or support units who aim to develop a roadmap, however, the methods or techniques required to achieve these objectives need to be determined independently from their research. For selected roadmap elements, additional literature and management tools and techniques have been identified, researched, selected, and compiled to present a potential method of achieving the elements' objective. This section discusses the elements, the objective, and the management tools and techniques (where appropriate) that will be included in the roadmap for SMEs in the SADC.

4.4.1 Strategy and Objectives and Strategic Alignment of Solutions

In Chapter 3, it was mentioned that a large portion of SME leadership lacks management or entrepreneurial background. This contributes to the fact that SMEs in the SADC lack a long-term vision and strategy. However, a strategy is an important factor to consider

for an organisation. Revisiting the literature in Subsection 2.2.2.1, a strategy assists organisations to move in the right direction and identify and exploit the sources of superior profitability (Wahlin and Karlsson, 2017). Furthermore, it allows a company to differentiate itself from its competitors and to outperform its rivals (Wahlin and Karlsson, 2017).

Since digital technologies are altering and transforming current business strategies, capabilities, and processes, the set of strategic opportunities and value-creation alternatives increases significantly (Wahlin and Karlsson, 2017). By merging digital and IT strategies with the organisational strategy, the decisions and actions of the organisation need to be aligned so that they support the achievement of strategic goals. This roadmap element, therefore, aims to assist SME leadership in defining the organisation's strategy, as in addition to its vision and mission (strategy and objectives). This helps ensure that the innovative digitalisation goal of the company suits the organisation's objectives (strategic alignment of solutions).

To achieve this, a Balanced Score Card can be used. The Balanced Score Card is a strategic planning and management tool that assists organisations to prioritise and measure targets (Kaplan and Norton, 1992). By completing the Balanced Score Card, the individual has the opportunity to gain a visual representation of the company goals, while simultaneously aligning these goals to the company's strategy. Furthermore, a strategic map can be created, which helps to visualise the cause-and-effect direction of the business objectives (QuickScore, 2020).

4.4.1.1 Balanced Score Card

The Balanced Score Card (BSC) is a useful tool that can be used to align a company's strategy with its activities. It allows the user to maintain the focus of the company's objectives, measures (key performance indicators or KPIs), targets for KPIs, and the initiatives that can help reach those targets (Kaplan and Norton, 1992). These elements align with the company's mission, vision, and values. The BSC assists in developing each of these elements in four different perspectives including financial, customer, internal business process, and finally learning and growth, which will be discussed in more detail

below (Kaplan and Norton, 1992).

1. **Financial Perspective:** This perspective indicates whether the strategy improves or contributes to the company's bottom line and how the strategy needs to be implemented and executed.

2. **Customer Perspective:** This perspective indicates the value proposition delivered to the customer by the company. This helps to identify the market segment that needs to be addressed.

3. **Internal Business Processes Perspective:** This perspective's main concern is the businesses' stability and operation. This helps to ensure that the products and services delivered to the customers meet their expectations.

4. **Learning and Growth Perspective:** This perspective relates to the training and improvement of the company's workforce and helps determine whether the employees have the necessary skills required to keep pace or exceed the competition.

The combination of these perspectives gives the scorecard the "balanced" approach. The perspectives are not independent of one another, but they do affect one another in specific ways (QuickScore, 2020). For example, if employees of a company are trained to practice effective communication and knowledge sharing (Learning and Growth), the company will run smoothly (Internal Business Processes) - which influences the customer's satisfaction positively (Customer). Therefore, the better the customer satisfaction, the better the sales (Financial) (QuickScore, 2020).

One major advantage of the BSC is the fact that it is designed by the business team itself and, therefore, meets the unique requirements of the organisation (Kaplan and Norton, 1992). By using the BSC, the user has the opportunity to generate business goals and determine the most realistic path to achieve them. The BSC assists in developing a strategic plan that aligns with the company's vision and considers the stakeholders involved. Business goals and objectives should be formulated by starting with a verb (improve, reduce, increase, optimise, maximise, minimise) and need to be measurable or quantifiable (QuickScore, 2020). The BSC further assists in bringing everyone in the

company on the same level of understanding and creates an opportunity to track the right metrics over time (Kaplan and Norton, 1992). The BSC must be reviewed and updated regularly. The user must ensure that it constantly relates to the organisational processes and if the BSC's design is appropriate for the company.

Once the BSC is completed, it would be useful to perform strategic mapping of the objectives. A strategic map helps to visualise the cause-and-effect direction of the business objectives (QuickScore, 2020). To create a strategic map, the perspectives can be layered in the sequence previously explained (Bottom-to-Top: Learning and Growth, Internal Business Process, Customer, Financial) together with their previously defined objectives. Finally, arrows can be inserted between the strategic objectives that show the cause and effect chain (QuickScore, 2020) (see Figure 4.4). Through the process of strategic mapping, performance outcomes, as well as key enablers or drivers of future performance, are identified to create a complete picture of the strategy. The map offers a clear picture of the organisation's strategy and, therefore, assists in understanding and communicating the organisation's strategy.

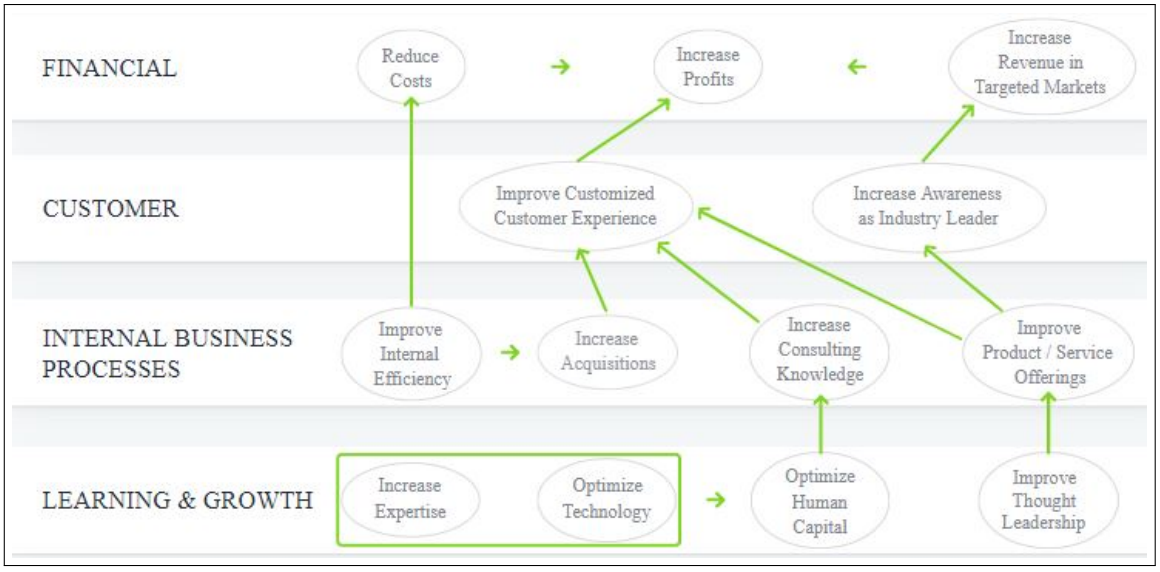

Figure 4.4 Strategy Map Example (QuickScore, 2020)

To develop a BSC, it is necessary to include the right people to derive the required information. The first step requires developing the vision of the company. Vision statements aim to provide clarification for the future of the organisation and should be inspirational.

Next, the company's strategic objectives must be determined. These are the goals that are most important to the business. The third step requires the analysis of the critical success factors (CSF). These are the crucial areas in the business where high performance is necessary to succeed. Once the CSF's have been determined, the Key Performance Indicators (KPIs) must be chosen for the business. These indicators are responsible for the alignment of the performance and the businesses' strategic objectives and will be discussed in more detail. KPIs must be formulated simply and should be linked to the organisation's budget. Finally, the last step is to set the targets, plans and initiatives. Targets should consider the KPIs current state as well as the aimed (to-be) state.

4.4.1.2 Key Performance Indicators (KPIs)

A Key Performance Indicator (KPI) is a measurable value that indicates how effectively a company succeeds in reaching its targets, and whether it is achieving its key business objectives. It helps the business leaders to understand how the organisation or department is performing (Jackson, 2019). There are high-level KPIs, which may focus on the overall performance of the business, while low-level KPIs may focus on processes in departments such as sales, marketing, HR, support and others. The use of KPIs can help guide the individuals in a company to understand whether they are moving in the right direction, towards achieving their strategic goals (Jackson, 2019). KPIs should fall into the SMART criteria (Specific objectives, Measurable progress, Attainable goals, Relevant to the organisation, and Time-bound). Therefore, for a KPI to be considered effective, Jackson (2019) states that it should be:

1. Well-defined and quantifiable,
2. Communicated throughout the entire organisation or department,
3. Crucial to achieving the goal, and
4. Applicable to the business.

Companies must carefully consider which KPIs are the right ones to select, as it depends on the industry and the department. Since each company or department has different goals and targets, it is of utmost importance to determine which indicators are relevant to each respectively. KPIs can be in different categories including financial, customer,

process, and people (Jackson, 2019). Examples of KPIs include overall satisfaction, satisfaction improvement, customer retention, net promoter score (the rate of customers who recommend your business to others), compared to competitors (rate of customers who choose your company over your competitors), active and resolved issues, employee productivity, retention or turnover, or cash flow. There are many more, but the organisation can also define its own KPIs.

4.4.2 Establish Planning Team

This roadmap element is important as choosing the right people to establish a planning team who is responsible for the DT project is not an easy task. The people with the right skills or capabilities for the project team must be identified and selected. For effective DT, people must work collaboratively with the processes and technology. By means of this step, SME leadership has the opportunity to identify the members of the planning team and the tasks, skills, and knowledge required by these individuals. The literature covered in Subsection 2.2.2.2 is used to establish a planning team successfully. For the leadership team, the tasks, skills, and knowledge required include:

- Individual with authority to make decisions,
- Manage people and drive cultural change,
- Communicate and update the team about decisions or changes,
- Fully understand the business, its activities, and customers,
- Be aware of alternative possibilities and include them in the business model,
- Good people management and communication skills, and
- Align DT ideas with the organisation.

For the Core DT team, the tasks, skills, and knowledge required include:

- Hands-on practitioners of technologies,
- Work with new systems and technologies,

- Update leadership team about the current status of the project (regular meetings),
- Knowledge about the tools/techniques/technologies enabling business transformation,
- Adaptable to change (re-skill, training, or education may be necessary),
- Agile practitioner,
- Communication skills,
- Skills in development, designing, data science, coding, and
- Committed to the new project.

4.4.3 Understand Business Model

This roadmap element ensures that the entire team who is in contact with the DT project is brought on the same level of understanding about the company's current activities and objectives. By assessing the different company elements, the user can recognise the areas that require action for improvement (Hemmer, 2016). The business model assessment further reveals clear paths on which to build the organisational innovation strategy (Hemmer, 2016). A handy tool that can help explain the current BM is the Business Model Canvas.

4.4.3.1 Business Model Canvas

The tool is usually a one-page document focusing on the customer (external) on the right-hand side of the canvas, while the left-hand side focuses on the business itself (internal) (see Figure 4.5).

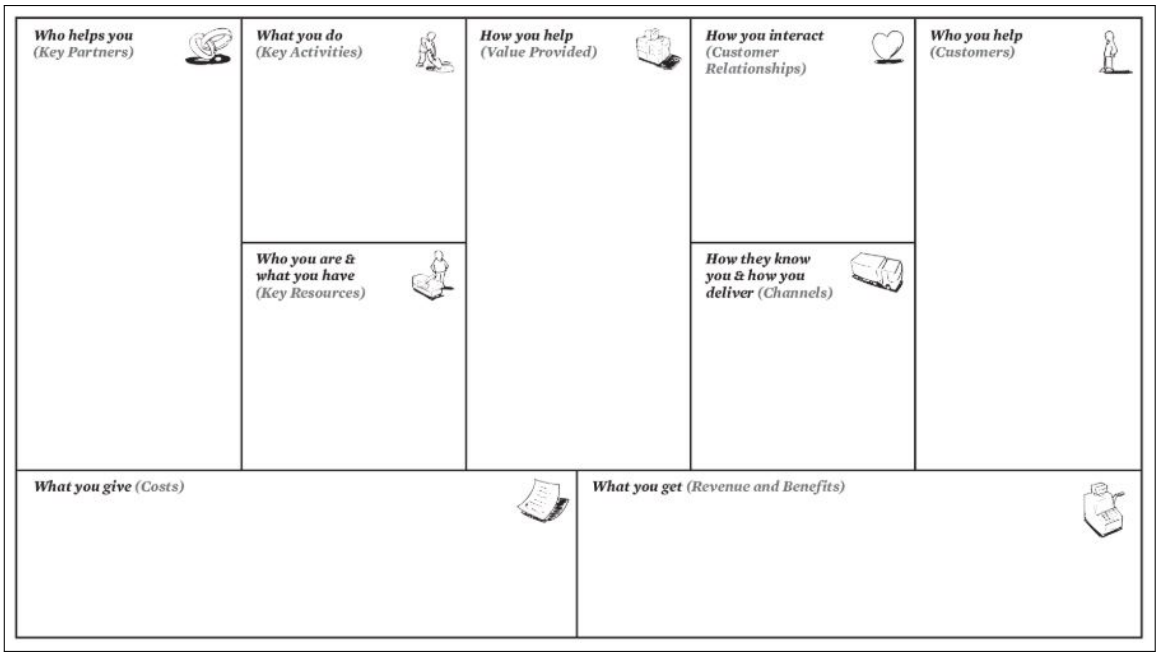

Figure 4.5 Business Model Canvas (Hemmer, 2016)

To provide an overview of the tool, a summary and the corresponding questions to derive the necessary information is presented below (Hemmer, 2016):

1. Value Propositions

A businesses' value proposition is the fundamental concept of the exchange of value between the business and the customer.

2. Customer Segments

This is the practice where the customer base is divided into groups depending on similarities (eg. age, gender, interests and spending habits).

3. Channels

Channels refer to how which customers can get hold of or contact the business. Examples of channels include social media, e-mails, networking, existing platforms, offline advertising (billboards, TV, radio), etc. This is generally covered by the marketing department of the company and is, therefore, of crucial importance in understanding how to reach the customers.

4. Customer Relationships

Customer relationships refer to the interaction between the business and the customers.

5. Revenue Streams

This refers to the method by which a business converts its value proposition or solution to the customers' problem into financial gain.

6. Key Partners

Key partners are external individuals, companies, suppliers, or other parties that are required by the organisation to deliver value to the customer.

7. Key Activities

These refer to the actions the business undertakes to achieve the value proposition for its customers.

8. Key Resources

The key resources include the resources that are required to achieve the key activities in the business. Key resources can include finances, human capital, office space, technologies, internet connection, vehicles, or electricity.

9. Cost Structure

The cost structure can be defined as the monetary cost required to operate the business. One should include the costs required to achieve the businesses' key activities, resources, and partnerships.

4.4.4 Analyse As-Is Situation and Gap Analysis

The objective is to identify underlying challenges, risks, or change in customer expectations (Barann *et al.*, 2019). This can be achieved by analysing the current as-is situation of the organisation. The analysis can enhance the employees' understanding of the process by presenting the documented process flow to them (process documentation). To visualise the process, the process steps have to be mapped. The visualisation of the current state

of the process allows the planning team to understand the as-is situation and to be aware of the tasks that require completion. Moreover, the individuals involved in the process can be identified.

Next, the mapped process will be assessed in more detail, using calculations and analysis techniques. The process analysis helps to investigate if all steps in the process are required or necessary. Process analysis allows the opportunity to easily document, understand, track, and optimise processes for better performance, greater efficiency, and improved outcomes. Furthermore, it enables the identification of process gaps, bottlenecks, weaknesses, and risks, as well as opportunities for improvement (Lucidchart, 2020). By quantifying the current situation, the as-is state serves as a baseline against which the future state of the process will be compared (gap analysis). Furthermore, the analysis helps create a solid foundation in an organisation's processes. This fundamental information is necessary to manage and improve processes and helps the business to identify a starting point for improvements. Additionally, businesses can also expect to align operations with business strategy, improve process communication and training, increase operational efficiency, increase control and consistency across the organisation, and also support the organisation to gain a competitive advantage (Lucidchart, 2020).

4.4.4.1 Process Maps

Process maps model process flows, by showing the sequence of the different activities (sequential or parallel) in a process, as well as the decisions that are made. Different types of process maps exist, including activity process maps, High-level (SIPOC) process maps, cross-functional process maps, or value stream maps (Lucidchart, 2020). Many more do exist, but for the purposes of this project, a combination of these four process maps is sufficient. The following list summarises the information that will be derived by making use of each specific process map (Business Enterprise Mapping, 2018):

- Defining the main supplier, input, purpose, output, and customer. Businesses need to focus on aligning the internal processes to meet the needs of their external customers (SIPOC process map).

- Identifying the main customer for each process, what value the process delivers to the customer, and the net benefit as perceived by the customer (SIPOC process map).
- Communicating supporting information, such as task instructions, reports, and procedures (Activity process maps).
- Identifying the persons involved in the process and how each of them affects the performance of the process (Cross-functional process maps).
- Recognising how technology fits into the process as well as its potential to improve its efficiency and effectiveness (Activity process maps, value stream maps).
- Identifying the value-adding- as well as wasteful activities (Activity process maps, value stream maps).
- Determine the processes' KPIs, efficiency, and effectiveness (Value stream maps).

For the user to successfully prepare a process map, the problem must be identified (Lucidchart, 2020). Processes that have failed or are majorly under-performing are of particular interest (Pearson, 2020). Next, all activities involved in the identified process must be identified and listed (Lucidchart, 2020). It is not required to sequence the steps, however, sequencing may help to remember which process steps to include, and which are outside the process boundaries. A level of detail must be established, and it must be determined which individual/machine completes which task and when (Lucidchart, 2020). To gather the right information, it would be useful to include the individuals who are directly involved in the process, as they have a good overview and are familiar with the process. Questions should be asked, such as what, how, when, where, who (Lucidchart, 2020). Once all information is gathered, the exact sequence of the step should be mapped out, by indicating the flow of the process, and the decisions involved. This can be done easily by making use of the simple flowchart symbols (Lucidchart, 2020).

4.4.4.2 Process Analysis

The information provided in the next paragraphs has been derived from academic teaching material from a tertiary institution in South Africa. The information includes definitions, formulas, and interpretations of calculation results. To analyse the process map, the right

questions should be asked about the performance of a system regarding flow, time, quality, quantity, and cost. Example questions have been summarised in Table 4.2.

Table 4.2 Process Flow Questions about Performance

Question Category	Examples
Flow	1. Is the transformation process balanced or unbalanced? 2. Where is the bottleneck in the transformation process? 3. Are all operational steps or activities necessary? 4. How jumbled is the flow within the transformation process?
Time	1. How long does it take to produce/deliver one unit of output? 2. Can the length of the time be reduced? 3. What is the time between successive units of output? 4. Where is there excessive setup time? 5. Where is there excessive waiting time?
Quantity	1. How many units can be produced/delivered in a given period (theoretic)? 2. How easy is it to change this quantity? 3. How many units are produced/delivered in a given period (actual)?
Quality	1. What is the historical defect rate? 2. Which operational step or activity contributes to the defect rate? 3. Where do errors occur?
Cost	1. How much does it cost to produce/deliver one unit of output? 2. What are the cost buckets that make up the cost to deliver/produce one unit of output? 3. Can some cost buckets be reduced/eliminated?

Additionally, different calculations can be carried out to measure the performance of a process. One example would be to calculate the capacity of the process. Capacity is the ability to produce, hold, receive, store, or accommodate, and can be measured as output rate, throughput rate, or flow rate. Capacity can be viewed in two ways, either in terms of output or input. Regarding output, capacity relates to the maximum rate of output per unit of time (for example products produced), and for input, capacity relates to the units of resources available (eg. number of hospital beds available). Capacity equals the maximum throughput rate of a process, or can be calculated by using the formula:

$$\text{Capacity} = \frac{1}{\text{Cycle time}} \tag{4.1}$$

Another important factor to consider is the cycle time, flow time, and takt time of a process. Cycle time is the time required to complete a single unit at a station, or can also be defined as the time between completing units for a process. It is the maximum time spent at any station. Flow time or lead time, however, is the total time to complete all stations. The takt time refers to the production pace required to meet customer demand. The takt time is used to determine the number of products that need to be produced throughout the shift. The formula and the units used are shown below:

$$\text{Takt time} = \frac{\text{Total available production time in a time window (s or min)}}{\text{Customer demand for the time window (unit)}} \tag{4.2}$$

The maximum capacity of a process is determined by the slowest activity or the minimum throughput rate of the process. The activity with the lowest throughput rate, or longest cycle time, is identified as the processes' constraint or bottleneck. These activities constrain the capacity of the overall system and, therefore, slow down the process. However, in some cases, the workstations that experience high arrival rates of input, may not be the slowest workstation but the most utilised. Therefore, this workstation may also be considered as a bottleneck, even though it might not be the slowest. A bottleneck, therefore, is a process with the highest utilisation over a long period of time. To calculate capacity utilisation, the following formula may be used:

$$\text{Capacity Utilisation (\%)} = \frac{\text{Time or capacity used or required}}{\text{Time or capacity available}} \tag{4.3}$$

Increasing capacity requires increasing the resource levels of each bottleneck resource pool. To achieve this, the following actions can be taken:

1. **Increase the Number of Resource Units:** Adding more units to the resource pool may increase the capacity, but will affect the production costs as well. Therefore, the cost of the resources needs to be compared to the additional throughput generated. In cases where resources are relatively cheap, readily available, and easy to install, this alternative would be most appealing.

2. **Increase Size of Resource Units:** By increasing the load batch of the resource, the resource capacity can be increased. For example, by investing in a larger machine that can accommodate larger batches, the resource capacity can be increased.

3. **Increase the Time of Operations:** Increasing the operating hours or employee overtime are common methods to increase process output.

4. **Subcontract or Outsource Bottleneck Activities:** Instead of investing in new bottleneck resources, higher capacities can be achieved by subcontracting or outsourcing. However, this option may involve higher operating and coordinating costs, and would, therefore, be less sustainable for organisations.

5. **Speed up the Rate at which Activities are Performed:** Capacity can be increased by speeding up the activity rate. However, this approach may involve investments in faster resources, such as machines or alternative incentives to workers.

Another option to increase capacity is to reduce the capacity of waste. This is often the most effective option, and can be achieved by the following approaches:

1. Eliminate non-value adding activities.
2. Avoid defects, rework, and repetitions.
3. Reduce time availability loss: By scheduling preventative maintenance or implementing effective problem-solving measures may decrease breakdowns or other work interruptions.
4. Reduce setup loss: By decreasing the frequency of changeovers, managing the product mix effectively, or actively reducing the time required for each setup, less time can be wasted.
5. Move some of the work to non-bottleneck resources.
6. Reduce interference waste: decrease the possibility of process starvation or blocking.

Correspondingly, other forms of waste need to be taken into consideration. According to Langstrand (2016), there are seven forms of waste, which can easily be remembered by the acronym TIM WOOD. Waste can, therefore, be defined as:

- Transportation
- Inventory
- Motion
- Waiting
- Overproduction
- Overprocessing
- Defects

By keeping all these forms of waste in mind, the current state analysis is mainly concerned with identifying the activities of the overall process that are closely related to these kinds of waste. Another useful approach is to assess the processes' efficiency. Efficiency indicates how well a process turns inputs into outputs. By determining the efficiency of the different resources (eg. machines or manual labour) in a process, the analyst has the opportunity to quantify the processes' performance. One can use the resource efficiency to create a benchmark or compare it to a standard.

Especially for labour-intensive processes, labour productivity is an important measure for business efficiency. Labour productivity refers to the output volume obtained from each employee. Since labour costs contribute significantly to total costs, labour productivity plays an important role in businesses to remain competitive. To increase the labour productivity of a workforce, certain factors need to be considered. Firstly, the quality of the fixed assets (eg. equipment, IT systems) needs to be up to standard in order to reduce productivity limitations. Workforce skills and motivation play a vital role, as well as the methods of the production organisation. Finally, external factors such as supplier reliability play a significant role in labour productivity. Labour productivity can be measured or calculated by using the following formula:

$$\text{Labour Productivity} = \frac{\text{Actual output per period (unit)}}{\text{Number of workers or worker hours}} \tag{4.4}$$

Finally, the costs in production also need to be considered throughout the process analysis

procedure. There are numerous costs involved throughout the production process. The following list presents an overview of the most important costs involved:

1. **Direct Material Used:** refers to all materials required to produce a product.

$$\begin{aligned}\text{Direct Material Used} = \text{Beginning Raw Material Inventory} + \text{Raw Material Purchases} \\ -\text{Ending Raw Material Inventory} - \text{Indirect Materials Used}\end{aligned} \tag{4.5}$$

2. **Total Manufacturing Cost:** costs of all resources required for the production process during a specified period.

$$\text{Total Manufacturing Cost} = \text{Direct Material} + \text{Direct Labour} + \text{Overhead applied} \tag{4.6}$$

3. **Cost of Goods Manufactured:** costs involved of all manufactured goods throughout a specified period of time.

$$\begin{aligned}\text{Cost of Goods Manufactured} = \text{Total Manufacturing Cost} + \\ \text{Beginning Work in Process Inventory} - \text{Ending Work in Process Inventory}\end{aligned} \tag{4.7}$$

4. **Cost of Goods sold:** refers to all costs involved for the goods sold during a specified period of time.

$$\begin{aligned}\text{Cost of Goods sold} = \text{Beginning Finished Goods Inventory} + \\ \text{Cost of Goods Manufactured} - \text{Ending Finished Goods Inventory}\end{aligned} \tag{4.8}$$

Further measures that are related to the cost of production include manufacturing cost per unit, profit margin per product, contribution margin per product, and product contribution margin per bottleneck time unit. The following formulas can be applied to derive the mentioned measures:

$$\text{Manufacturing cost per unit} = \frac{\text{Cost of goods manufactured}}{\text{Total units produced in the same time unit}} \tag{4.9}$$

$$\text{Profit margin per product} = \text{Sales price per unit} - \text{Manufacturing cost per unit} \tag{4.10}$$

$$\text{Contribution margin per product} = \text{Sales price per unit} - \text{Direct material cost per unit} \tag{4.11}$$

$$\text{Product contribution margin per bottleneck time unit} = \frac{\text{Contribution margin per product}}{\text{Time required on bottleneck for a product}} \tag{4.12}$$

4.4.5 Generate Solutions

To pinpoint the company goals for digitalisation, it is required to establish solutions the organisation aims to achieve with the DT. As discussed in Subsection 2.2.2.1, the bottom-up idea generation approach aims to identify the "low hanging fruits" of the existing processes. Employees and management have to determine what opportunities digitalisation has to offer and which innovation opportunity is suitable for the organisation. Therefore, by creating awareness about digitalisation and its potentials, SME leadership can select the goal that is desired to be achieved. The goal should indicate an alternative or possible improvement of the current as-is situation previously analysed (Parviainen *et al.*, 2017). In Chapter 2, it was mentioned that roughly 70% of DT projects fail to reach their stated goals and this is mostly due to the inefficient generation of ideas or inadequate definition of company goals. To define the DT goal, ideas must be generated to determine how the goal can be achieved. To ensure effective idea generation, individuals from the workforce should be involved as they may contribute inside information about the process that may help to identify problem areas or find alternative ways to optimise or improve the process.

4.4.6 Solution Evaluation

After practical implementation ideas have been generated, they require further analysis and evaluation. This is necessary to determine if the organisation can actually afford the investment and also if the project is worth the investment in terms of money and time. To determine the value-for-effort of the DT goal, the risks and costs involved will be

compared to the potential benefits attained from the DT goal. Possible idea evaluation techniques include cash flow analysis, cost-benefit analysis, and risk analysis. Many more do exist, but for this thesis, these three have found to be sufficient.

4.4.6.1 Cash Flow Analysis

Every manufacturing businesses' main objective is to make a profit (Gual, 2018). Late payments, poor stock control, delayed VAT returns, and seasonality, however, make it difficult for SMEs to operate effectively (Gual, 2018), (Novick, 2019). One very important factor contributing to achieving this objective is cash availability (Gual, 2018). For a business with high cash availability, it is easier to stay afloat and to achieve its financial objectives (Gual, 2018). The factors playing a vital role in cash availability include liquidity, cash flow, and profit.

Liquidity refers to the amount of cash an organisation has available to cover immediate costs or short-term obligations (Gual, 2018). Cash flow, on the other hand, is the difference between all the money that moves in and out of the business during a specific accounting period (Novick, 2019), (Gual, 2018). Cash flow simply represents how much cash a business has on hand, and what remains after the expenses have been paid. Positive cash flow indicates that the cash flowing into the business exceeds the cash that is leaving the business (Novick, 2019). Inflowing cash includes the money that is received from sales, accounts receivable, and borrowed capital - like term loans or lines of credit (Novick, 2019). Cash outflow, on the other hand, relates to the money going out through accounts payable, payroll, and other expenses - like loan payments and rent (Novick, 2019).

Although profit and cash flow are often used interchangeably, they differ in numerous ways (Novick, 2019). As mentioned, cash flow refers to all the cash that has been flowing in and out of a business in a given time period (Novick, 2019). Furthermore, cash flow only provides insight into the businesses' bank account and does not include any pending payments or receivables (Novick, 2019). Profit, on the contrary, refers to the organisation's net income, that remains after all expenses have been deducted from the revenue (including accruals) (Gual, 2018). Since cash flow reflects the amount of money that is

available to meet operating expenses, a cash flow analysis is one way to gauge the stability of your business (Novick, 2019).

A cash flow analysis is an analysis that entails measuring the amount of cash produced against the amount of cash spent during a specific period of time (Novick, 2019). The analysis involves the identification and examination of the components that affect cash flow, such as accounts receivable, inventory, accounts payable, and credit terms (Ward, 2020). The cash flow analysis is useful for businesses that are planning to undergo a rapid expansion where capital expenditure, higher labour costs, or new equipment or infrastructure investments require large cash outflows, at the same time that sales are in a growth phase and cash inflows tend to be lower (Ward, 2020). Since all these factors play a vital role in a DT project, this analysis is suitable for the roadmap. Furthermore, especially SMEs in the SADC face substantial challenges regarding their finances and, therefore, forecasting the cash flow may be an advantage to the business itself.

Depending on the user of the cash flow analysis, the analysis can vary in complexity and detail. A simple way would be to compare the total of unpaid purchases against the total sales due at the end of each month (Ward, 2020). If more cash needs to be spent than received, the business will run into a potential cash flow problem, as the total unpaid purchases are greater than the total sales due. According to Novick (2019), a more detailed cash flow analysis exists, where the cash flow statement is broken down into three parts: Operations, Financing, and Investing. For the purpose of this research, however, the aforementioned technique of subtracting the cash outflow from the cash inflow is sufficient. The net cash balance can be derived using the formula:

$$\text{Net Cash Flow} = \text{Cash Inflows} - \text{Cash Outflows} \tag{4.13}$$

4.4.6.2 Cost-Benefit Analysis

The Cost-Benefit Analysis (CBA) is a decision-making tool that can help management to determine the course of action that is required for a long-term or short-term decision (Sraders, 2019). The tool can help with decisions regarding (MindTools, 2019):

- Hiring new team members,
- Evaluating a new project, and
- Determining the feasibility of capital investment.

The user lists every project expense and what the benefits will be after successfully executing the project (Landau, 2019). Monetary values need to be assigned to all tangible (eg. financial gain) or intangible (eg. customer satisfaction, employee morale, social benefits) benefits, as well as costs (also includes opportunity costs) (Sraders, 2019). When assigning monetary values it is generally helpful to assign the benefits and costs at their present value, as the value of money may often change due to factors such as inflation (Sraders, 2019). Intangible benefits and costs need to be factored in as they may play a big role when deciding between several options (Sraders, 2019). Once the benefits and costs have been quantified, the tool can be used to weigh the benefits against the costs of an action, by dividing the sum of all benefits by the sum of all the costs involved (Sraders, 2019). This action allows the individual to determine if the potential decision would make financial sense for the business (Sraders, 2019). Furthermore, the Return on Investment (ROI), internal rate of return (IRR), net present value (NPV) and the payback period can be calculated (Landau, 2019). More complex formulas do exist, but the benefit-cost ratio essentially shows which factor (benefit or cost) outweighs the other. As a rule of thumb, if the costs are 50% of the benefits and the payback period is not more than a year, the action is worth taking (Landau, 2019). The main purposes of using the tool include determining whether the project is justifiable and feasible, and to serve as a baseline for comparing projects by determining which project's benefits are greater than its costs (Landau, 2019). For more complex, business-critical or high-cost decisions, more robust approaches are commonly used, as this tool is best for making quick and simple financial decisions (MindTools, 2019). Summarising the most important steps that need to be undertaken throughout the CBA:

1. Brainstorm the costs and benefits of the potential action or decision and compile lists.
2. Assign monetary values to costs and benefits. Create cost estimates of the different actions that will be required or generated by the decision.

3. Setup equation and compare.

4.4.6.3 Risk Analysis

A risk is defined as the likelihood some event or circumstance that occurs. This event typically affects an organisation negatively (Small Business Development Corporation, 2020), (Nicholas and Steyn, 2017). The most common risks found in organisations are (Small Business Development Corporation, 2020):

- Strategic: Decisions concerning an organisation's objectives.
- Compliance: The need to comply with laws, regulations, and standards.
- Operational: Operational and Administrative procedures.
- Environmental: External events such as weather or economic conditions.
- Reputation: Goodwill or branding of a business.
- Financial: Financial transactions, systems and structure.
- Others: Health and safety, project, equipment, security, technology, stakeholder management, and service delivery.

Risk management (RM) is the identification of risks, measuring the probability and possible impact of events, as well as treating, reducing, or eliminating risks and their effects (Verbano and Venturini, 2013). Innovative projects require RM, as they often involve risky decisions and activities (Verbano and Venturini, 2013). Without a structured risk management framework in place, organisations will encounter problems with the evaluation of the possible impacts on the project objectives (eg. scope, time, cost, and quality). Further issues with the identification of secondary or new risks, as well as the lack of transparency and communication throughout the organisation may occur (Lavanya and Malarvizhi, 2008). For this reason, to successfully adopt DT projects an RM strategy is of emotive importance for SMEs due to their constraints in various areas (Verbano and Venturini, 2013). Small firms struggle to manage risks with regards to the operational and financial aspects and, therefore, experience challenges in obtaining loans from banks and investors (Verbano and Venturini, 2013). The main purpose of risk assessments is to aid the manager in avoiding hazards that could damage the organisation's finances (Cameron, 2017).

Therefore, by identifying and managing risks in the early stage, SMEs can control project-related risks, and successfully manage all stages of the innovative projects (Verbano and Venturini, 2013). The assessment informs the user about the steps required to protect the business and what situations need to be addressed and avoided (Cameron, 2017). Risky events can be external or internal. External factors include economic, environmental, social, political and technological aspects and internal factors include infrastructure, human resources, process and technology used by a company (Verbano and Venturini, 2013).

Summarising the most important steps that need to be undertaken to create an RM plan (Verbano and Venturini, 2013), (Lavanya and Malarvizhi, 2008), (Nicholas and Steyn, 2017):

1. Identify the risk: Review the business to identify potential risks. Determine the risk sources and whether they are internal, such as market risk (failure to correctly identify changing demands), technical risk (technical problems with end item), or assumptions risk (uncertainty, poor communication), or whether they are external including risks occurring in the project environment.
2. Assess the risk: Identify the qualitative and quantitative impact of the risk (likelihood or frequency of the risk, and the consequence or impact if the risk occurred). The level of risk is calculated using this formula:

$$\text{Level of risk} = \text{likelihood} \times \text{consequence} \tag{4.14}$$

   Once the level of risk has been determined, a risk log or risk register should be compiled, where risks are rank-ordered, showing the greatest risk consequence first.
3. Manage the risk: There are different options of how to deal with risks:
   - Risk Avoidance: Find an alternative that may have a similar outcome, but involves less risk or eliminates the risk.
   - Risk Transfer: Make use of another party (eg. contracting, partnerships, insurance).
   - Risk Reduction or Control: If it can't be avoided, implement procedures, legislation, or processes that can help reduce the risk.

- Contingency Plan: Develop a disaster management plan, to determine what can be done in case the event occurs.
- Accept the risk.

4. Monitor and review: Ensure the control measures and insurance cover is adequate.

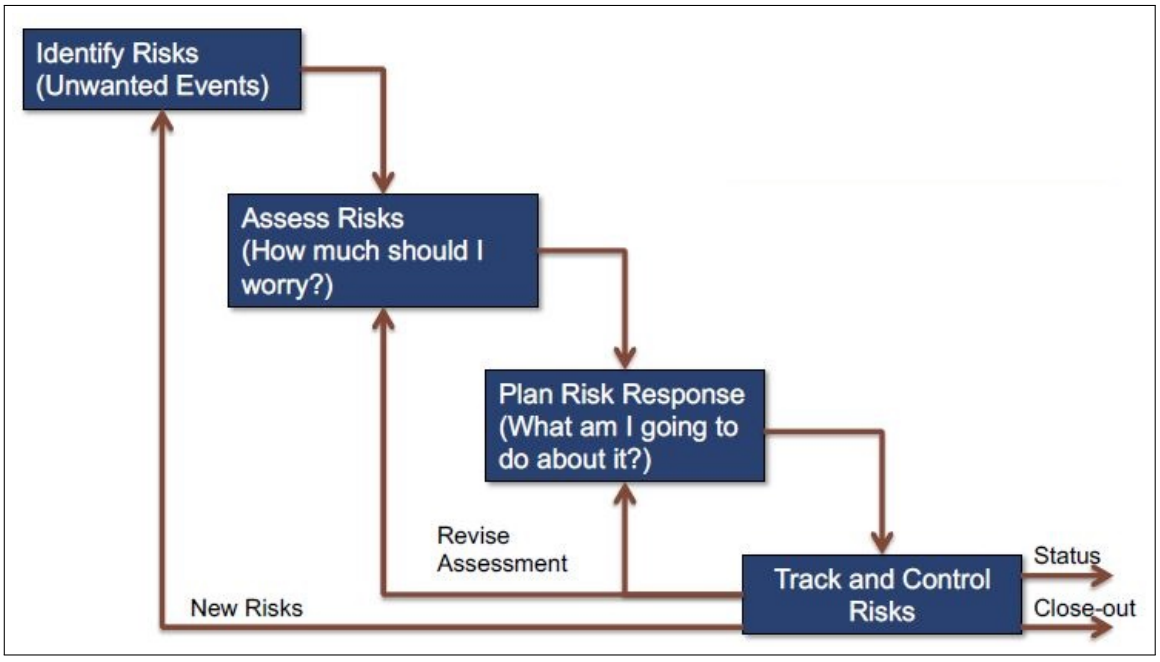

Figure 4.6 Risk Management and Process (Nicholas and Steyn, 2017)

4.4.7 Develop Roadmap, Perform Resource and Project Planning, and Build Expertise

If the DT goal is found to be adequate for the organisation, this roadmap element focuses on planning the DT. This is useful to gain an overview of the tasks, actions, and time required to realise the project. Furthermore, the task overview helps SMEs to determine what skills are required to complete the tasks, and therefore, helps to identify suitable individuals. A tool that summarises such information is a Gantt Chart.

4.4.7.1 Gantt Chart

The Gantt chart is a project management tool that provides a visual representation of an entire project (Apac CIO Outlook, 2020). It assists in planning and scheduling projects

by visualising timelines and tasks in the form of horizontal bar charts, showing the start and end date, dependencies, scheduling and deadlines (Apac CIO Outlook, 2020). Furthermore, the individual responsible for the task is indicated on the chart (Apac CIO Outlook, 2020).

To set up a Gantt chart, one needs to identify all tasks involved in the project and determine if and how they can be divided into manageable components (Apac CIO Outlook, 2020). From this, an individual can be identified who will be responsible for completing the task (Apac CIO Outlook, 2020). Additionally, task relationships have to be identified and the starting and completion dates have to be established (Apac CIO Outlook, 2020). The final Gantt chart illustrates the tasks in sequential order and displays task dependencies (ie. how one task relates to another). Next, the resource(s) can be allocated to complete the task(s).

4.4.8 Create Supportive Environment

Lastly, this roadmap element from Barann *et al.* (2019) procedure model and Cognizant's framework is mainly concerned with change management in a business, focusing on staff members. This roadmap element can be used to suggest recommendations to SME leadership how to manage change effectively and what measures need to be in place to create a digitalisation culture (eg. trust, openness, a non-error culture, and communication). Furthermore, it will include information about developing and sustaining the DT.

4.5 Chapter Summary

In this chapter, it was discovered that DT roadmaps are the most suitable means to support SMEs in the SADC. While readiness assessments and maturity models are poorly documented and have been found to be unrealistic "step-by-step" recipes, roadmaps break down complex DT projects into separate and manageable tasks and assist leaders to make informed decisions. After selecting three independent existing approaches to DT, specific elements could be isolated that should be addressed by researchers or entities who aim to develop a roadmap. These elements include: "Strategy and Objectives", "Analyse As-

Is Situation", "Gap Analysis", "Generate Solutions", "Strategic Alignment of Solutions", "Solution Evaluation", "Roadmap Development", and "Create Supportive Environment". All these elements are available in at least two of the three models compared within this chapter. Additional elements that are useful to include in the alternative DT approach were identified from the research from Barann *et al.* (2019). These include: "Establish a Planning Team", "Understand Business Model", "Resource and Project Planning", and "Build Expertise to Develop or Sustain Project". The objectives of each element were further discussed, and potential methods and techniques for achieving each elements' objective have been introduced.

Chapter 5

Proposed Digital Transformation Roadmap for SMEs in the SADC

This chapter focuses on designing the final roadmap found in Appendix B. First, the approach and methodology followed to design the roadmap are introduced and discussed. Next, the DT roadmap for SMEs in the SADC is designed. A high-level overview of the roadmap is provided, as well as a detailed discussion describing each step individually.

5.1 Approach and Methodology for Designing the Roadmap

To accommodate the significantly low skill level experienced throughout SADC's SME sector, the complexity of the roadmap must be kept to a minimum. The roadmap must be easily accessible, straightforward, and informative. Initially, it was intended to present the roadmap as a website to the user. However, due to the limited internet access throughout the SADC region, it was decided to lay out the steps in an excel template that can be completed by the user. However, throughout the development phase, it was found that not all steps could be presented in a template format that required completion by the user. It was, therefore, decided to compile the roadmap as a text document in the form of a user guide. The document includes information that provides the user with a short step description. This includes the step's aims and objectives, why the step is important, and what information can be expected as an output. Furthermore, guidelines will be provided to the user that explains a procedure that can be followed to achieve the steps objective. By making use of a case study, the procedure is presented in terms of a practical example.

This allows the user to gain insight into the practical application of the step and also how the output can be interpreted. If necessary, different tools or techniques that allow the fulfilment of each objective, have been identified. These tools and techniques have been identified, researched, selected, and compiled in Chapter 4. To increase practicality, an excel template will be provided to the user for selected tools. These templates can either be adjusted and completed by the user or may serve as an example that can be used for capturing the data. Possible interpretation guidelines for the step output will also be supplied to the user, to enhance the insight and understanding of the step findings.

The roadmap, therefore, may be considered as a guideline that raises awareness about the steps that are necessary to undergo a DT and how to complete these steps. It can be directly applied and will assist SME leadership throughout the planning process of a DT endeavour. Furthermore, it provides methods and guidelines on completing the steps and will aid the user throughout the decision-making process to determine whether the planned project is worth the effort and what effects can be expected if implemented.

5.2 Digital Transformation Roadmap for SMEs in the SADC

One of the prime objectives of this research project is to enhance the pro-activity of SME managers or owners and to create awareness about a DT endeavour. Furthermore, the scope of the project mainly focuses on the preparation phase of a DT endeavour. Referring to Chapter 3, SMEs in the SADC experience numerous difficulties that are caused by the region's harsh and underdeveloped business environment. To make the roadmap more applicable for SMEs located within this geographical location, a combination of the existing models from Barann *et al.* (2019), Stich *et al.* (2020), and Krishnan *et al.* (2015) was developed. The corresponding roadmap elements, identified in Chapter 4, have been included in the roadmap, as well as the additional elements identified from the Barann *et al.* (2019) procedure model. The alternative designed roadmap consists of 13 steps that require completion and is illustrated in Figure 5.1. The adjustments have been derived from the literature discussed in Chapter 2 and 3, as well as from industry experts

that were consulted throughout the validation phase of this research project (discussed in Chapter 6).

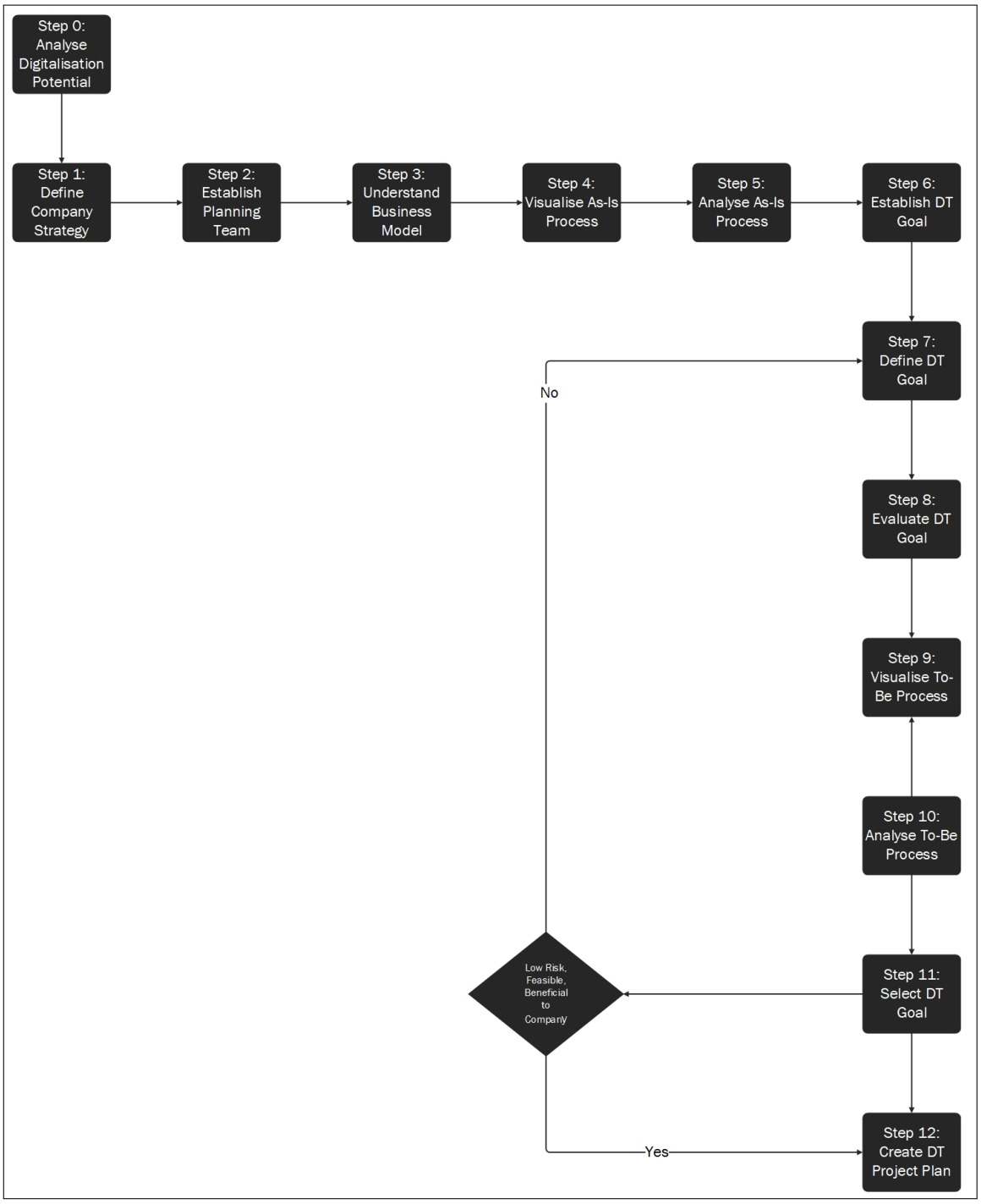

Figure 5.1 DT Roadmap for SMEs in the SADC

The next paragraphs summarise the objectives to be achieved and the reason for the importance of completing each step. The content of each step has either been adopted from the existing roadmap models or has been adjusted accordingly.

5.2.1 Step 0: Analyse Digitalisation Potential

This step has been labelled as Step 0, as it is considered as the pre-evaluation of the organisation. The insufficient availability of technological infrastructure (discussed in more detail in Subsection 3.3.2) results in SMEs in the SADC to be exposed to a significantly low technology maturity level. Along with these constraints, SMEs in the SADC also face the problem of the high failure rate and difficulty to obtain additional funding from external resources. It is clear that most SMEs in the SADC focus on survival, rather than investing in expensive and risky DT projects. Additionally, this roadmap is aimed to be used by SME leadership, who only have limited time, skills, and knowledge available to prepare for such a project. However, to complete such a roadmap, fundamental knowledge is required regarding DT. It is, therefore, proposed to evaluate the level of expertise among SME leadership to establish their level of knowledge and understanding and if they require assistance from external support units (eg. experts, consultants). This step aims to assist the user of the roadmap to establish the following:

- The SMEs' potential towards DT, and
- The level of expertise among SME leadership.

From the literature study conducted in Chapter 2, it has become clear that not only the business processes and operations change, but also internal business areas. To successfully transform digitally, an organisation has to conduct changes regarding its strategy, employees, customers, culture, and business environment (discussed in Subsection 2.2.2). Furthermore, an organisation should have specific cultural attributes available, including risk tolerance, organisational learning, failure tolerance, open communication, knowledge sharing, collaboration, employee empowerment, customer centricity, changeability, agility and flexibility, and finally ideating new digitalised working methods and services. In Chapter 3, however, it was discovered that SMEs in the SADC experience significant challenges, including their small market size, underdeveloped physical and technological

infrastructure, limited access to financial resources, insufficient skilled and trained human capital, and finally, the ineffective administration processes. From this information, it can be derived that SMEs within this region already encounter challenges in the following areas:

- Customers (Small Market Size),
- Digital Environment (Underdeveloped Physical and Technological Infrastructure), and
- Employees (Insufficient Skills and Trained Human Capital).

From Figure 3.11 it can be derived that the restricted access to financial resources contributes significantly towards the aforementioned challenges. The SADC region experiences high failure rates among the SME sector. SMEs are, therefore, often considered as a high-risk investment and find it difficult to receive external funding. This in turn affects their ability to attract and maintain skilled labour and to invest in physical and technological infrastructure. The insufficient availability of skills can influence numerous factors.

Firstly, it may contribute to the lack of understanding of the concept of DT, causing the organisation to fear the concept, its changes and challenges, and in turn, results in organisations being risk-averse and reluctant to change. Restricted financial opportunities also play a significant role in this regard. SMEs cannot afford to fail. This becomes problematic, since organisations who want to transform successfully, should be open to change (changeability), possess an appetite for risk (risk tolerance), and should not fear failure (failure tolerance).

Secondly, limited skills in the marketing sector may lead to the failure of identifying and meeting the dynamic changes in the market, which in turn makes it difficult to meet the standards and requirements of the customers (customer centricity, agility and flexibility). Furthermore, the lack of skills may also contribute to the lack of decentralised decision-making among the workforce (employee empowerment).

The lack of investment in physical and technological infrastructure, on the other hand, causes the majority of SMEs in the SADC to have an insufficient telecommunication infrastructure, resulting in limited access to the internet and other ICTs. The low technological maturity creates a significant challenge to DT, as internet access and ICTs are prerequisites for creating a digital environment(ideating new digitalised working methods and service).

Initially, it was planned to make use of existing maturity models or readiness assessments to assess the organisation's potential towards DT. However, after reviewing different models and assessments, it has become clear that the existing models are too advanced for SMEs in the SADC. The technological infrastructure within the SADC (discussed in more detail in Subsection 3.3.2) is significantly underdeveloped, resulting in SMEs encountering a low level in their technological maturity. If maturity models or readiness assessments would be selected, one can assume that the target group for this research would not score past level 0 or 1. It was, therefore, decided to make use of the information discussed in Chapter 3 to develop statements to analyse the digitalisation potential of the SME. Since the majority of SMEs experience the challenges discussed above, this step will be used to remind the user about the challenges experienced. Furthermore, the information supplied to the user will include details about the different components that are required for a DT, as well as its cultural attributes. The user can use the information to decide whether the organisation is ready to approach a DT project, or if there are not more important or current problems to solve. The decision, however, is completely up to the user, as this step merely serves to raise awareness and does not indicate any kind of recommendations or decision-making guidelines.

Coupled with this information, a short paragraph is provided to the user describing the skills required to complete this roadmap. The roadmap includes numerous managerial tools and techniques that require fundamental knowledge and understanding. Due to the limited managerial and entrepreneurial background experienced among SME leadership, it has been found to be necessary to notify the user about the skills and knowledge required to complete the roadmap. From this, the user can decide if additional assistance

is required or if independent research on the public domain (internet) will be guidance enough.

5.2.2 Step 1: Define Company Strategy

In Chapter 3, it was mentioned that a large portion of SME leadership lacks management or entrepreneurial background. This contributes to the fact that SMEs in the SADC lack a long-term vision and strategy. However, a strategy is an important factor to consider for an organisation. Revisiting the literature in Subsection 2.2.2.1, a strategy assists organisations to move in the right direction and identify and exploit the sources of superior profitability (Wahlin and Karlsson, 2017). Furthermore, it allows a company to differentiate itself from its competitors and to outperform its rivals (Wahlin and Karlsson, 2017).

Since digital technologies are altering and transforming current business strategies, capabilities, and processes, the set of strategic opportunities and value-creation alternatives increases significantly (Wahlin and Karlsson, 2017). By merging digital and IT strategies with the organisational strategy, the decisions and actions of the organisation need to be aligned so that they support the achievement of strategic goals. This step, therefore, aims to assist SME leadership in defining the organisation's strategy, as in addition to its vision and mission. This helps ensure that the innovative digitalisation goal of the company suits the organisation's objectives.

To achieve this, a Balanced Score Card can be used (literature discussed in Subsection 4.4.1.1). The Balanced Score Card is a strategic planning and management tool that assists organisations to prioritise and measure targets (Kaplan and Norton, 1992). By completing the Balanced Score Card, the individual has the opportunity to gain a visual representation of the company goals, while simultaneously aligning these goals to the company's strategy. Furthermore, a strategic map can be created, which helps to visualise the cause-and-effect direction of the business objectives (QuickScore, 2020).

The text document provided to the user explains the necessity of defining an organisational strategy. Furthermore, guidelines are provided that introduce a possible procedure

to be followed to achieve this outcome. The first two tasks include stating the vision and mission of the organisation. Vision statements should aim to provide clarification for the future of the organisation and should be inspirational. Next, a Balanced Score Card needs to be completed, as well as a strategy map. The guidelines provided to the user regarding the completion of a Balanced Score Card and strategy map have been derived from the literature that will be introduced and discussed. Furthermore, an excel sheet template named "Balanced Score Card" has been created that can be completed by the user.

5.2.3 Step 2: Establish Planning Team

To transform an organisation digitally, a company needs to be positioned within digitalisation, and a planning team needs to be established. The aim of this step is to assist SME leadership in establishing a planning team who is responsible for the DT project. However, sometimes it is not so easy to choose the people with the right skills or capabilities for the project team. For effective DT, people need to work collaboratively with the processes and technology. The team planning the DT endeavour should comprise of a person who has authority to make decisions, and the members involved in the DT and should be committed to the project. By means of this step, SME leadership has the opportunity to identify the members of the planning team and the tasks, skills, and knowledge required by these individuals.

The text document informs the user about the different team components and summarises the tasks, skills, and knowledge that is required by each team member. The literature covered in Subsection 2.2.2.2, includes the information that was used to educate and inform the user.
The user is required to appoint the different team members and allocate them to the respective team. Furthermore, each team member needs to be categorised into a specific resource category. The resource options have been introduced in Subsection 2.2.2.2 as well, and include the following:

1. Internal Resources: Individuals available within the business itself who are capable of completing the job (should consider up-skilling, training, or education).

2. Partner Resources: Possible partners of the organisation who could potentially contribute towards achieving the DT.

3. Vendor Resources: Possible project support opportunities that might support the organisation throughout the implementation phase.

An additional resource option is offered to the user, namely the "New Resource" option. The step output gives the user an overview of the team, tasks, knowledge, skill requirements, and how many people are needed.

5.2.4 Step 3: Understand Business Model

Once the planning team is established, the next step requires the individuals to understand the current business model (BM) of the organisation. This is a useful step, as it brings the entire planning team on the same level of understanding about the business activities and objectives (Barann *et al.*, 2019). By assessing the different company elements, the user can recognise the areas that require action for improvement (Hemmer, 2016). The BM assessment further reveals clear paths on which to build the organisational innovation strategy (Hemmer, 2016). A handy tool that can help explain the current BM is the Business Model Canvas which was introduced previously in Subsection 4.4.3.1. The Business Model Canvas is a useful tool that breaks a BM down into easily-understood segments. This can help to recognise the areas that require action for improvement and reveals the paths on which to build the organisational innovation strategy (Hemmer, 2016). The Business Model Canvas can provide the project team with a good overview of the businesses' current position and its objectives (Hemmer, 2016).

The text document presents the user with the layout of the tool, as well as with guidelines indicating the steps that are required to complete the tool. Short explanations of the different fields are provided. The user also has the option to complete a sample template provided in the excel file. The template includes a short description and a few sample questions to clarify what information is required. The questions and information were retrieved from the literature, summarised below.

5.2.5 Step 4: Visualise As-Is Process

The objective is to identify underlying challenges, risks, or change in customer expectations (Barann *et al.*, 2019). This can be achieved by analysing the current as-is situation of the organisation. The current state analysis can focus on an entire business organisation or one or more specific processes within a department or team. For the SME to find a starting point for the DT, this step works under the assumption that the user of this roadmap has identified a problem area in the organisation, such as a specific business department, operation, or process that requires DT. The user must, however, bear in mind that the DT project may have effects on other business areas. By keeping the overall end goal in mind, the current state analysis is particularly useful when processes can be identified where known issues are present. Furthermore, employees are confused about what the right process is or what steps to take in what situations, especially if the organisation plans to automate or streamline its current processes. It can, therefore, enhance the employees' understanding of the process by presenting the documented process flow to them (process documentation).

To visualise the process, the process steps have to be mapped. The visualisation of the current state of the process allows the planning team to understand the as-is situation and to be aware of the tasks that require completion. It is useful to include the people who are involved and familiar with the process itself. By involving them, the right information about the process can be obtained and the process can be defined and visualised. One way of completing this step is by making use of a process map (discussed in Subsection 4.4.4.1).

To create such a process map, the text document provides the user with a list of steps that should be followed to visualise the process successfully. It is, however, advised to make use of additional research or a consultant who can assist in this step.

5.2.6 Step 5: Analyse the As-Is Process

Once the flowchart of the process has been created, the process flow can be analysed to gain additional insight into the as-is process that requires transformation. This can

be achieved by using calculations and analysis techniques. The process analysis helps to investigate if all steps in the process are required or necessary. The data can also be used at a later stage to compare the current state with the future process after the transformation. Process analysis allows the opportunity to easily document, understand, track, and optimise processes for better performance, greater efficiency, and improved outcomes. Furthermore, it enables the identification of process gaps, bottlenecks, weaknesses, and risks, as well as opportunities for improvement (Lucidchart, 2020). By quantifying the current situation, the as-is state serves as a baseline against which the future state of the process will be compared. Furthermore, the analysis helps create a solid foundation in an organisation's processes. This fundamental information is necessary to manage and improve processes and helps the business to identify a starting point for improvements. Additionally, businesses can also expect to align operations with business strategy, improve process communication and training, increase operational efficiency, increase control and consistency across the organisation, and also support the organisation to gain a competitive advantage (Lucidchart, 2020).

To complete this step, the user is provided with two different process analysis approaches: a high-level approach and a more detailed approach. The high-level approach allows the identification of the number of people involved in the process, the inputs and outputs, and also the time required to complete the process. The more detailed analysis approach investigates the processes flow, time, quality, quantity, and cost in depth. A formula sheet has been compiled and attached in the appendix of the text document provided to the user. Furthermore, an excel template has been prepared, where the user has the option to insert the data required. The information provided in the text document and the excel file has been derived from academic teaching material from a tertiary institution in South Africa (presented in Subsection 4.4.4.2). The information includes definitions, formulas, and interpretations of calculation results. Although many more performance measurement calculations and process analysis options and techniques do exist, it was decided to keep the information included in the roadmap as simple as possible. As mentioned, the skills and level of expertise in the SADC are relatively low and, therefore, it is aimed that the information included in the roadmap is kept to minimum complexity. If a user

chooses to enhance the complexity, they have the option to conduct further calculations to gain more insight into their current process.

5.2.7 Step 6: Establish DT Goal

To establish the DT goal of the organisation, Parviainen *et al.* (2017) suggest to include four different action items: digitalisation impacts, digitalisation drivers, digitalisation scenarios, and digitalisation goals.

First, the company's digitalisation impacts have to be analysed to decide on the position that the company wants or needs to take in the change. This can be achieved by identifying and analysing current and upcoming digitalisation trends. These trends should be relevant to the company's business domain. By making use of the SWOT (Strengths, Weaknesses, Opportunity, Threat) analysis, the trends can be categorised into topics that are strengths or weaknesses or can create opportunities or present threats in the business domain (Parviainen *et al.*, 2017). By using the literature in Chapter 2, Figure 5.2 was compiled and summarises the SWOT analysis of DT. This analysis forms the baseline for positioning the company in digitalisation (Parviainen *et al.*, 2017).

SWOT Analysis					
		Helpful		Harmful	
		to achieving the objective		to achieving the objective	
Internal Origin	attributes of the organisation	STRENGTHS		WEAKNESSES	
		1	Optimisation or resource & energy efficiency	1	Broad & complex topic
		2	Reduce burden of market volatility & product complexity	2	Lack of sufficient awareness & expertise about concept
		3	Faster & more accurate production	3	High capital investments required
		5	Encourage more advanced workforce skills eg. Problem management, problem-solving, self-organise	4	Insufficient preparation & implementation guidelines
		6	Rapid & accurate response towards customer requirements & demands	5	Strategic alignment required of DT and organisational goals & objectives
		7	Customisation of products	6	Cultural change required within organisation
		8	Business Transparency allowing easier identification of improvement opportunities	7	Vague definitions of responsibilities for staff members
		9	Maintaining low cost & environmental impact when responding to product variety & flexibility		
External Origin	attributes of the environment	OPPORTUNITIES		THREATS	
		1	Continuous resource productivity & flexibility	1	Technology-related risks: Possible technology failures
		2	Improved business responsiveness	2	Cyber risk: Unauthorised sharing/access of confidential data
		3	Increase productivity & accelerate innovative developments	3	Operations risks: inadequate control of operating procedures
		4	Automation of manual, repetitive tasks	4	Data leakage
		5	Enable sustainable prosperity such as reducing energy consumption, resource replenishment, and negative environmental impact	5	Inappropriate handling of data by third party (eg. Vendor)
		6	Integration of objects, humans, intelligent machines, production lines, and processes forming an intelligent network chain	6	Privacy and Regulatory concerns

Figure 5.2 Digital Transformation SWOT Analysis

The next step is to identify digitalisation drivers. By using the results previously derived in the SWOT analysis, the impact of the relevant trends on the company can be examined (Parviainen *et al.*, 2017). According to the Parviainen *et al.* (2017) research, impacts can be related to internal efficiency (improved way of working via digital means and

re-planning internal processes), external opportunities (new business opportunities in the existing business domain), or disruptive (digitalisation changes business roles completely). Therefore, once the DT impacts have been established and understood, the organisation must clearly define the most important drivers to pinpoint its DT goal. Examples of drivers for DT have been discussed in Subsection 2.2.1 where the critical need for DT is examined. The list below represents the information discussed in Subsection 2.2.1 concerning the potential impact areas previously mentioned:

- Internal Efficiency: Reduce dependency on external factors (eg. natural resources, non-renewable resources, weather conditions, inflation), and optimisation (increasing productivity, efficiency, profitability).
- External Opportunities: Volatile, uncertain, and complex market conditions, changing customer demand, and change in regulations.
- Disruptive: New technologies introduced into markets, remaining competitive in the business domain (offer product-service innovation, higher product variety, product customisation, improved quality standards, offer support services, the immediacy of satisfaction).

Once the digitalisation impacts and drivers have been established, different scenarios of DT should be identified and reviewed. By reviewing practical examples, the planning team has the opportunity to enhance their understanding of different DT goals, and what value has been added through the DT concept (Parviainen *et al.*, 2017). Four practical examples have been discussed in Subsection 2.2.3. These examples include the digital land registry system in Mauritius, the livestock traceability system in Swaziland and Namibia, FNB's concept of mobile money, and precision farming in South Africa. Although these examples are not SME specific, they demonstrate the projects' overall digitalisation objective and indicate the benefits achieved by implementing the scenario. This action step merely serves to create awareness among the team members about DT opportunities in a practical context.

The final action item is to establish the company's digitalisation goal. The goal can include a single project, such as introducing technology for faster operations, or a complete transformation of the business (Parviainen *et al.*, 2017).

The text document requests the user to first identify problem areas from the as-is analysis. Using the data output from the process analysis of the as-is situation, the information can be interpreted and improvement possibilities The text document provides guidelines that aim of assisting the user to identify the overall goal the organisation aims to achieve with the DT. As discussed in Subsection 2.2.2.1, the bottom-up idea generation approach aims to identify the "low hanging fruits" of the existing processes. Employees and management have to determine what opportunities digitalisation has to offer and which innovation opportunity is suitable for the organisation. Therefore, by creating awareness about digitalisation and its potentials, SME leadership can select the goal that is desired to be achieved.

5.2.8 Step 7: Define DT Goal

After establishing the overall DT goal, the next step includes a detailed definition of the goal. The goal should indicate an alternative or possible improvement of the current as-is situation previously analysed (Parviainen *et al.*, 2017). In Chapter 2, it was mentioned that roughly 70% of DT projects fail to reach their stated goals and this is mostly due to the inefficient generation of ideas or inadequate definition of company goals.

The aim of this step is to generate ideas that allow the achievement of the mentioned goal. To complete this step successfully, the literature in Chapter 2 suggests consulting the employees who are involved in the process that has been mapped and analysed in Steps 4 and 5. They may contribute to information about the process that may help to identify problem areas or find alternative ways to optimise or improve the process. Furthermore, an effective idea generation process should be followed. As mentioned, the bottom-up approach has been employed in the previous step, where areas for improvement have been identified. By consulting the employees, possible ideas have to be generated that can contribute to achieving the goal. To complete the second part of the idea generation process,

the top-down approach has to be followed. Leadership has to evaluate whether the generated ideas meet the organisation's objectives and align with the company strategy. The previously established overall end goal needs to be kept in mind at all times (for example increase efficiency, reduce throughput time, improve quality, or even boost worker morale),

The text document supplies the user with a few hints that allow an effective idea generation process that should be employed to reach the overall digitalisation goal. The user is required to select the goal with the highest priority which simultaneously aligns with the company strategy.

5.2.9 Step 8: Evaluate DT Goal

A practical implementation idea has been generated, and now requires evaluation. Since every business is unique, its challenges and limitations differ from other businesses. Companies must, therefore, evaluate and refine their aligned ideas (Barann *et al.*, 2019). This is necessary to determine if the organisation can actually afford the investment and also if the project is worth the investment in terms of money and time. To determine the value-for-effort of the DT goal, the risks and costs involved will be compared to the potential benefits attained from the DT goal.

The text document provides the user with a step-by-step procedure that can be followed to conduct a cash flow-, cost-benefit-, and risk analysis successfully. The information included in the document has been derived from the information discussed in the literature in Chapter 4 (Subsections 4.4.6.1, 4.4.6.2, and 4.4.6.3). Additionally, excel templates are provided that can be completed if the user chooses to.

5.2.10 Step 9: Visualise To-Be Situation

For the planning team to understand the to-be situation and to be aware of the tasks that require completion, the future state of the process must be visualised. Visualising the future state of an organisation allows for the opportunity to easily identify, document, understand, and compare the current process against the future process after the DT.

This allows the planning team to understand the to-be situation and to be aware of the tasks that require completion. Using the same technique as in Step 4, the future state is visualised by making use of process maps.

The text document proposes the user to follow the same procedure as described in Step 4: Visualise As-Is Process. Again, no excel template has been prepared to the user.

5.2.11 Step 10: Analyse To-Be Situation

To conduct a more accurate comparison of the as-is and to-be state of the process, the process should be analysed by making use of the same calculations and analysis techniques, as in Step 5. The comparison helps identify whether this digitalisation opportunity fits into the organisation's process or not.

The user is required to follow the same process analysis procedure as in Step 5. This means that the same level of detail should be included, as well as the same calculations. Again, an excel template has been prepared and provided to the user where the information can be entered.

5.2.12 Step 11: Select Opportunity

In this step, the DT goal established and defined in Step 6 and 7 is either selected or discarded by the planning team. All data that has been captured throughout the roadmap is used to compare the as-is process with the to-be process, to determine whether the future state of the process is more favourable than the current one. Furthermore, it needs to be established whether the project matches the company's strategy, vision, and mission. Additionally, potential impact areas can be identified. If the goal is found to be more favourable, the next roadmap step can be approached. If, however, the goal is found to be inadequate, it will be discarded and Step 6 will be revisited to establish a new goal, or select the next one.

The text document instructs the user to summarise all data that has been captured throughout the roadmap. Summarising the data will help to compare the as-is process with the to-be process. An excel template has been created, that provides the user with an overview of the data that has been captured if the previous templates have been completed. The values from the templates are directly transferred to the "Select Opportunity" sheet. The text document as well as the excel template provide the user with additional guidelines to determine the following:

1. Whether the goal aligns with the company strategy,
2. Whether external resources are required for the planning and project team,
3. What impact the goal has on the current business model,
4. Whether the goal improves the as-is state in terms of time, money, or effort, and
5. Whether the goal assists the organisation to achieve a more favourable cash flow, if the benefits outweigh the costs, or if the risks involved can be managed by the business.

Furthermore, the user has to establish whether additional infrastructure (physical and technological) is required for the future state. The same applies to additional funding opportunities, or changes in the company workforce (lay off or hiring) that are required or result from the DT goal implementation. A table was compiled and presented in the text document to create awareness about the potential impact the changes may have on specific business areas. The information used to compile the table in the text document was researched and discussed in Chapter 3. Different factors have been identified that should be considered by SMEs in the SADC, including finance, administration, time, and skills. The table summarises which factor will have an impact on the possible change, and a short explanation or example is presented.

After studying all information, the user has to decide whether the DT goal meets the company's strategic objective, vision, and mission and whether the benefits of the DT goal are worth the risks, costs and effort. If this is the case, the user can move on to

Step 12, otherwise, an alternative DT goal from Step 6 should be considered and further evaluated.

5.2.13 Step 12: Create a Digital Transformation Project Plan

To create a DT project plan, the organisation needs to gain an overview of the tasks, actions, and time that is required to realise the project. This step aims to create an overview of the tasks and skills that are required to complete the project. To complete this step, a useful tool has been identified, namely the Gantt chart (introduced in Subsection 4.4.7.1).

The text document instructs the user to determine the tasks or actions that are required to prepare the organisation for the project implementation. It further requests that the user identifies the relationships between the tasks to determine which task is a predecessor or successor for another task. Next, a time frame needs to be allocated to each task, as well as a resource responsible for the completion. Finally, a Gantt chart can be created to visualise and summarise the information. An excel sheet is also provided to the user to record the data.

5.3 Chapter Summary

Throughout this chapter, a roadmap was developed that serves the needs of SMEs located in the SADC region. The roadmap and the excel file provide the user with straightforward procedures and informative details regarding a DT project. The procedures and details include researched information from the literature and different management tools or techniques that allow the fulfilment of each step objective. Due to the guidelines and methods included in the DT roadmap, SMEs in the SADC have the opportunity to directly apply the roadmap.

Chapter 6

Validation and Discussion of Roadmap

This chapter describes three different phases that have been utilised to check the correctness and functionality of the roadmap developed in Chapter 5. The findings of each phase are stated and discussed and changes were made where necessary.

6.1 Overview of the Validation Approach

To validate the roadmap developed in Chapter 5, a combined approach is used consisting of both a verification and validation process (as described in Section 1.6). To check the correctness of the roadmap, the model is firstly verified by consulting experts. The model is then adjusted according to the feedback and then validated to test its functionality by consulting SMEs located in the SADC. After deriving an output and feedback from the validation process, the industry experts are consulted again to verify the roadmap output. The following subsections summarise the actions taken and the results obtained from the combined approach.

6.1.1 Phase 1: Roadmap Verification

Although the final version of the roadmap is presented as a guideline compiled in a text document, alternative versions of the roadmap were planned earlier. The initial idea was to present the roadmap on a website, where the user can access the roadmap online. However, throughout the literature study, it became clear that due to the underdeveloped technological infrastructure in the SADC, internet access is limited and expensive. Furthermore, the planned concept became too complex, which would cause difficulties for the user. After this finding, it was decided to lay out the steps in an excel file. Since the majority of businesses make use of Microsoft software packages, it was decided to use excel to

improve the accessibility of the roadmap. Excel allows numerous analysis techniques and simplifies and automates the execution of calculations. The excel file consisted of different sheets, where each sheet presented a roadmap step. Similar to the final version in the text document, each sheet introduced the step objective, as well as the reason of importance for completing this step. Instructions were provided to indicate a possible procedure that can be followed to complete the step, and if necessary, templates were provided to the user that could be completed. Furthermore, the roadmap allowed the user to evaluate different DT options. At the end of the roadmap, a summary sheet was presented to the user. The sheet summarised all the data that was captured in the templates when completing the roadmap. This allowed the user to compare the different DT options that were evaluated and provided more insight into each alternative. This roadmap format was the version that was sent to the experts for the first verification round.

To verify the roadmap, individuals working in the industry have been selected and consulted (from now on referred to as experts). The experts have been selected according to certain criteria, which will be discussed in more detail in the following subsection. An email was sent out to request the experts' participation, which provided a short description regarding the project background, problem statement, and research objective and approach. Furthermore, a short explanation was prepared to indicate the task expected from the validation candidates. It was requested from the experts to examine the content and the logic of the roadmap to analyse the correctness of the tool. Once the experts had reviewed the roadmap, their feedback was retrieved, either via email or by means of a phone call.

6.1.1.1 Industry Expert Selection

The objective of this step is to gain external feedback from the experts, to determine whether the roadmap would be suitable to be used in the industry, if important or relevant information or steps have been missed throughout the development phase, and to check the correctness and logic of the roadmap. For this reason, the individuals chosen have to meet at least three of the four criteria listed below.

1. Engineering Background,

2. Five years of industry experience (or more),
3. Active in the SME sector in the SADC, and
4. Possess fundamental knowledge regarding digitisation, digitalisation, and DT.

A total of five experts were consulted. They are all familiar with SADC's business environment and have been (or still are) active in the SME sector. The experts consulted include two engineers (mechanical and electrical) who are active in Namibia's consulting industry and three industrial engineers. One of the industrial engineers is a lecturer at the University of Stellenbosch, while the other two are self-employed and actively involved in projects across Namibia and South Africa. All three industrial engineers possess a thorough understanding and background of DT.

6.1.1.2 Roadmap Verification Findings

The following list summarises the feedback that was obtained from the industry experts. The paragraphs following the list provide a more detailed discussion and overview of the feedback.

1. Aim of project not clear.
2. Sophisticated model, not suitable for self-assessment.
3. DT potential of the target group unknown.
4. Model does not address the following factors sufficiently:
    - Digital tools and technologies available,
    - Cash flow,
    - Information flow,
    - Skills required, and
    - Time required.

1. Aim of project not clear

The excel templates intended to demonstrate possible examples of completing the respective step. However, throughout the development phase, it became clear that not all steps could be presented in a template format that required completion by the user (eg. visualise as-is and to-be process). In this case, guidelines were provided to explain possible

procedures to complete the respective step. The problem with this approach was that the roadmap became a mixture of a guideline and a worksheet. The mixed approach caused considerable confusion among some of the validation candidates. They became unsure about the actual objective of this roadmap and questioned whether it was intended to resolve issues or to evaluate the DT goal.

2. Sophisticated Model

It was further mentioned that this version of the roadmap is too sophisticated for the intended target group. Apart from adhering to the peculiarities posed by the nature of SMEs, the roadmap is not designed to serve a specific sector in the industry. Thereupon, the template content was significantly generalised and required individualised editing to suit the needs of each organisation that would use the excel file. However, with the low skill level, SME owners or managers would experience difficulties in adjusting the model adequately. It was, therefore, recommended by the experts to make use of a consultant who is familiar with the model on excel to guide SME owners through the roadmap.

3. Target Group

A further remark addressed the target group of the roadmap. DT requires a significant investment in terms of money and time. The experts noted that not every SME in the SADC shows potential to undergo a DT. Some have more important problems to solve and need to prioritise these above. Furthermore, SME leadership is relatively preoccupied with running a business and, therefore, tend to only have limited time available to identify opportunities and to plan for their project. The experts pointed out that the excel version of the roadmap is relatively time-consuming and should rather focus on one individual DT project than evaluate different alternatives.

4. Model Content

Regarding the content of the roadmap, experts indicated that the original model does not address cash flow sufficiently. Initially, the roadmap introduced the user only to a cost-benefit analysis and a risk analysis. However, cash flow was mentioned to be a very important aspect, especially for SMEs. Another comment was that limited introduction

of available digital tools and technologies was provided to the user. Another factor that was lacking in the roadmap is an analysis of information flow. Since information flow is critical in DT and digitalisation, this factor needs to be included in such a roadmap. An additional limitation of the roadmap mentioned is that the final sheet in the excel file presented a breakdown of the project, but did not indicate a timeline for completing the project and what skills would be required for completing the tasks.

6.1.1.3 Roadmap Adjustments

In general, the experts found that the excel file could still serve as a useful consulting tool. For a person who is familiar with the information in the excel document and its functions, this roadmap can be relatively useful for SMEs in the SADC. However, it was discovered in the literature, that financial constraints hinder SMEs in hiring a third party who can assist in this regard. It was, therefore, decided to shift from a practical approach to a more theoretical one. This means, that a text document was compiled that provides the user with a set of instructions indicating how each roadmap step could potentially be completed. Excel templates are still provided to serve as an example for the possible step completion, however, only for selected steps. Furthermore, they only serve as a possible method to capture data the users' data, but it is not mandatory to complete the templates.

At the beginning of the text document, a short introduction is provided describing the objective of this roadmap, its structure and what output can be expected after completing the steps in the roadmap. These changes were conducted to **reduce** the roadmap's **complexity** so that SME leadership can use the roadmap as a self-assessment. Furthermore, the instructions aim to **clarify the project aim**.

To address the feedback regarding the **target group**, it was decided to design the "Analyse Digitalisation Potential" step as a pre-evaluation of the business. This step aims to help the user establish whether the organisation is ready to approach a DT project or whether there are not more important or current problems to solve. The roadmap in the text document provides information to create awareness about the different components and cultural attributes that should be considered by organisations before, during, and

after a DT. This step, therefore, assists the user in determining whether the roadmap is suitable for the business or not. This can save valuable time.

The roadmap works under the assumption that the user has identified a problem area and already has a possible solution in mind that can address the issue. The user, therefore, has a digital solution in mind, which only requires further evaluation. The roadmap aims to raise awareness and demonstrates a possible approach for evaluating the DT project and does not help the user to resolve any issues. Therefore, it was not found to be necessary to incorporate the feedback regarding the digital tools and technologies introduction. Additionally, digital tools and technologies are very market and sector-specific. It was found to be difficult to include such information in a generalised roadmap that aims to serve the manufacturing industry.

To address the remaining **content** remarks, a cash flow analysis was added to the roadmap. Furthermore, Step 12 introduces the user to Gantt charts, which can be used to add a timeline to the project and to allocate appropriate individuals to the project tasks. With this overview, the user can identify which tasks are missing which skills. Finally, to analyse the information flow, Step 5 and Step 10 encourage the user to identify the input and output type of each process step that was mapped in the as-is and to-be process. This allows the user to compare these two processes and how it changes from an analogue data recording to a digital one. It was, however, decided to omit information regarding digital tools and technologies. The roadmap is aimed to serve as a guideline that encourages a systematic way of thinking of approaching DT rather than providing recommendations to the user. By including digital tools and technologies, specific examples would have to be recommended to the roadmap user, which in some cases, would not be applicable to all SMEs.

Apart from these changes, no major changes were made regarding the roadmap structure. The sequence and scope of the steps remained the same, however, the level of detail increased. More information is provided to the user to ensure that the guideline can be understood and followed easily.

6.1.2 Phase 2: Roadmap Validation

To check the functionality of the roadmap, two approaches are used. The first approach is a supervised approach, where the SME is accompanied through the roadmap by a consultant (in this case this researchs' author). By using one of their digitalisation projects, the roadmap was tested to check its functionality. The data, outputs, and interpretations of this process were captured and compiled. This information was then included in the text document and attached as an appendix. The reason this case study is included in the text document is to provide future users with a practical application example of this DT approach. Furthermore, it is aimed to demonstrate possible ways of the output derived from each step and how it can be interpreted. This would then be useful for the second approach. The second approach included consulting SME owners or managers who examine the roadmap on their own and provide feedback. This was important in determining whether the roadmap can be completed without guidance or whether it is not suitable as a self-assessment.

6.1.2.1 Criteria of Case Studies Selected

The objective of this phase is to validate the functionality of this roadmap and if it meets the needs of SMEs in the SADC. To qualify as a validation candidate for this research project, the SME needs to fulfil the following requirements:

1. Employ the specified number of people as defined in the country's legislation (to qualify as an SME),
2. Positioned in the manufacturing industry,
3. Located in the SADC,
4. Established and operating business, and
5. Consider DT as an option and is open to change.

The SMEs chosen are all situated in Namibia. The number of employees all range between 11 and 100. They are active in the manufacturing sector, one in the charcoal industry and the others in the engineering consulting industry. They are all established businesses, operating for at least five years. The case study business (active in the charcoal industry)

has already realised small digitalisation projects and the other SMEs are considering DT for selected processes.

6.1.2.2 Roadmap Validation Findings

The following paragraphs summarise the findings of the two different approaches conducted throughout the validation phase.

Supervised Case Study Approach

The organisation chosen for the case study is a charcoal packaging SME, located in Namibia. The organisation was founded in 2016 by five individuals who are all farmers in Northern Namibia. Due to the ever-increasing invader bush growth on their land and the continued absence of rain, the farmers struggled to manage and maintain their livestock. They have, therefore, started to sustainably utilise the invader bush as a renewable resource to produce charcoal. They founded an organisation to increase the value of the raw material (in this case the charcoal) by packaging and shipping the product to international markets. Since the majority of the founders are individuals with limited business management and entrepreneurial background, this organisation was found to be an ideal candidate to practically apply this roadmap. Due to the unfortunate situation caused by the COVID-19 pandemic, the organisation put all of its current and future DT projects on hold. However, to prove the roadmap concept, the roadmap was applied to a past digitalisation project the company already realised earlier in 2020. The directors of the case study organisation have found that their inventory management process is inefficient and tedious. Initially, the stock levels were updated manually by individuals. The aim was to automate and optimise the inventory management process. Considering this project, one of the SME's directors was consulted to obtain the background of the problem and all necessary information that is required to complete the roadmap. Each roadmap step was applied, discussed, and recorded. As mentioned, the information was compiled and added to the roadmap document to provide a practical example. This example aims to assist users who would like to attempt the roadmap without any external help from a consultant. The case study is also included in the roadmap document that is attached in Appendix B.

Although a past project has been used, the SME director found that the approach could have been useful to the organisation if they would have planned their project accordingly. It was further mentioned that the guidelines provided by the roadmap mostly demonstrate a simple approach to DT, but it does leave room for adjustments and customisation to meet the organisation's individual needs. Since this approach was supervised by the author of this roadmap, all information and interpretations could be communicated verbally to the SME director and, therefore, saved significant time and effort. The SME director also believes that this roadmap format shows potential to be used by SME owners without the support from a consultant. However, it was mentioned that the document is relatively text-heavy and includes a lot of information which may diminish the motivation of potential users to go through the information.

Self-reliant Approach

For the second approach, area managers from an engineering consulting firm were asked to study the roadmap together with the case study. The candidates are lab area managers of the consulting company who are all situated in Oshakati in northern Namibia. The overall feedback from the individuals is summarised in the following paragraph.

Presenting the roadmap in different steps was found to be a convenient and practical approach for the candidates. Especially since each step had its objective that contributed towards the main goal of the operation. Although the case study in the roadmap appendix only included a small and simple digitalisation project, it proved to be very useful to the candidates. They found it helpful to see a practical example of the output that can be derived after completing each step and the roadmap. However, the process seemed slightly overwhelming at first, due to all the information and concepts included in the roadmap. Without help, it will be difficult to start with the process. It was, therefore, mentioned that most SMEs might not be willing to go to the trouble unless they are well convinced. Despite this, the candidates stated that they see a possibility of investing in consulting someone with sufficient knowledge and understanding to support them throughout the process, especially if positive results can be yielded from its outcome. Moreover, it was

stated, that once the principles are understood, the roadmap would become a repetitive process, so any future improvements and changes will become easier and the roadmap can be utilised without external help.

6.1.3 Phase 3: Roadmap Output Verification

After updating the roadmap in Phase 1 and attaching the case study in Phase 2, the document was again sent to the experts consulted earlier in Phase 1. This was necessary to verify whether their feedback and recommendations from Phase 1 had been implemented adequately and whether the output from the case study is useful and correct.

6.1.3.1 Roadmap Output Verification Findings

The updated version and format of the roadmap was found to be a significant improvement on the initial excel file. Although the initial version is a useful consulting tool, it was mentioned that the text document is more suitable for the low skill level experienced in the target group. However, similar to the comment made by the lab area manager in Phase 2, it was also suggested to provide more support to the user, especially when the roadmap is used for the first time. It was further mentioned that individuals are often afraid to ask questions as they do not want to appear to be ignorant or are afraid that someone may take over their ideas. To assist in this regard, it was recommended to include a list of individuals or organisations who can support the roadmap user virtually or physically.

6.2 Discussion of Overall Findings

Comparing the original excel file with the final PDF roadmap version, significant changes were made. The roadmap and its objectives became clearer and the complexity was reduced significantly. However, the skill level of the target group was found to be even worse than initially anticipated. Although a great effort was invested to create a roadmap that can be used by SME owners or managers themselves, additional support and assistance from a consultant who guides them seem inevitable. The information and concepts presented in the roadmap seemed overwhelming at first and may diminish the motivation

of potential users to go through the information. Even though additional fees would be required to consult an expert, the organisation would experience numerous advantages. Firstly, they have a person to turn to who can assist them and their organisation individually. Secondly, with a consultant present, the information and output interpretations can be communicated much faster to the individual, saving valuable time. Thirdly, the roadmap can be explained and demonstrated, and afterwards, the roadmap would become a repetitive process. Therefore, future improvements and changes in the organisation will become easier and the roadmap can be utilised by the organisation without external help. Finally, even if money is spent and the outcome of the consultation indicates that the DT project is not suitable for the organisation and its current situation in the economy, the organisation has a reference point regarding its problem areas and knows where to start in order to improve.

6.3 Chapter Summary

The combined process consisting of a verification and validation approach proved to be highly valuable. The literature study conducted in the previous chapters could only provide insight into the information that is already known. However, after the three phases discussed within this chapter, it was found that the actual skill level of SME owners and managers is even worse than the research suggests. Furthermore, valuable insight could be gained from the industry experts and the SME validation candidates. Their suggestions and recommendations contributed significantly towards the final version of the roadmap. The iterative process utilised for developing the roadmap allowed the roadmap to be more applicable to SMEs in the SADC region.

Chapter 7

Findings and Future Research

This chapter provides an overview of the findings that have been derived from this study. Furthermore, the future work that follows this thesis will be discussed in more detail.

7.1 Research Findings

A comprehensive methodology was followed to move through the entire process of establishing the final DT roadmap for SMEs in the SADC. Chapter 1 identified and defined the problem and introduced a methodology to systematically work towards a solution. Four objectives were established and contributed towards the knowledge and understanding required to develop the final roadmap. The next paragraphs summarise the completion of the objectives and what results have been obtained.

Objective 1: Identify the internal areas within an organisation that will be affected during a DT.

In Chapter 2, a literature review was performed to identify the internal business areas that are affected during a DT. In this chapter, it became clear that DT not only involves the transformation of systems, processes, and operations, but also affects the organisation's strategy, its employees and customers, its culture, and finally, its business environment. The strategy differentiates an organisation from its competitors by choosing a set of activities to deliver a unique mix of value. If an organisation aims to create additional or differential value by leveraging digital technologies, a digital strategy must be put in place. This digital strategy, however, must be aligned and merged with the current business strategy. Next, employees have been found to be the most important

factor to help companies realise DT. The human factor in the business was found to be the main barrier to change. The reason for this is that their work environment is altered and their skill- and qualification requirements change due to DT. Organisations must focus on transforming their workers' mindsets and build a culture of collaboration within the workforce. Important building blocks to achieve this include an integrative workforce strategy, continuous education and training, a no-error culture, and employee empowerment. Moreover, organisations must also focus on improving their responsiveness to their customer. Customers demand traceable individualised products and services quickly. Therefore, the culture of an organisation must evolve constantly. Organisations must change and adapt constantly and continuously reinvent themselves to realise DT successfully. Finally, a digital environment is a crucial element that contributes to the future competitiveness of companies.

Objective 2: Research the factors contributing to the limited opportunities experienced by SMEs in the SADC region.

In Chapter 3, research was conducted to understand the operational environment SMEs are currently operating in. The harsh business environment includes factors and challenges that are contributing to the limited opportunities experienced by SMEs in the SADC region. The challenges they are facing include the small market size, the underdeveloped physical and technological infrastructure, the limited access to financial resources and skilled labour, and finally the ineffective administration processes. It was found that all factors contribute towards the limited industrialisation experienced in the SADC, which eventually leads to the underdeveloped economic sector. Figure 3.11 shows the interrelationships that could be established while studying the literature. From the research, it is evident that the skill shortage in the SADC region contributes significantly to the underdeveloped economic sector. This confirmed the critical need to provide assistance to SME owners or managers to plan for projects that demand such radical changes, like DT.

Objective 3: Identify frameworks and their corresponding elements that are required to develop a supporting framework to support SMEs in the SADC with DT

To provide such support, available frameworks that demonstrate an approach to DT were identified and researched in Chapter 4. From the research, it was found that DT roadmaps are more applicable to SMEs in the SADC than maturity models and readiness assessments. To develop an applicable roadmap, three existing approaches to DT were identified, researched, and compared. While comparing the existing approaches, it became clear that they are similar in numerous ways and include the following elements: strategy and objectives, analyse the as-is situation, gap analysis, generate solutions, strategic alignment of solutions, solution evaluation, roadmap development, and create a supportive environment. Additional elements could be identified from the Barann *et al.* (2019) procedure model. This provided the author with a fundamental understanding regarding the topics and aspects that should be addressed by such roadmap. By combining the three existing models, an alternative DT approach was developed, specifically designed for SMEs in the SADC. The roadmap developed in this research is a complete model that proved to be effective in the SADC.

Objective 4: Develop a supporting framework that aims to assist SME leadership

The roadmap developed for this research study consists of 13 steps, ranging from 0 to 12. Step 0 aims to raise awareness among SME leadership about the most important factors that need to be taken into consideration. Step 1 to 5 help SMEs to establish a strategy and understand their current business environment by using a Balanced Score Card, a Business Model Canvas, and Process Mapping and Analysis. Step 6 and 7 help to establish and define the DT goal, where Step 8 assists in determining whether the value gained by their envisioned endeavour is worth the effort required (in terms of time, money, etc.) - using a cash flow, cost-benefit, and risk analysis. Furthermore, Step 9 and 10 support in establishing whether the DT endeavour creates more favourable conditions

than experienced in the current situation by encouraging the user to map and analyse the future process after the transformation. In Step 11, the user must decide whether the DT goal meets the company's strategic objective, vision, and mission and whether the benefits of the DT goal are worth the risks, costs and effort. If this is the case, the DT endeavour is broken down into simple and manageable tasks using a Gantt chart.

7.2 Conclusion of Findings

Considering the research from Chapter 2 and 3, it was discovered that SMEs in the SADC show significant weakness in the following business areas: Customers (small market size), digital environment (underdeveloped physical- and technological infrastructure), and employees (lack of skills and education). It can be argued that financial constraints contribute significantly to these weaknesses. Furthermore, limited business management or entrepreneurial background contributes to the lack of a long-term vision. Moreover, the company culture shows significant room for improvement, especially since most organisations in the SADC are risk-averse and reluctant to change. This creates substantial challenges for SMEs in the SADC in preparing for a digital endeavour. Therefore, the roadmap developed to assist SMEs in this regard was found to be satisfactory in terms of the objectives that have been set in Chapter 1.

The framework developed in this research can be considered as a complete model as it addresses all correlating and additional elements that have been discovered as important in Chapter 4. Throughout Chapter 5, an alternative approach to DT has been developed that is specifically designed for SMEs in the SADC. The framework is accessible, straightforward, and informative. While the existing models only provide guidance on the DT approach and the step objectives, this framework model provides the user with methods and guidelines describing how each objective can be achieved. This makes it easier for entities to use the roadmap, instead of developing their own. Furthermore, the case study that is included in the roadmap provides the user with practical application examples of completing the roadmap. Since the complexity of the roadmap was kept at a minimum, it is, however, recommended to complete all steps to ensure that no important aspects are

omitted or incomplete. Each framework step aims to achieve a specific objective which was found to play an important role in DT. By omitting steps, the results obtained may not be accurate and incomplete.

Even though the roadmap was validated using Namibian SMEs as case studies, one can argue that they can be considered as applicable examples and representatives of this research's target group. These SMEs are exposed to the majority of the challenges discussed in Chapter 3, including the financial constraints, low skill level, and underdeveloped infrastructure. There may, of course, be organisations within this sector that are more advanced, but there are also SMEs at an even lower level than those used for the model validation. From this, it can be concluded that this framework can be a useful tool for SMEs in the SADC region who are on a similar level as the case studies used in this research.

Although the original excel file can be a useful tool for a consultant who is familiar with the information in the excel document and its functions, it would be difficult to implement in the industry. Using the feedback obtained from the verification and validation candidates, it was discovered that the underdeveloped skill level in the SADC is even worse than initially expected. According to the industry experts that were consulted throughout the verification phase, a significant gap exists regarding knowledge and understanding among SME owners and managers. The iterative development process of this roadmap allowed the author to construct a more suitable roadmap version for the intended target group. Although the possibility exists that they may still require assistance to start the process, they will reap the benefits in the long-term.

7.3 Future Work and Recommendations

Nevertheless, the roadmap designed in this research only shows one possibility to design a potential DT approach. Therefore, further research is required to provide a refined roadmap that can be used by SMEs independently, without external help. Additionally, other management tools or techniques could be chosen to achieve each steps' objective.

Additionally, there are still substantial amounts of possibilities to contribute to improvements in this research. Those improvements may include potential adjustments that can be made to the roadmap and are summarised in the list below:

- Provide a list of people who can give guidance, and support from Banks and Government for SMEs to obtain financial or educational support. These channels are often not public knowledge and not easy to get to.
- Add a virtual helpline where a knowledgeable person can guide the roadmap user through the procedures at the beginning.
- Reconsider to present the roadmap on a website to increase accessibility and practicality.
- Determine if the roadmap is applicable to other emerging economies as well as in developed countries.

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Appendices

Appendix A

SADC Profiles

Profiles of the SADC Countries

Table A.1 SADC Profiles (Savela *et al.*, 2018)

	Namibia	**South Africa**	**Angola**	**Botswana**
Capital	Windhoek	Pretoria (Administrative), Cape Town (Legislative), Bloemfontein (Judicial)	Luanda	Gaborone
Area (km^2)	824,292	1,219,090	1,246,700	581,730
Population	2,484,780	54,841,552	29,310,273	2,214,858
Population density (# of people per km^2)	3.01	42.4	23.51	3.81
Urban Population (%)	33	57	36	52
Currency	Namibian Dollar (NAD)	South African Rand (ZAR)	The Angolan Kwanaba (AOA)	Botswana Pula (BWP)
GDP (per capita US$)	11 500	13 400	6 800	18 100
GDP (per total, Purchasing Power Parity) (US$)	27.02 billion	757.3 billion	192 billion	39.55 billion
Income Category	Upper middle income	Upper middle income	Lower middle income	Upper middle income
Unemployment (%)	28.1	27.6	6.6	20
Main Industries	Meat, Fish, Dairy, Pasta, Beverages, Mining (diamonds, lead, zinc, tin, silver, tungsten, uranium, copper)	Mining (platinum, gold, chromium), Automobile assembly, Metalworking, Machinery, Textiles, Iron and Steel, Chemicals, Fertilizer, Foodstuffs, Commercial ship repair	Petroleum, Diamonds, Iron ore, phosphates, feldspar, bauxite, uranium, and gold; cement, Fish, Food processing, Brewing, Tobacco products, Sugar, Textiles	Mining (Diamonds, copper, nickel, iron ore, silver), Salt, Soda ash, Coal, Meat, Textiles
Harbours and Ports	Yes	Yes	Yes	Landlocked

	Namibia	**South Africa**	**Angola**	**Botswana**
Top Export Products	Zinc, live animals, fish and crustaceans, inorganic chemicals, meat, pearls, precious stones, copper, edible fruits, nuts, ores, mineral fuels, oils	Vehicles, iron and steel, machinery and nuclear reactors, edible fruits, nuts, beverages, spirits, ores, electrical machinery, aluminium, pearls, precious stones, mineral fuels, oils	Mineral fuels, oils, pearls, precious stones, fish and crustaceans, salt; sulphur, wood, coffee, tea	Nickel, pearls, precious stones, meat, salt; sulphur, ores, inorganic chemicals, electrical machinery, plastics, vehicles, machinery and nuclear reactors
Languages	English, Oshiwambo dialects, Khoekhoe, RuKwangali, Herero, Tswana, Gciriku, Fwe, Kuhane, Mbukushu, Yeyi and Khoisan Naro	English, Afrikaans, Ndebele, Pedi, Sotho, Swati, Tsonga, Tswana, Venda, Xhosa and Zulu	Portuguese, Umbundu, Kimbundu, Kikongo, Tchokwe, Ovambo	Setswana, English
SME size (Number of Employees)	11-100 (Ngatjizeko, 2016)	6-200 (The Banking Assiciation South Africa, 2019)	11-200 (Ginga, 2011)	5-99 (Khanie, 2018)
	Zimbabwe	**Mozambique**	**Zambia**	**Tanzania**
Capital	Harare	Maputo	Lusaka	Dar es Salaam Administrative), Dodoma (Legislative)
Area (km^2)	390,757	799,380	752,618	947,300
Population	13,805,084	26,573,706	15,972,000	53,950,935
Population density (# of people per km^2)	35.33	33.24	21.81	56.95
Urban Population (%)	35	37	36	36
Currency	United States Dollar (USD)	Mozambican Metical (MZN)	Zambian Kwacha (ZMW)	Tanzanian Shilling (TZS)
GDP (per capita US$)	2 300	1 300	4 000	3 300

	Zimbabwe	**Mozambique**	**Zambia**	**Tanzania**
GDP (per total, Purchasing Power Parity) (US$)	33.87 billion	37.39 billion	68.9 billion	362.8 billion
Income Category	Low income	Low income	Lower middle income	Low income
Unemployment (%)	95 (**Note:** data include both unemployment & underemployment)	22.4	15	10.3
Main Industries	Mining (coal, gold, platinum, copper, nickel, tin, diamonds, clay, numerous metallic and nonmetallic ores), steel, wood products, cement, chemicals, fertilizer, clothing and footwear, foodstuffs, beverages	Aluminum, petroleum products, chemicals (fertilizer, soap, paints), textiles, cement, glass, asbestos, tobacco, food, beverages	Copper mining and processing, emerald mining, construction, foodstuffs, beverages, chemicals, textiles, fertilizer, horticulture	Agricultural processing (sugar, beer, cigarettes, sisal twine); mining (diamonds, gold, and iron), salt, soda ash; cement, oil refining, shoes, apparel, wood products, fertilizer
Harbours and Ports	Yes	Yes	Landlocked	Yes
Top Export Products	Tobacco, cotton, salt; sulphur, sugars, wood, pearls, precious stones, iron and steel, coffee, tea, ores, mineral fuels	Aluminium, tobacco, cotton, sugars, wood, mineral fuels, oils, ores, edible fruits, nuts, machinery and nuclear reactors, pearls, precious stones	Copper, cobalt, cereals, salt; sulphur, sugars, other base metals, inorganic chemicals, tobacco, machinery and nuclear reactors, pearls, precious stones, mineral fuels, oils	Edible vegetables, animal or vegetable fats, residues food industries, coffee, tea, fish and crustaceans, electrical machinery, tobacco, edible fruit and nuts, pearls, precious stones, ores
Languages	English, Shona, Sindebeleo	Portuguese	English, Bemba, Nyanja,Tonga, Lozi	kiSwahili, English
SME size (Number of Employees)	5-40 (Financial Tribune, 2020)	5-100 (Baxter *et al.*, 2016)	11-100 (Mutati, 2008)	5-99 (Gamba, 2019)

	Lesotho	**Madagascar**	**Mauritius**	**Seychelles**
Capital	Maseru	Antananarivo	Port Louis	Victoria
Area (km^2)	30,355	587,041	2040	455
Population	1,958,042	25,054,161	1,356,388	93920
Population density (# of people per km^2)	64.5	42.68	664.9	206.42
Urban Population (%)	18	36.4	44	54.2
Currency	Maloti (LSL)	Malagasy ariary (MGA)	Mauritian Rupee (MUR)	Seychellois Rupee (SCR)
GDP (per capita US$)	3 900	1 600	21 600	28 900
GDP (per total, Purchasing Power Parity) (US$)	7.448 billion	39.81 billion	27.44 billion	2.712 billion
Income Category	Lower middle income	Low income	Upper middle income	High income
Unemployment (%)	28.1	2.1	6.9	3
Main Industries	Food, beverages, textiles, apparel assembly, handicrafts, construction, tourism	Meat processing, seafood, soap, beer, leather, sugar, textiles, glassware, cement, automobile assembly plant, paper, petroleum, tourism, mining	Food processing (largely sugar milling), textiles, clothing, mining, chemicals, metal products, transport equipment, nonelectrical machinery, tourism	Fishing, tourism, beverages
Harbours and Ports	Landlocked	Yes	Yes	Yes
Top Export Products	Wood, apparel and clothing, apparel clothing (not knit- ted or crocheted), products milling industry, pearls, precious stones, cotton, articles of leather, footwear, furniture; bedding, electrical machinery	Nickel, coffee, tea, apparel and clothing, apparel clothing (not knitted or crocheted), cotton, other base metals, edible vegetables, fish and crustaceans, ores, mineral fuels, oils	Knitted fabrics, prep. of meat, fish, apparel and clothing, apparel clothing (not knitted or crocheted), sugars, cotton, electrical machinery, fish and crustaceans, machinery and nuclear reactors, pearls, precious stones	Meat, Fish, aircraft, spacecraft, residures food industries, ships, boats, tobacco, optical, photo-graphic, animal or vegetable fats and oils, fish and crustaceans, mineral fuels, oils

	Lesotho	**Madagascar**	**Mauritius**	**Seychelles**
Languages	SeSotho, English	Malagasy and French	English and French	French, English, Seychellois Creole (Kreol)
SME size (Number of Employees)	6-50 (Mutsonziwa *et al.*, 2016)	4-100 (Appui au Developpement Autonome, 2016)	5-200 (Ramsurrun and Dalrymple, 2002)	15-50 (Enterprise Seychelles Agency, 2019)
	Swaziland/Eswatini	**Democratic Republic of Congo**	**Malawi**	**Comoros**
Capital	Mbabane	Kinshasa	Lilongwe	Moroni
Area (km^2)	17,364	2,344,858	118,484	2235
Population	1,467,152	83,301,151	19,196,246	808,080
Population density (# of people per km^2)	84.49	35.53	162.02	361.56
Urban Population (%)	24	32	17	29.4
Currency	Lilangeni (SZL)	Congolese Franc (CDF)	Malawi Kwacha (MWK)	The Comorian Franc (KMF)
GDP (per capita US$)	9 900	800	1 200	1 600
GDP (per total, Purchasing Power Parity) (US$)	11.34 billion	67.99 billion	22.49 billion	1.323 billion
Income Category	Lower middle income	Low income	Low income	Low income
Unemployment (%)	28	46.1	20.4	6.5

	Swaziland/Eswatini	**Democratic Republic of Congo**	**Malawi**	**Comoros**
Main Industries	Soft drink concentrates, coal, forestry, sugar processing, textiles, and apparel	Mining (copper, cobalt, gold, diamonds, coltan, zinc, tin, tungsten), mineral processing, consumer products (textiles, plastics, footwear, cigarettes), metal products, processed foods and beverages, timber, cement, commercial ship repair	Petroleum, Diamonds, Iron ore, phosphates, feldspar, bauxite, uranium, and gold; cement, Fish, Food processing, Brewing, Tobacco products, Sugar, Textiles	Fishing, tourism, perfume distillation
Harbours and Ports	Landlocked	Yes	Landlocked	Yes
Top Export Products	Essential oils, sugars, print- ed books, newspapers, other chemical products, wood, apparel and clothing (not knitted or crocheted)	Other base metals, copper, ores, inorganic chemicals, wood, pearls, precious stones, coffee, tea, cocoa and cocoa preparations, mineral fuels, oils, commodities (not elsewhere specified)	Tobacco, dairy produce, ed-ible vegetables, coffee, tea, sugars, cotton, residures food industy, fertilisers, plastics, machinery and nuclear reactors	Cloves, vanilla, essential oils, wood charcoal and scrap aluminium
Languages	siSwati, English	French, Lingala, Kikongo, Swahili, Tshiluba	English, Chichewa	Comorian, Arabic, French
SME size (Number of Employees)	6-50 (Magagula, 2002)	5-99 (Couvreur, 2009)	5-100 (Darroll, 2012)	4-200 (World Bank, 2018)

Appendix B

DT Roadmap

Final version of the developed DT roadmap for SMEs in the SADC

A Roadmap to support SMEs in the SADC Region to Prepare for Digital Transformation

Introduction

This document aims to assist SME owners or managers in the SADC to prepare for digital transformation (DT). This step-by-step roadmap aims to break down such endeavour and to raise awareness of the factors that should be considered. The roadmap consists of 13 steps. Each step aims to achieve a specific objective and output. Different management tools have been included and described in the roadmap, that can be used to achieve the intended objective.

Document Design

The document consists of the 13 steps and three appendices.

The first twenty pages summarise the different steps. For each step, the objective is stated, as well as the reason of importance, and the expected output. A detailed guideline is presented to explain the step approach. **Appendix B.1** and **Appendix B.2** provide **additional information and insights** that can be visited to enhance their understanding and knowledge in particular steps. **Appendix B.3** consists of a **case study**, to provide you (the user) with a **practical application of this roadmap** as well as with possible interpretations of the output. Additionally, an excel file has been created for selected steps, that can be completed. The excel sheet is shared on a google drive and can be accessed via the following link:

https://drive.google.com/file/d/1KDS4EKIwzf5GSatNkJdEHdabx_NqkTpx/view?usp=sharing

The excel sheet name is also indicated in the step introduction. **It is, however, NOT mandatory to use the excel templates, whereby the data can be captured in an alternative format.**

Expected Output after using the Roadmap

This roadmap is most suitable for **SMEs** who are active in **SADCs manufacturing sector** and **who vision a DT endeavour**.

The main goal of this roadmap is to assist SME owners or managers in the SADC to prepare for the envisioned DT project and to break it down into manageable tasks. Furthermore, it intends to determine the defined DT goal should be selected or not. This can be achieved by establishing if the value gained by such endeavour is worth the effort required. This roadmap will assist to determine the value-for-effort of the DT project. Different management tools and techniques are provided as well as guided analyses and comparisons. This will help determine if the envisioned DT project creates more favourable conditions than experienced in the current situation. Furthermore, the benefits of the DT project are evaluated against the risks, costs, and other investments that are required. Moreover, the roadmap helps determine if the DT goal aligns with the company strategy, its vision, and mission.

Instructions

The information included in each step should be studied carefully. A procedure describing the completion of the step is provided and should be followed. As mentioned, excel templates have been prepared for selected steps and can be completed. To gain more insight and understanding about the roadmap and its step, **refer to the case study attached in Appendix B.3.**

Step 0: Analyse Digitalisation Potential

Objective:

Create awareness about the different components and cultural attributes that are required for a DT to assist in establishing the SMEs' potential towards DT and the level of expertise among SME leadership.

Reason of Importance:

To decide if the organisation is ready to approach a DT project, or if there are not more important or current problems to solve (eg. focus on their survival).

Excel Template:

N/A

Output:

Overview about the different components that are required for a DT as well as its cultural attributes and what level of expertise is required.

Guideline:

BUSINESS REQUIREMENTS

Determine if your organisation experiences any difficulties (or like those mentioned) in the following regard:

a. Obtaining external financial support (eg. Bank loans, investors).
b. Attracting and maintaining skilled labour.
c. Hiring external experts (financial issues or administrative challenges eg. Work permits).
d. Financing additional training opportunities for the workforce (workshops for upskilling, education).
e. Reacting to market opportunities due to absence of requested standards.
f. Reacting to rapidly changing market conditions.
g. Investing in basic infrastructure required to create a digital environment (eg. Internet access).
h. Investing in new digital technologies required to transform digitally.

If you experience any difficulties similar to those above**, you need to carefully examine if your business is ready for the concept of DT or if there are more important or current problems to solve**. However, the decision is completely up to you, as the following information merely serves to raise awareness and does not indicate any kind of recommendations or decision-making guidelines.

If your organisation considers DT, you should be aware that DT not only affect an organisations' processes and operations but also its

1. Strategy,
2. Employees,
3. Customers,
4. Culture, and
5. Business Environment.

1. Company Strategy:

DT creates an opportunity for organisations to capture, create, or deliver greater value than before by creating or taking a unique position in relation to competitors and to sustain that profitable difference over time.

These changes in value creation must be incorporated into the existing company strategy and need to be aligned with its vision and mission.

2. Employees:

Employees can be considered as the most important factor to help companies realise their DT. They are most affected by the changes in the digital workplace, as their working environment is altered, and their skill requirements and qualifications are changing.
Therefore, companies need to

- prepare their employees for these changes using appropriate training and continuing education.
- focus on transforming their workers' mindsets and building a culture of collaboration within the workforce.
- encourage open communication between the workforce and leadership.
- encourage and invest in sufficient workforce training proactively to ensure the workforce has the skills and the cultural willingness to work effectively with digital technologies.
- allow the workforce to experiment with the new products or system and create a no-error-culture.

3. Customers:
An organisation should pay attention to is to improve its responsiveness to its customers. This can be done by:

- empowering their front-line workers to resolve issues faster.
- delivering individualized products or services fast and easily.
- providing easy and fast access to the information that is requested by the customer to enable business transparency and product traceability.
- allowing them to co-create products through open innovation (reduces the risk of experimentation).
- analysing and integrating data to understand how they interact and what problems they experience.

4. Organisational Culture:
To handle the changes before and after a transformation, an organisation should work on developing the following cultural attributes:

- Changeability: Open/willing to change ways of work, constantly reinvent itself,
- Risk Tolerance: Taking risks,
- Organisational learning: Learning from failures, test and learn, experimenting,
- Failure Tolerance: No blame culture,
- Open Communication: Transparency (internal and external),
- Knowledge Sharing among the workforce,
- Collaboration: Collaboration across company boundaries, cross-company/functional collaboration
- Employee Empowerment: Decentralised decision-making,
- Customer Centricity: Customer focus and alignment,
- Agility and Flexibility: Flexible working, speed, agility, quickly sensing/responding to changes in the environment, external orientation, flexibility,
- Ideating new digitalised working methods and services: encouraging employees to ideate new digitalized working methods/services, trust in processes and systems.

5. Digital Environment:
DT also requires the organisation to incorporate a digital environment.
DT does not only drastic technological measures such as smart factories, smart operations, and smart products. It also includes the use of

- intelligent technologies,
- advanced sensors,
- artificial intelligence,
- human-machine interaction between the business and its employees, customers, and suppliers,
- advanced analytics,
- additive manufacturing (eg. 3D printing),
- other digital technologies that can optimise or simplify processes.

These technologies require companies to re-calibrate their existing IT infrastructure. Furthermore, companies that are undergoing such transformation, experience challenges in terms of optimising processes and harmonising systems for the Internet of Things, services, data and people.

SKILL REQUIREMENTS

This roadmap includes numerous managerial tools and techniques that require basic knowledge and understanding (eg. Flow Charts, Business Model Canvas, etc.). Instructions are provided that describe how these tools and techniques can be applied and completed.

You may, therefore, consider it necessary to obtain assistance from an external resource such as researching the public domain (internet) or consulting a skilled individual. However, if you do not find this necessary, feel free to complete the steps using the described procedure as guidance.

Step 1: Define Company Strategy

Objective:

Define the organisation's strategy, as well as its vision and mission.

Reason of Importance:

Ensure that the innovative digitalisation goal of the company suits the organisation's objectives. The decisions and actions of the organisation need to be aligned so that they support the achievement of strategic goals.

Excel Template:

Balanced Score Card

Output:

A strategy that defines what the business wants to achieve and how.

Guideline:

It is necessary to include the right people and ask the right questions to derive the required information.

1. State the vision of your company.
   (The current and future objectives of an organization, where the company wants to be within a certain timeframe)
   eg. "**Our vision is to create a better everyday life for many people**" (IKEA).

2. State the mission of your company.
   (An action-oriented vision statement, declaring the purpose an organization serves to its audience. It often includes a general description of the organization, its function, and its objectives)
   eg. "**To continually raise the bar of the customer experience by using the internet and technology to help consumers find, discover, and buy anything, and empower businesses and content creators to maximise their success. We aim to be Earth's most customer-centric company**" (Amazon).

3. Determine the strategic objectives of the organisation and complete a Balanced Score Card. Use the template in the excel file or make use of an alternative option to capture your data. To complete a Balanced Score Card, follow the procedure below:

   a. State the business goals and objectives.

      i. Should be formulated by starting with a verb (improve, reduce, increase, optimize, maximize, minimize).
      ii. Needs to be measurable or quantifiable.

   b. Determine the perspective this objective could be classified (financial, customer, internal business processes, or learning & growth).

      i. **Financial:** indicates whether the strategy improves or contributes towards the company's bottom line and how the strategy needs to be implemented and executed.
      ii. **Customer:** indicates the value proposition delivered to the customer by the company.
      iii. **Internal Business Processes:** helps to ensure that the products and services delivered to the customers meet their expectations.
      iv. **Learning & Growth:** relates to the training and improvement of the company's workforce and helps determine if the employees have the necessary skills required to keep pace or exceed the competition.

   c. Select and formulate Key Performance Indicators (KPIs) for each objective.
      (KPIs are measurable values that indicate how effectively a company succeeds at reaching its

targets and if it is achieving its key business objectives).

i. KPIs should be well-defined and quantifiable, crucial to achieving the goal, and applicable to the business.
ii. **Example KPIs include:** overall satisfaction, satisfaction improvement, customer retention, net promoter score (the rate of customers who recommend your business to others), compared to competitors (rate of customers who choose your company over your competitors), active and resolved issues, employee productivity, -retention or -turnover, or cash flow.

d. **OPTIONAL:** You may set targets for each KPI and enter them in the "Targets" column (eg. Increase/decrease a certain %).

4. Create a strategic map of the objectives. The strategic map helps to visualise the cause-and-effect directionality of the business objectives.

   Use the Balanced Score Card and add arrows between the strategic objectives to show the cause-and-effect chain.

Step 2: Establish Planning Team

Objective:

Identify individuals who are responsible for the digital transformation project.

Reason of Importance:

Team members need to have a clear understanding of their roles and be aware of the tasks that are expected from them. Therefore, the team members need to be chosen according to their knowledge, skills, and capabilities, and communicate the tasks expected from each member.

Excel Template:

Planning Team

Output:

A detailed overview of the planning team, including their task description.

Guideline:

To capture your data, you can enter your information into the red fields in the template provided in the excel sheet labelled “Planning Team”.
To complete this step, the following needs to be done:

1. Appoint individual(s) who have the authority to make decisions (eg. Business owner, manager).
    a. They should:
        - Understand the business, its activities, and customers,
        - Be aware of alternative possibilities of the business processes or operations,
        - Possess people management and communication skills,
        - Align the digital transformation ideas with the organisation.
    b. Their tasks include:
        - Managing people, and driving cultural change
        - Communicating and updating team about decisions or changes.

2. Appoint individual(s) who are involved in the digital transformation and committed to the project (eg. Experienced Individuals such as senior department manager, developers, designers, other capable individuals).
    a. They should:
        - Understand the tools/techniques/technologies enabling business transformation,
        - Adapt to change, work in a team, and communicate clearly
        - Be an agile practitioner,
        - Be familiar with technology,
        - Be committed to the new project.
    b. Their tasks include:
        - Working with new systems and technologies,
        - Update leadership about the current status of the project.

3. Indicate what type of resource the appointed team member is. Is the individual a:
    a. Internal resource: Individuals available within the business itself who are capable to complete the job (should consider up-skilling, training, or education),
    b. Partner resource: Possible partners of the organisation who could potentially contribute towards achieving the DT,
    c. Vendor Resource: Possible project support opportunities that might support the organisation throughout the implementation phase,
    d. New Resource: If no suitable individual could be found in the first three options, a new employee should be hired.

Step 3: Understand Business Model

Objective:

Bring the entire planning team on the same level of understanding about the company's current business model and to gain an overview of the businesses' current position and its objectives.

Reason of Importance:

By assessing these company elements, one can recognise the areas that require action for improvement. The assessment further reveals clear paths on which to build the organisational innovation strategy.

Excel Template:

Business Model

Output:

A detailed overview of the company's business model.

Guideline:

To complete this step, you need to complete a Business Model Canvas. An example template is provided in the excel file (excel sheet named "Business Model"). You may, however, choose an alternative option to capture your data.

Study Figure B.1. The figure illustrates the fields that require completion, and the numbers indicate the sequence that should be followed to complete the fields. Follow the steps below:

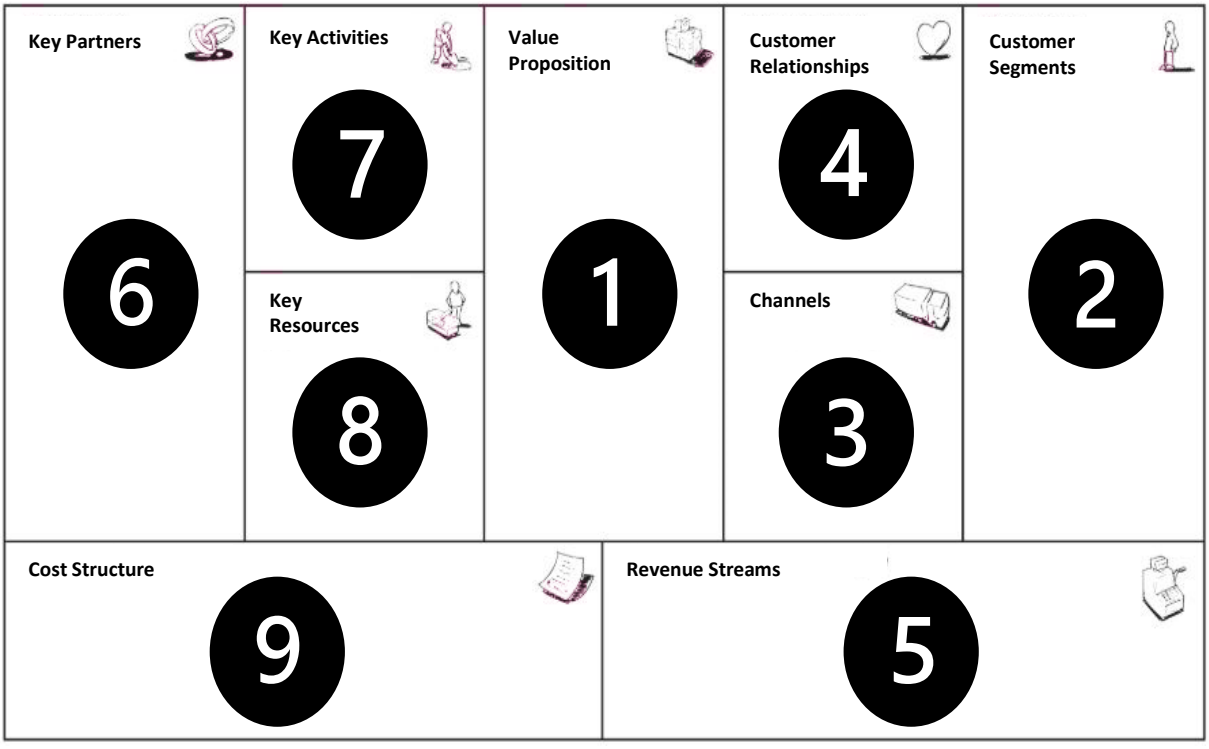

Figure B.1: Business Model Canvas

1. To complete the fields in the Business Model Canvas, the following information is required:
    a. Value Proposition: Determine which products and/or services create value to your customer.
    b. Customer Segments: Identify your most important customers (eg. Age group, gender, interests).
    c. Channels: Recognize the method you communicate you communicate with your customers (eg. Social media, radio)
    d. Customer Relationships: Establish how your business interacts with the customers.
    e. Revenue Streams: Define the method by which your organisation converts its value proposition or solution to the customers' problem into financial gain.

f. Key Partners: Identify the external individuals, companies, suppliers, or other parties that are required by the organisation to deliver value to the customer.
g. Key Activities: List the actions the business undertakes to achieve the value proposition for its customers.
h. Key Resources: Determine the resources that are required to achieve the key activities in the business.
i. Cost Structure: Identify the monetary cost required to operate the business. Include the costs required to achieve the business key activities, key resources, key partnerships.

In case you require more guidance, feel free to view the practical application of the Business Model Canvas, illustrated in Table B.3.2 in Appendix B.3.

Step 4: Visualise As-Is Process

Objective:

Identify underlying challenges, risks, or change in customer expectations of a known process by visualising the current state of the process.

Reason of Importance:

Visualisation of the current state of the process allows the planning team to identify what tasks need to be completed, who is involved and to investigate if all steps in the process are required or necessary.

Excel Template:

N/A

Output:

A flow chart that allows a visual representation of the sequence of the process steps involved in the organisation's current state.

Guideline:

To complete this step, you need to create a flow chart of the process that requires the transformation.

There are numerous digital options available to record the data required for this step, such as:

- Microsoft Visio Software
- Other Microsoft office programs such as word or excel
- Online applications such as Lucidchart, Smartdraw, etc.

If you do not have any experience with any of these, you may prefer the **traditional pen and paper** version.

1. Identify the problem.
    a. For example: Processes that have failed or majorly under-perform.
    b. Include the individuals who are directly involved in the process, as they have a good overview and are familiar with the process.

2. Identify and list the activities involved in the process.
    a. It is not required to sequence the steps; however, sequencing may help you remember which process steps to include, and which are outside the process boundaries.

3. Determine which individual/machine completes which task and when.
    a. Ask questions such as what, how, when, where, who.

4. Map out the sequence of the steps/activities in the process.
    a. Also indicate the flow of the process and the decisions involved.

5. Start visualising the steps/activities by making use of a simple flowchart.
    a. If you are new to the concept of process mapping, it is advised to:
        i. Consult an expert who can assist you, **or**
        ii. Conduct research on the public domain (eg. Internet), **or**
        iii. Watch YouTube tutorials.
    b. Feel free to study the flow chart example represented in Appendix B.3. Refer to information provided in the case study description in Appendix B.3 to enhance your understanding of the flowcharts content.

6. Identify the supplier (entity producing the input) and customer (entity receiving the output) for each step.

Step 5: Analyse As-Is Process

Objective:
Identify underlying challenges, risks, or change in customer expectations of a known process by analysing the visualised current state of the process.

Reason of Importance:
Process analysis allows the planning team to identify who is involved in the process and helps quantify process gaps, bottlenecks, weaknesses, and risks, as well as opportunities for improvement.

Excel Template:
As-Is Analysis

Output:
Identification and quantification of problem areas. The data can be used at a later stage to compare the current state of the process to the desired future state after the digital transformation.

Guideline:

You can make use of a high-level process analysis, or a more detailed one.

For a high-level process analysis, you can identify the following:

1. How many people are involved in each process step?
2. What is the input for each process step or from whom is the input required?
3. What is the output of each process step, or who produces the output?
4. How long does it take to complete the entire process?
5. For each supplier and customer identified for each step/activity in Step 4, determine possible factors that may create or contribute towards the problems experienced in the process.

Record your data where it is easy to access, as you will revisit it in Step 11.

If you, however, choose to undergo a more detailed process analysis (regarding flow, time, quality, quantity, and cost), you can make use of the template provided in the excel file, named “As-Is Analysis”.

The template provides you with important definitions and can assist you with the calculations. You may enter the required information into the red fields.

If you, however, choose to conduct your own analysis, the formula sheet attached in Appendix , which provides definitions as well as the formulas for the calculations. **The formula sheet also includes explanations and definitions for selected calculations.**

If you would like to enhance the complexity, you may conduct additional calculations that are not included in the formula sheet to gain more insight into your current process.

Step 6: Establish DT Goal

Objective:

Create awareness about digitalisation opportunities to establish the digital transformation goal.

Reason of Importance:

Identifying innovation opportunities that are suitable for the organisation specifically.

Excel Template:

N/A

Output:

Identification of the overall goal the organisation aims to achieve with the digital transformation.

Guideline:

Use the data you obtained from the as-is analysis to identify problem areas in your process.

To establish your organisation's digital transformation goal, follow the procedure below.

1. Study Figure B.2 to learn about the possible impacts digitalisation may have on your organisation.

SWOT Analysis					
		Helpful		Harmful	
		to achieving the objective		to achieving the objective	
Internal Origin	attributes of the organisation	STRENGTHS		WEAKNESSES	
		1	Optimisation or resource & energy efficiency	1	Broad & complex topic
		2	Reduce burden of market volatility & product complexity	2	Lack of sufficient awareness & expertise about concept
		3	Faster & more accurate production	3	High capital investments required
		5	Encourage more advanced workforce skills eg. Problem management, problem-solving, self-organise	4	Insufficient preparation & implementation guidelines
		6	Rapid & accurate response towards customer requirements & demands	5	Strategic alignment required of DT and organisational goals & objectives
		7	Customisation of products	6	Cultural change required within organisation
		8	Business Transparency allowing easier identification of improvement opportunities	7	Vague definitions of responsibilities for staff members
		9	Maintaining low cost & environmental impact when responding to product variety & flexibility		
External Origin	attributes of the environment	OPPORTUNITIES		THREATS	
		1	Continuous resource productivity & flexibility	1	Technology-related risks: Possible technology failures
		2	Improved business responsiveness	2	Cyber risk: Unauthorised sharing/access of confidential data
		3	Increase productivity & accelerate innovative developments	3	Operations risks: inadequate control of operating procedures
		4	Automation of manual, repetitive tasks	4	Data leakage
		5	Enable sustainable prosperity such as reducing energy consumption, resource replenishment, and negative environmental impact	5	Inappropriate handling of data by third party (eg. Vendor)
		6	Integration of objects, humans, intelligent machines, production lines, and processes forming an intelligent network chain	6	Privacy and Regulatory concerns

Figure B.2: SWOT Analysis of Digital Transformation

2. Identify the key driver of your digital transformation. Examples of key drivers are presented in the list below:
    a. **Internal Efficiency:** Reduce dependency on external factors (eg. natural resources, non-renewable resources, weather conditions, inflation), optimisation (increasing productivity, efficiency, profitability).
    b. **External Opportunities:** Volatile, uncertain, and complex market conditions, changing customer demands, change in regulations.
    c. **Disruptive:** New technologies introduced into markets, remaining competitive in the business domain (offer product-service innovation, higher product variety, product customisation, improved quality standards, offer support services, the immediacy of satisfaction).

3. Determine the overall digitalisation objective and the expected benefits you aim to achieve with the digital transformation in your organisation.

    You may refer to Appendix B.2, where different digital transformation examples in the SADC have been identified and discussed.

4. Establish the organisation's digital transformation goal. The goal can include a single project, such as introducing technology for faster operations, or a complete transformation of the business.

Step 7: Define DT Goal

Objective:
Generate ideas to achieve the DT goal.

Reason of Importance:
To identify an idea that can be implemented to reach the DT goal.

Excel Template:
N/A

Output:
An alternative or possible improvement of the current as-is situation previously analysed.

Guideline:

Generate ideas that will allow you to achieve your overall digitalisation goal.

Remember to keep the overall digital transformation goal in mind (from the previous step).
To generate and select ideas effectively, you should:

1. Consult the employees who are involved in the process that has been mapped and analysed in Steps 4 and 5.
   They may contribute inside information about the process that may help to identify alternative ways to optimize or improve the process.

2. What impact will each generated idea have on the organisations current business model? For example:
   a. Value Proposition: Will the new idea create better value for the customer?
   b. Customer Segments: Will the idea increase or decrease the size of the intended customer group?
   c. Channels: Are additional channels required to communicate the idea to the customers?
   d. Customer Relationships: Does the idea allow better interaction between the business and customers?
   e. Revenue Streams: Does the idea increase the opportunity to solve customer problems or financial gain?
   f. Key Partners: Are other parties required and available after the implementation of the idea?
   g. Key Activities: Are additional activities required to achieve the value proposition for the customers?
   h. Key Resources: Are additional capabilities and competencies required?
   i. Cost Structure: Are additional monetary costs required?

3. Evaluate if the generated ideas align with the company strategy and the organisation's objectives (revisit your output from step 1).
   a. Does the idea create an opportunity for the organisation to outperform its rivals?
   b. Will the new digital resources create differential value?
   c. Will the new system improve existing capabilities and establish new digital capabilities to increase value creation?
   d. Will the idea improve overall processes and operations and improve the interface with the company customer and supplier?

4. Select **one** idea with the most favourable outcomes.

Step 8: Evaluate DT Goal

Objective:
Evaluate the DT goal.

Reason of Importance:
To determine if the time and money investment are worth the effort.

Excel Template:
Cash Flow Analysis, Cost-Benefit Analysis, Risk Analysis

Output:
Identification of the risks and costs that are involved. Those can then be compared to the benefits attained from the DT goal.

Guideline:
Evaluate the idea you have selected in the previous step. This roadmap provides guidelines to conduct the following analyses: • Cash Flow Analysis • Cost-Benefit Analysis • Risk Analysis You do not have to complete all analysis options. It is, however, **recommended to complete all analyses options to gain more insight about your digital transformation project.** You may, of course, also make use of alternative analyses options.

a. Cash Flow Analysis

Objective:
Identify and forecast the cash components flowing in and out of the organisation for a given time period.

Reason of Importance:
The cash flow analysis is useful for businesses that are planning to undergo a rapid expansion where capital expenditure, higher labour costs, or new equipment or infrastructure investments require large cash outflows at the same time sales are in a growth phase and cash inflows tend to be lower.

Excel Template:
Cash Flow

Output:
The assessment indicates the impact the digital transformation will have on the businesses cash flow.

Guideline:

Use the following procedure to draw up a cash flow statement forecast:

1. List all cash items flowing into the business.
   - Analyse business patterns and events from previous years to predict future cash inflows.
   - Research your businesses industry, your competitors, and the economic factors to determine upcoming trends in the markets.
   - Take future bills and invoices into account but pay attention to the billing terms.
   - Examples include:
     Money that is received from sales, accounts receivable and borrowed capital like term loans or lines of credit (**does not include any pending** receivables).

2. List all cash items flowing out of the business.
   - Take budgeted items into consideration.
   - Examples include:
   - Money that is going out through accounts payable, payroll, and other expenses like loan payments and rent (**does not include any pending** payables or depreciation).

3. **OPTIONAL:** You may categorize each cash in- and outflow into:

   a. **Operating:** cash inflows and outflows from the day-to-day operations.
      For example:
      Cash inflows: sales transactions (only cash, excluding credit)
      Cash outflows: payroll, payments to suppliers for inventory, taxes, or insurance premiums.
   b. **Financing:** all the debt and equity transactions.
      For example:
      Cash inflows: the cash that is received by the organisation from any external funding opportunities.
      Cash outflows: payments made to repay debt are included in the cash outflow.
   c. **Investing:** sale or purchase of long-term assets, such as equipment or property.

4. Calculate the net cash flow by using the following formula:

$$Net\ Cash\ Flow\ =\ Cash\ Inflows\ -\ Cash\ Outflows$$

b. Cost-Benefit Analysis

Objective:
Identify the costs involved in the digital transformation project and what the benefits will be after successfully executing the project.

Reason of Importance:
To determine the course of action that is required for a long-term or short-term decision, including hiring new team members, evaluating a new project, or determining the feasibility of capital investment.

Excel Template:
Cost-Benefit Analysis

Output:
The assessment indicates about the costs involved in the digital transformation project and what gains can be expected.

Guideline:

To complete this analysis, follow the procedure below:

1. List every expense for the digital transformation project.
2. List every benefit for the digital transformation project.
3. Assign monetary values to the expenses and benefits.

   (Assign the benefits and costs with their present value, as the value of money may often change due to factors such as inflation).
4. Calculate the total of all the costs involved.
5. Calculate the total of all the benefits involved.
6. Calculate the cost-benefit ratio by using the following formula:

$$Cost\ Benefit\ Ratio = \frac{Total\ Benefits}{Total\ Costs}$$

   If the cost-benefit ratio is less than 1, the total costs outweigh the total benefits gained.

c. Risk Analysis

Objective:
Identify, assess, and manage the risks involved in the digital transformation project.

Reason of Importance:
Innovative projects require Risk Management, as they often involve risky decisions and activities. Without a structured risk management framework in place, organisations will encounter problems with the evaluation of the possible impacts on the project objectives.

Excel Template:
Risk Analysis

Output:
The assessment indicates the steps required to protect the business and what situations need to be addressed and avoided.

Guideline:

To complete this analysis, follow the procedure below:

1. Identify and list the risks. (it may be useful to research the internet for possible risks generally experienced in similar projects)

   Risk: the likelihood some event or circumstance will occur that affects an organisation negatively.

   The most common risks found in the organisation are:
   a. **Strategic:** Decisions concerning an organisation's objectives.
   b. **Compliance:** The need to comply with laws, regulations, and standards.
   c. **Operational:** Operational and Administrative procedures.
   d. **Environmental:** External events such as weather or economic conditions.
   e. **Reputation:** Goodwill or branding of a business.
   f. **Financial:** Financial transactions, systems and structure.
   g. **Others:** Health and safety, project, equipment, security, technology, stakeholder management, and service delivery.

   Other risks, most commonly linked with DT include:

   a. **Technology:** Technology-related risks may impact systems, people, and processes and may contribute to potential losses in case of technology failures.
   b. **Cyber:** The digital environment needs to be protected from unauthorized access/usage of confidential data.
   c. **Data Leakage:** Data is constantly being transmitted throughout the digital ecosystem and may, therefore, be intersected by external sources if not encrypted properly.
   d. **Third-party:** Risks arising due to inappropriate controls at vendors/third party operating environment. Factors including data sharing, technology integration, operations dependency, or vendor resiliency may play a key role in this area.
   e. **Privacy:** Personal or sensitive data may be handled inappropriately within an organisation, which may impact the privacy of the individual (customer or employee).
   f. **Regulatory:** Companies need to adhere to statutory requirements including technology laws, sectoral laws, and regulations.
   g. **Resilience:** High dependency on technology causes business operations or services to be interrupted or unavailable in case of technology failure. Organisations need to work on concepts including IT/Network disaster recovery, cyber resiliency, and crisis management.

2. Assess the risk. For each risk:

    a. Quantify the likelihood (Probability) of the risk
    b. Quantify the consequence (Impact) if the risk occurred.

    From this the level of risk will be calculated using the formula:

$$Level\ of\ risk\ =\ likelihood\ \times\ consequence$$

3. Manage the risk. Determine the effect of the risk, as well as the preventative action.

    This step is necessary to identify, evaluate, select, and implement one or more strategies to get the risks to an acceptable level.

    There are different strategies of how to deal with risks:

    a. **Risk Avoidance:** Find an alternative that may have a similar outcome but involves less risk or eliminates the risk. Try to eliminate the sources of risk.
    b. **Risk Transfer:** Make use of another party to share the risk. Use contracts or insurances to help reduce the effects of the risk.
    c. **Risk Reduction or Control:** If it cannot be avoided, implement procedures, legislation, or processes that can help reduce the risk. For example:
        i. Employ the best team and strong team incentives.
        ii. Use known and mature technology and tools.
        iii. Use parallel development on high-risk tasks.
        iv. Increase the frequency and severity of reviews and tests.
        v. Keep the system as simple as possible.
        vi. Use design margins.
    d. **Contingency Plan:** Develop a disaster management plan, to determine what can be done in case the event occurs.
        Study possible what-if scenarios and develop a plan for each.
        Perform early prototyping/testing on risky components.
    e. **Accept the risk:** If the risk cannot be eliminated, reduced, or controlled, accept the risk.

Step 9: Visualise To-Be Process

Objective:
Visualise the To-Be Situation of the newly defined process to compare against the As-Is Situation.

Reason of Importance:
The mapping of the future state of an organisation allows the opportunity to easily document, understand, and compare the current process against the future process after the digital transformation.

Excel Template:
N/A

Output:
A process that map allows a visual representation of the sequence of the process steps involved in the transformed process of the organisation.

Guideline:

To complete this step, follow the procedure below:

1. Identify and list the activities involved in the new process.

2. Determine which individual/machine completes which task and when.
    a. Ask questions such as what, how, when, where, who.

3. Map out the sequence of the steps/activities in the process.
    a. Also indicate the flow of the process and the decisions involved.

4. Start visualising the steps/activities by making use of a simple flowchart.
    a. If you are new to the concept of process mapping, it is advised to:
        i. Consult an expert who can assist you, **or**
        ii. Conduct research on the public domain (eg. Internet), **or**
        iii. Watch YouTube tutorials.
    b. Feel free to study the flow chart example represented in Appendix B.3. Refer to information provided in the case study description in Appendix B.3 to enhance your understanding of the flowcharts content.

Step 10: Analyse To-Be Process

Objective:
Analyse the visualised To-Be Situation of the newly defined process to compare against the As-Is Situation.

Reason of Importance:
Process analysis allows the planning team to identify who is involved in the process and helps quantify process gaps, bottlenecks, weaknesses, and risks, as well as opportunities for improvement.

Excel Template:
To-Be Analysis

Output:
The data can be used at a later stage to compare the transformed process with the current state of the process.

Guideline:
Use the same process analysis procedure you have followed in the As-Is process analysis. 1. Use the same level of detail as in Step 6. 2. Make use of the same calculations and units to ensure an accurate comparison. You can make use of the template provided in the excel file, named “To-Be Analysis”. The template provides you with important definitions and can assist you with the calculations. You may enter the required information into the red fields. If you, however, choose to conduct your own analysis, the formula sheet attached in Appendix B.1 provides definitions as well as the formulas for the calculations. **The formula sheet also includes explanations and definitions for selected calculations.** If you would like to enhance the complexity, you may conduct additional calculations that are not included in the formula sheet to gain more insight into your transformed process.

Step 11: Select Opportunity

Objective:
Determine if the defined DT goal should be selected or not.

Reason of Importance:
Establish if the DT goal is more favourable than the current as-is process and if the risks, costs, and other investments are worth the effort. Furthermore, the project needs to match the company's strategy, vision, and mission.

Excel Template:
Select Opportunity

Output:
Determining if the DT goal is suitable or not.

Guideline:

This step is responsible for summarising all data that has been captured throughout the roadmap. Summarising the data will help to compare the as-is process with the to-be process. Furthermore, all costs, benefits, and risks are presented.

Evaluate the DT goal established and defined in **Step 6 and 7**. Use the data obtained from the output(s) from:

1. **Step 1** to determine if the DT goal aligns with the company strategy.

2. **Step 2** establish if no external sources need to be consulted or hired to establish a planning team.

3. **Step 3** to identify if the DT goal has a positive impact (or none) on the company's current business model.

4. **Step 4, 5, 9, and 10** to determine if the DT goal improves the as-is process in terms of:

    a. Time,
    b. Money,
    c. Convenience,
    d. Effort,
    e. Or any other improvement.

5. **Step 8** to establish:

    a. If positive or more favourable cash flow can be achieved,
    b. If the benefits outweigh the costs,
    c. If the risks involved are manageable for the business.

Furthermore, you need to **establish if you require additional infrastructure** (physical and technological), **additional funding opportunities, or lay off or hire new staff members,** to implement the DT goal.

If the to-be state has found to be more favourable than the as-is state, the following information should be studied. Typical impact areas have been researched and are typically experienced by SMEs in the SADC.

After studying all information, you need to decide if the DT goal meets the company's strategic objective, vision, and mission and if the benefits of the DT goal are worth the risks, costs, and effort. If this is the case, you can move on to Step 12, otherwise, you need to consider an alternative DT goal.

Additional Infrastructure		
Examples	Electricity, Internet Access, ICT Systems, Buildings or Office Space, Vehicles for road transport	
Impact Areas	Finance	Capital investments infrastructure and running costs
	Administration	Administrative processes and documents (eg. Building plans) may be required for the infrastructure upgrade
	Time	Installation or construction will cost time; if SME is located in a rural area, time delays need to be taken into consideration as support unit needs to travel to the location
	Skills	Individuals required to install or lead project

Additional Funding		
Examples	Electricity, Internet Access, ICT Systems, Buildings or Office Space	
Impact Areas	Administration	Applications for bank loans, sponsorships, etc.
	Time	Processing time for applications needs to be accounted for
	Skills	Skills required to prepare a business proposal or business plan

Employees		
Impact Areas	Lay off	
	Finance	Lay off costs involved
	Administration	Administrative procedures necessary for lay off/firing
	Skills	The situation may affect employee motivation and morale
	Education and Training	
	Time	Additional training or education may impact the timeline
	Finance	A higher level of skills or more responsibility for a staff member may increase salary; training and educational costs (including fees, housing, salary, etc.)
	Skills	Affect employee motivation and morale; can cause jealousy among employees
	Consult Experts	
	Time	External experts may not be available immediately
	Administration	In case the external expert needs to cross borders, arrange flights, visas, etc.
	Finance	Need to cover logistic costs, service costs, housing, etc.
	Hire new	
	Administration	Need to consider rigid labour regulations (eg. BEE, NEEEF, gender equality); applications for social security, medical aid, work permit etc.
	Time	If an employee is a foreigner, need to take into account the application process for work permits, visas, etc.
	Finance	Salary of a new employee; cost for benefits offered to attract new employee; housing or transport if necessary

Step 12: Create DT Project Plan

Objective:
Identify the time, tasks, and actions required to create a DT project plan.

Reason of Importance:
Gaining an overview of the time, tasks, and actions that are required to realise the project. The overview also helps to determine the skills and capabilities required to complete these tasks, and therefore, helps to identify suitable individuals.

Excel Template:
Roadmap

Output:
A rough DT project plan that summarises the tasks and actions required to realise the DT goal and to allocate a rough time estimate to the project.

Guideline:

To complete this DT project, the following information is still required:

1. Determine the tasks or actions that are required to prepare the organisation for the project implementation.

2. Determine which tasks or actions are predecessors (when a certain task needs to be completed before another task can be started).

3. Allocate an estimated time frame for each task.

4. Determine the skills or capabilities required to complete the task.

5. Identify individuals/machines/software in your organisations who possess the required skills or capabilities to complete the task.

   If you do not have any individual/machines/software available, determine alternative options, such as:

   a. Consulting experts (vendors or partners)
   b. Investing in new resources to complete specific tasks.

6. **OPTIONAL:** Create a Gantt chart, containing all data. You can do this by using:

   a. MS Project or Excel
   b. Other project planning software
   c. Pen and paper

Appendix B.1: Formula Sheet

Capacity

- ability to produce, hold, receive, store, or accommodate.
- Maximum throughput rate of a process
- Can be viewed in terms of:
    - Input: the units of resources available (eg. number of hospital beds available)
    - Output: maximum rate of output per unit of time (for example products produced)

$$Capacity = \frac{1}{Cycle\ time}$$

Cycle time

- Time required to complete a single unit at a station **OR** the time between completing units for a process.

Flow time/Lead time

- the total time to complete all stations.

Takt time

- production pace required to meet customer demand.
- used to determine the number of products that need to be produced throughout the shift.

$$Takt\ time = \frac{Total\ available\ production\ time\ in\ a\ time\ window\ (s\ or\ min)}{Customer\ demand\ for\ the\ time\ window\ (unit)}$$

Bottleneck

- the station with the lowest throughput rate in the process or highest utilisation over a period of time.
-

$$Capacity\ Utilisation\ (\%) = \frac{Time\ or\ capacity\ used\ or\ required}{Time\ or\ capacity\ available}$$

A **bottleneck** is ta process with the **highest utilisation** over a long period of time.

Efficiency

- how well a process turns inputs into outputs.
-

$$Efficiency\ (\%) = \frac{Units\ produced/delivered\ in\ a\ given\ period\ (actual)}{Units\ produced/delivered\ in\ a\ given\ period\ (theoretic)}$$

Labour Productivity

- the output volume obtained from each employee.

$$Labour\ Productivity = \frac{Actual\ output\ per\ period\ (unit)}{Number\ of\ workers\ or\ worker\ hours}$$

Machine Productivity

- the output volume obtained from each machine.

$$Machine\ Productivity = \frac{Actual\ Output\ per\ period\ (unit)}{Machine\ time\ available\ for\ production\ (hours)}$$

Production Costs:

Direct material used

- refers to all materials required to produce a product.
-

$$\begin{aligned} &Direct\ Material\ Used \\ &= Beginning\ Raw\ Material\ Inventory\ +\ Raw\ Material\ Purchases \\ &-\ Ending\ Raw\ Material\ Inventory -\ Indirect\ Materials\ Used \end{aligned}$$

Total Manufacturing Cost

- costs of all resources required for the production process during a specified period.

$$Total\ Manufacturing\ Cost\ =\ Direct\ Material\ +\ Direct\ Labour\ +\ Overhead\ applied$$

Cost of Goods Manufactured

- costs involved of all manufactured goods throughout a specified period of time.
-

$$\begin{aligned} &Cost\ of\ Goods\ Manufactured \\ &= Total\ Manufacturing\ Cost\ +\ Beginning\ Work\ in\ Process\ Inventory \\ &-\ Ending\ Work\ in\ Process\ Inventory \end{aligned}$$

Cost of Goods sold

- refers to all costs involved in the goods sold during a specified period of time.
-

$$\begin{aligned} &Cost\ of\ Goods\ sold \\ &= Beginning\ Finished\ Goods\ Inventory\ + Cost\ of\ Goods\ Manufactured \\ &-\ Ending\ Finished\ Goods\ Inventory \end{aligned}$$

Manufacturing cost per unit

$$Manufacturing\ cost\ per\ unit\ =\ \frac{Cost\ of\ goods\ manufactured}{Total\ units\ produced\ in\ the\ same\ time\ unit}$$

Profit margin per product

$$Profit\ margin\ per\ product\ =\ Sales\ price\ per\ unit\ -\ Manufacturing\ cost\ per\ unit$$

Contribution margin per product

$$\text{Contribution margin per product} = Sales\ price\ per\ unit\ -\ Direct\ material\ cost\ per\ unit$$

Product contribution margin per bottleneck time unit

$$\begin{aligned} &Product\ contribution\ margin\ per\ bottleneck\ time\ unit \\ &= \frac{Contribution\ margin\ per\ product}{Time\ required\ on\ bottleneck\ for\ a\ product} \end{aligned}$$

Appendix B.2: Digital Transformation Scenarios

Digital Land Registry in Mauritius

The inefficient bureaucracy system has found to be a major challenge within the SADC. Most countries in the SADC are still relying on paper-based systems where administrative information such as land registration needs to be entered manually. However, hard copies are susceptible to damages and often difficult to be located in case of unorganised storage. In 2011, the Registrar General Department of Mauritius, which is the central repository of all documents that are registered within the country, has successfully transformed from a paper-based system to a paperless one. The system allows automatic population of information on registered properties and enables different branches of the Registrar-General's Department to share information, hence increasing efficiency. The system also allows users to copy information from scanned deeds. The Registrar General and its stakeholders (including the general public) have access to an electronic dashboard allowing the user to carry out registry searches, submit documents for registration, pay the registration fees online, and receive their registered documents in electronic form. After four years, Mauritius was able to reduce the time for registration from 210 days to 14.

In summary:

Objective: Mauritius' Registrar General Department aimed at transforming the department into an e-service body to decrease the processing time and to create a digital record of their data.

Value Added:

- **Data optimisation:** Decreasing the storage of duplicate information.
- **Improved data storage and processing:** Computerised systems can handle large amounts of data and can process and compile information much faster in ways not possible with manual systems.
- **Data accuracy:** Each transaction entered in the system is captured and updated. Automatic registration of the data also decreases the possibility of errors.
- **Data transparency:** Information is shared throughout the department and accessible to all stakeholders.
- **Data back-up:** Information is less susceptible to physical damage as copies of the data can be made and saved in different locations.
- **Process optimisation:** Streamlining workflows, making a system more efficient. Throughout the registration processes, individuals can apply for mortgages immediately, saving time.
- **Performance analysis:** The computerised system assesses the systems overall performance to further improve its services to customers.
- **Quality Control:** Staff can perform consistency checks and verify data instantly.

Livestock Traceability Systems in Swaziland and Namibia

The strict regulations and legislations of Europe's food industry have forced developing countries such as Swaziland and Namibia to revolutionise their meat exporting procedures. Livestock traceability systems have become a mandatory export prerequisite due to recent food scares (eg. mad cow disease), but also people have become more aware of what they are eating and where it comes from. This forced these two countries to improve the effectiveness of their traceability systems. In 2005, Namibia introduced the Namibian Livestock Identification and Traceability System (NamLITS) to trace the health status of animals north and south of the veterinary cordon fence. In 2010, Swaziland also upgraded from a paper-based system to a modern computerised system called the Swaziland Livestock Information and Traceability System (SLITS) and Namibia expanded their system to trace the movement of the cattle of communal farmers in the Northern Communal Areas. Both systems have been implemented successfully in 2014. The system captures information about the movement of each animal, contains unique identification details for each farmer as well as animal, and the animal's state of health for more effective disease control.

In summary:

Objective: Managing and controlling animal diseases and improving overall animal health to ensure better market access for the countries.

Value Added:

- **Accurate Animal Tracking:** Exact tracing of the animal and its products from the original farm to the final consumer.
- **Data optimisation:** Unique identification information decreases the possibility for duplicate storage of information.
- **Traceability:** Monitoring of animal health; allowing disease control.
- **Quality Control:** Managing nutrition and yield of meat products.
- **Entry to new markets.**

Mobile Money (eWallet)

Mobile money has become more and more popular globally. In the SADC, the eWallet concept developed by the First National Bank (FNB) has shown immense growth since 2009. The concept was first launched in South Africa and adopted by other countries including Botswana, Namibia, Zambia, and Lesotho. The concept is simple: Money can be sent to anyone who has a valid cell phone number within a domestic range. Cross border eWallet transactions have not been enabled yet. The huge advantage of the concept is that this payment method is suitable for any cell phone model and the recipient does not need to have a bank account. This makes this concept ideal for consumers who have minimal transaction requirements, have limited access to banks, or do not own identification documents. It is often the case that people born in rural areas do not own any kind of identification document which is necessary for opening a bank account. Furthermore, banks are not necessarily located in the villages, but rather in larger towns or big cities, limiting their accessibility. Since the use of cell phones continues to grow, this concept could be adopted successfully. The money sent is instantly available in the eWallet and the recipient can access the money immediately at an FNB ATM without needing a bank card. Furthermore, the recipient can check the balance, get a mini statement, and buy prepaid airtime or electricity.

In summary:

Objective: Simplifying paperless money transfers (transaction

Value Added:

- **Increase Efficiency:** eWallet allows the instant transfer of funds, speeding up the payment process.
- **Improve Security:** No cash handling is required.
- **Enhance Customer Experience:** The system is simple, fast, and convenient. Furthermore, the user does not require a bank account to send or receive money.

Precision Farming in South Africa

Only 13.7 % of South Africa's total area is arable and used for intensive agriculture. The unreliable rainfall and unpredictable weather changes, high input costs, and increasing global competition put South Africa's crop production under pressure. Precision farming has become a popular practice among the farmers, for them to intensify their production and make optimum use of available resources. Precision farming promotes sustainability and is a strategy where farmers can vary inputs (eg. application of fertilizers, pesticides, cultivars, as well as cultivation and harvesting techniques) and practices using applicable technology and principles. By making use of advanced technologies, information can be derived which allows the farmer to apply inputs, such as fertilisers or seeds, at variable rates exactly where they are needed. In practice, data is entered, interpreted, and analysed. Furthermore, management strategies for specific times and scales can be developed and

implemented. The most beneficial outcomes derived from the use of this practice is that major costs can be saved with the variable fertilizer application.

In summary:

Objective: Maximising the agricultural output using intelligent technologies.

Value Added:

- **Resource Efficiency:** Efficient use of fertilizers, chemicals, water, fuel, etc.
- **Increase Output**
- **Improve Output Quality**
- **Increase Yield**
- **Decrease environmental footprint**
- **Capturing data:** Can be used for predictions
- **Data sharing:** Sharing captured data on online platforms with other users.
- **Assist farmer in the decision-making process**

Appendix B.3: Case Study

Background

The organisation that is used as a case study is a charcoal packaging SME, located in Namibia. The organisation was founded in 2016 by five individuals who are all farmers in Northern Namibia. Due to the ever-increasing invader bush growth on their land and the continued absence of rain, the farmers struggled to manage and maintain their livestock. They have, therefore, started to sustainably utilise the invader bush as a renewable resource to produce charcoal. They have founded an organisation to increase the value of the raw material (in this case the charcoal) by packaging and shipping the product to international markets.

Since the majority of the founders are individuals with limited business management and entrepreneurial background, this organisation has found to be an ideal candidate to practically apply this roadmap. Each roadmap step will be applied and discussed in detail throughout the section of this document. If specific organisational information is required to complete the step, a short description will be provided that can be studied by the user.

Step 1: Company Strategy

Objective:

Define the organisation's strategy, as well as its vision and mission.

Output:

A strategy that defines what the business wants to achieve and how.

Case Study Output:

1. **The Vision of the organisation is the following:**

   The organisation strives to be the leader in charcoal products associated with superior quality.

2. **The mission of the organisation is the following:**

   Our mission is to deliver high-quality products, and will, therefore, attract and retain business partners who demand an innovative, loyal, honest, and highly skilled supplier of choice. We are committed to further developing distribution channels to provide an uninterrupted supply of high-quality charcoal to potential partners and customers. We also strive to exceed stakeholders (customers, employees, and founders') expectations through the delivering of a consistently high-quality product on a timely basis, realizing mutual growth and profit, by living our values.

3. **The strategic objectives for this company have been highlighted in bold in the text. The completed balanced score card is presented in Figure B.3.1 and discussed below.**

   Like any other SME, this company's main objective is to **increase** its **profits**. By simply **reducing** their **costs** and **increasing** their **sales**, the organisation plans to achieve its objective. However, increasing sales can be rather challenging, especially for a young company like this one. Similar to most organisations located within the SADC region, their market access remains rather limited, and so does their **customer base**. Initially, the sales of the organisation consist of two main products: restaurant charcoal and barbeque charcoal. The organisation has, therefore, **increased** its **product offerings** by adding a new product to its range, namely charcoal briquettes. The price of the raw material that is required to produce charcoal briquettes is much lower, which will, therefore, also contribute to reducing the overall costs. Furthermore, the organisation provides its customers with the option to **customize** their **order** by offering different bag sizes for each product to be packaged in and can also supply bags of their own brand. Other challenges the organisation faces, are the **inefficiencies** experienced within the **packaging plant** as well as an **ineffective inventory management process**. Introducing improvements will help decrease machine breakdowns and help save time, translating towards a reduction in costs. To achieve this, the organisation aims to **increase** the **level** of its **in-house expertise** to encourage **autonomous decision-making** among their employees. Autonomy among the workforce is important, as they can contribute useful insight into the different processes as they are often directly involved in the process itself.

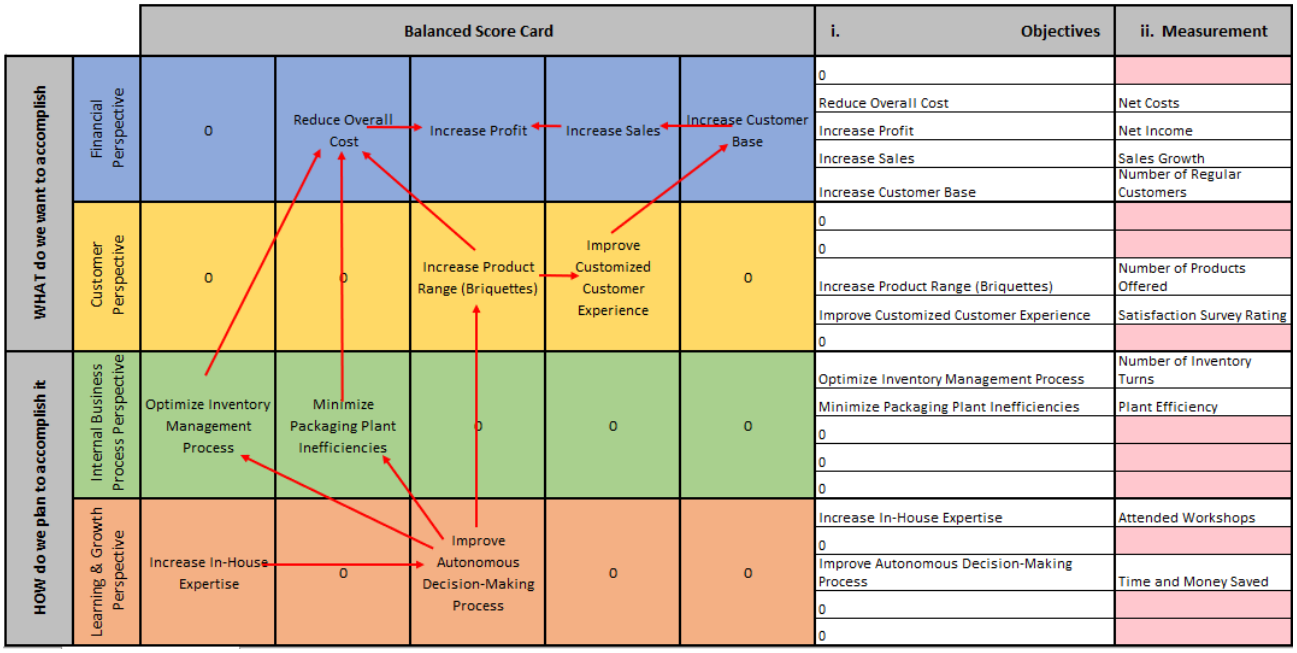

Figure B.3.1: Completed Balanced Score Card and Strategy Map

As you can see, all objectives start with a verb and have been allocated to a specific perspective. The financial perspective includes the increase in profits, reduce overall costs, increase customer base, and increase sales. The value propositions delivered to the customer include the increase in product range by adding briquettes as a sale item and allowing customized packaging options to the customer (Improve Customized Customer Experience). By optimizing the inventory management process and minimising the packaging plant inefficiencies, the organisation aims to ensure that the products and services delivered to the customers to meet their expectations. Finally, the learning and growth opportunities of the organisation aim to increase the in-house expertise to improve the autonomous decision-making process.

The KPIs have been identified by the organisation itself, however, no specific targets have been set. Furthermore, when you record your objectives, you do not have to fill all the fields. In this particular example, some perspectives' fields have been filled in sequence, while others only fill every second field. This is merely to ensure that the arrows used to create a strategy map (next step) do not cross each other or cause confusion.

4. **As you can see in Figure B.3.1, arrows have been added between the items of the balanced score card. This represents the strategy map.**

Increasing the in-house expertise encourages autonomy among the workforce. Since employees are often in direct contact with the processes, they may contribute valuable insight regarding possible changes or improvements. This can help the organisation to minimise the inefficiencies that are available in the entire packaging process, as well as optimise the inventory management process. By improving these processes, numerous costs can be saved, leading to an overall decrease in cost. Also, new products can be researched and introduced by the workforce, leading to the launch of an additional product, in this case, briquettes. Since the raw material cost is significantly lower than of the other products, valuable production costs can be saved. By introducing new and customisable products, the customer experience can be improved, and a wider range of customers can be satisfied. This leads to an increase in the company's customer base, leading to more sales. As a result, the decreased costs and increased sales, a larger profit can be earned by the organisation.

Step 2: Establish Planning Team

Objective:

Identify individuals who are responsible for the digital transformation project.

Output:

A detailed overview of the planning team, including their task description.

Case Study Output:

1. For the leadership team, two individuals have been appointed. The individuals chosen are the two directors of the SME. They have fundamental knowledge about the business, its activities, as well as its customers. They understand the business processes and operations and their management and communication skills are good. Since they possess a fundamental knowledge about the organisation, they can align the transformation ideas with the company's objectives, vision, and mission. They will be the individuals in charge of managing the people and updating the team about their decisions and changes resulting from the transformation.

2. Similar as for the leadership team, two individuals have been appointed to the core digital transformation team. These two individuals possess fundamental knowledge of the tools/techniques/technologies that are enabling the transformation and continuously update leadership about the current status of the project.

3. In this example, all team members are part of the company and therefore are considered as an internal resource. Therefore, no external individuals need to be consulted and no new members need to be hired by the organisations. Table B.3.1 summarises the data that has been obtained from this step.

Table B.3.1: Summary of the Planning Team

Team Component	Task Description	Skills and Knowledge Required	#	Resource Option	Person Designated to Task (Name)
Leadership	Individual with authority to make decisions	Fully understand business, its activities, and customers	1	Internal	Ralf
Example: Business Owner, Manager	Manage people and drive cultural change	Be aware of alternative possibilities and include them in the business model	2	Internal	Dirk
	Communicate and update team about decisions or changes		3		
		People management and communication skills	4		
		Align DT ideas with organisation	5		
Core DT	Hands-on practitioners of technologies	Understand the tools/techniques/technologies enabling business transformation	1	Internal	Erni
Example: Experienced Individuals eg. Senior department manager, developers, designers, other capable individuals	Need to work with new systems and technologies		2	Internal	Heiko
	Update leadership team about current status of the project (regular meetings)	Adaptable to change (re-skill, training, or education might be necessary)	3		
			4		
		Team player	5		
		Agile practitioner	6		
		Communication skills	7		
		Skills in development, designing, data science, coding	8		
		Committed to new project	9		

Step 3: Understand Business Model

Objective:

Bring the entire planning team on the same level of understanding about the company's current business model and to gain an overview of the businesses' current position and its objectives.

Output:

A detailed overview of the company's business model.

Case Study Output:

To complete the Business Model Canvas, the following information has been retrieved from the case study description:

The products that create value to the customer, include the **high-quality charcoal** which can be ordered by the customer in **customizable** bags in **large volumes**. The products are stamped with a bar code and can be **traced** by the customer or the organisation itself. This allows the system to be **transparent**, as the customer has direct access to determine where the product originated as well as the current location.

The most important customers include **international retailers**, as well as **restaurants**.

The organisation has a **website** available through which the organisation can be contacted by potential customers and quotes can be requested. Their products' high quality allowed them to build up a **reputation**, which allowed them to gain access to new markets.

The business interacts with its customers through their internal **sales department** as well as **agents** who represent the company internationally. Furthermore, the **Namibian Charcoal Association (NCA)** also plays a significant role in the organisation's interaction with customers.

As mentioned, the organisation offers more than one product. Their pricing depends on the **product type, volume, packaging option** (pallets or slip sheets), **bag sizes, and shipping option**.

To start the business, the organisation required private investors. Those include individuals, as well as other organisations (which will be referred to as **shareholders**). Furthermore, since the factory is located on a farm, the organisation requires a **logistic agency** that delivers to and from the factory.

The organisation provides the customers with different **product mix** options and also offers to either pack the bags loosely into the container or **palletized**. Furthermore, they have obtained numerous **certifications** including TFT, FSC, and BSCI.

Since the factory is on a farm, the **housing for the employees** and the **office spaces** are available. Numerous **vehicles and machines** are available that are required to shift the raw material.

The major costs involved to operate the business **include insurance premiums due to the high risk of fires, transport, raw material, labour**, and **fuel**.

1. Using the above information, the Business Model Canvas could be completed (see Table B.3.2). By completing the Business Model Canvas, you have a visual breakdown of your current business model. This information is useful at a later stage, as it helps you understand what impact the digital transformation will have on your current business model.

Table B.3.2: Completed Business Model Canvas of the Case Study

<table>
<tr><th>Key Partners</th><th>Key Activities</th><th>Value Proposition</th><th>Customer Relationships</th><th>Customer Segments</th></tr>
<tr><td rowspan="2">Logistic Agency

Shareholders</td><td>Offering a product mix to the customer

FSC, TFT, and BSCI clearance

Palletized packaging</td><td rowspan="2">High-Quality Namibian Charcoal

Customized Charcoal Packaging

Traceable Products

Transparent Systems

High Volume Product Quantities</td><td>Sales Department

Namibian Charcoal Association

Agents</td><td rowspan="2">International Retailers

Restaurants</td></tr>
<tr><td>Key Resources

The factory is located on a farm, therefore
• housing is offered to the employees
• office spaces are available and rent
• vehicles to shift raw material
• electricity is available

Human Capital, Machinery</td><td>Channels

Website

Reputation (Word-of-Mouth)</td></tr>
<tr><th colspan="3">Cost Structure</th><th colspan="2">Revenue Streams</th></tr>
<tr><td colspan="3">Insurance premiums due to the high risk of fires

Logistic costs

Raw material costs

Labour costs

Fuel costs</td><td colspan="2">Pricing depends on product type, volume, packaging option, bag sizes, and the shipping option</td></tr>
</table>

Step 4: Visualise As-Is Process

Objective:

Identify underlying challenges, risks, or change in customer expectations of a known process by visualising the current state of the process.

Output:

A flow chart allows a visual representation of the sequence of the process steps involved in the organisation's current state.

Case Study Output:

1. **Identify the problem.**

   The directors of the case study organisation have found that their inventory management process is inefficient and tedious. Currently, the stock levels are updated manually by individuals.

   To take inventory out of the system, the current process is as follows:
   The customer places an order that specifies a specific quantity of the certain charcoal grade. This **order** is **received** by the sales department and sent to the production manager. Once the order is received by the production manager, the **stock availability** needs to be **determined**. If no stock is available, the **purchasing department** needs to be **contacted** to order new raw material. If, however, the stock is available, the **sales department** is contacted to confirm the order. The sales department, therefore, **issues** a **packing order** and sends it back to the production manager, stating the charcoal grade, quantity, bag size, and packaging option (pallets, slip sheets, or loose). The production manager **creates a packing list** which includes all the material that is required to complete the order. This packing list is then sent back to the sales department who **issues** an **invoice** and sends it back to the **customer** who requested an order. The invoice is also sent to the **administrator**, who **updates the inventory levels** in the excel sheet.

   The problem of this process is that it is tedious and that it leaves room for numerous opportunities to cause delay or lose valuable information.

2. **3. and 4.** Identify the activities involved in the process, the sequence of the activities, and the individual or machine that completes the task.

   The following table summarises the activities and individuals/machines involved in the process. Furthermore, they are listed in sequence (according to the text).

Table B.3.3: Summary of Activity Sequence and Individuals completing the Task

Activity	Individual/Machine
Receive and Send Customer Order	Sales Department
Receive Customer Order	Production Manager
Determine if Stock is Available	Production Manager
If no: Contact Purchase Department	Production Manager
If yes: Contact Sales Department	Production Manager
Confirm Stock Availability	Production Manager
Issue and Send Packing Order	Sales Department
Receive Packing Order	Production Manager
Compile and Send Packing List	Production Manager
Receive Packing List	Sales Department
Issue and Send Invoice to Customer and Administrator	Sales Department
Update Stock Levels	Administrator

5. To create a flow chart for this process, Microsoft Visio was used and is presented in Figure B.3.2. A short description will follow, discussing the flow chart symbols used.

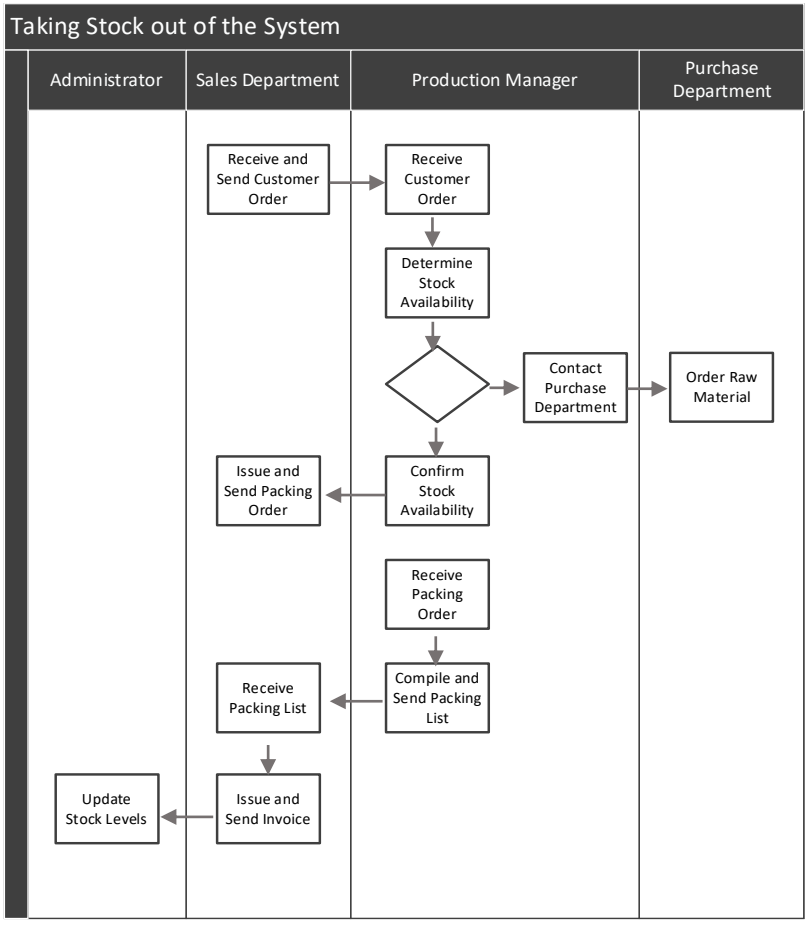

Figure B.3.2: Flow Chart of Current Process

Each employee or business department is represented by means of the vertical rectangle, called a swim lane. This makes it easier to indicate which individual is responsible for completing which task. The steps or tasks of the process are presented in the small rectangles, of which each indicates the task performed. The diamond shape represents a decision node, where, in this case, the production manager needs to determine if stock is available or not. If no, then the purchasing department will be contacted. If yes, the sales department will be contacted. The arrows in the diagram represent the sequence in which the process flows.

Step 5: Analyse As-Is Process

Objective:

Identify underlying challenges, risks, or change in customer expectations of a known process by analysing the visualised current state of the process.

Output:

Identification and quantification of problem areas. The data can be used at a later stage to compare the current state of the process to the desired future state after the digital transformation.

Case Study Output:

The formulas provided in the formula sheet in Appendix B.1 are more suitable for processes where physical output is produced. However, the process that requires transformation does not produce physical output, and it was, therefore, decided that **a high-level process analysis** would be sufficient. The following table summarises the analysis results.

The table includes the person who is responsible for the task and the input and output of each process step (as well as its type).

Table B.3.4: As-Is Process Analysis

Activity	Person/Machine	Input	Input Type	Output	Output Type
Receive and Send Customer Order	Sales Department	Customer Order	Document	Customer Order	Document
Receive Customer Order	Production Manager	Customer Order	Document	Customer Order	Document
Determine if Stock is Available	Production Manager	Stock Level from Database	Data	Stock Level From Database	Data
Confirm Stock Availability	Production Manager	Stock Level From Database	Data	Order Confirmation	Document
Issue Packing Order	Sales Department	Order Confirmation	Document	Packing Order	Document
Receive Packing Order	Production Manager	Packing Order	Document	Packing Order	Document
Compile and Send Packing List	Production Manager	Packing Order	Document	Packing List	Document
Receive Packing List	Sales Department	Packing List	Document	Packing List	Document
Issue and Send Invoice to Customer and Administrator	Sales Department	Packing List	Document	Sales Invoice	Document
Update Stock Levels	Administrator	Sales Invoice	Document	Updated Stock Levels	Data

As mentioned, the problem of this process is that it is tedious and that it leaves room for numerous opportunities to cause delay or lose valuable information. It takes three different individuals (highlighted in green) to take stock out of the system (excludes the purchasing department, as it was only included for completeness sake and is not directly involved in the process itself). Also, numerous documents (highlighted in yellow) are sent between the different parties, including the customer order, the order confirmation, the packing order, the packing list, and finally the sales invoice. The only data flow can be observed when the stock level is requested from the database by the production manager. It takes a total of approximately 10-15 minutes to complete this step.

In summary:

Total Number of Workers: 3
Total Number of Documents: 5
Total Process Time: 10-15 minutes

Step 6: Establish DT Goal

Objective:

Create awareness about digitalisation opportunities to establish the digital transformation goal.

Output:

Identification of the overall goal the organisation aims to achieve with the digital transformation.

Case Study Output:

The problem with the process is that it takes long and also leads to inaccurate inventory management. It also allows room for losing valuable information (eg. Losing the physical document) or may cause a major delay in the entire process.

1. By studying the SWOT analysis in Figure B.2, insight could be gained about DT. This merely serves as a simplified literature review about the topic at hand.

2. **Identify the key driver of your digital transformation.**

   The key driver of this digital transformation is "Internal Efficiency" as the organisation aims to optimize its inventory management process.

3. **Determine the overall digitalisation objective and the expected benefits you aim to achieve with the digital transformation in your organisation.**

4. Objective: Optimize the inventory management process to decrease the processing time and ensure accurate and real-time stock levels.

   Value Added:
   - Accurate Stock Levels
   - Improved Inventory Control
   - Faster process execution
   - Improved Customer Experience

5. **Establish the organisation's digital transformation goal. The goal can include a single project, such as introducing technology for faster operations, or a complete transformation of the business.**

   In this case study, the transformation will only focus on a single project. To transform the stock management process, the organisation will make use of a technology that will decrease the processing time and ensure accurate and real-time stock levels.

Step 7: Define DT Goal

Objective:
Generate ideas to achieve the DT goal.

Output:
An alternative or possible improvement of the current as-is situation previously analysed.

Case Study Output:
For organisations who have **more than one option** to improve the processes' as-is situation, the idea generation process provided in the step description should be followed. For the case study organisation, however, it was suggested to make use of an inventory management software that will simplify their inventory management control. The software that is selected is named TradeGecko. The software provides an online inventory management platform that aims to help businesses manage their sales and supply chains through inventory control and customer and supplier tracking. Customers can request an order directly from the platform, from which the software can automatically send credit notes, invoices, and shipping documents if stock is available. The software provides an overview of the real-time inventory levels as well as the order status. Part of the reason why this particular software has been selected by the organisation is that it is linked with Xero, which is an online bookkeeping platform. All the data that is derived from the TradeGecko software (inventory, sales, purchases) is directly transferred to the organisations' accounting system and recorded. Since the as-is process is of internal nature, the transformation will have no direct impact on the current business model. Revisiting the balanced score card from step 1, the company objectives included that the organisation would like to optimise their inventory management process. Therefore, the DT goal does align with the company strategy.

Step 8: Evaluate DT Goal

Objective:
Evaluate the DT goal.

Output:
Identification of the risks and costs that are involved. Those can then be compared to the benefits attained from the DT goal.

Case Study Output:
The DT goal defined in the previous step is to implement an inventory management software named TradeGecko. Different analyses will be performed to determine what risks, costs, and benefits are in case when the software will be implemented.

Cash Flow Analysis

Objective:
Identify and forecast the cash components flowing in and out of the organisation for a given time period.

Output:
The assessment indicates the impact the digital transformation will have on the businesses cash flow.

Case Study Output:
Cash flow simply represents how much cash a business has on hand. Therefore, cash flow only provides insight into the businesses' bank or cash account and does not include any pending payments, receivables, or inventory. In this case study, the organisation aims to improve its inventory control. This transformation project, therefore, does not have a direct effect on the sales or the costs of the organisation. Following this, it was not found to be necessary to analyse what effect the DT project will have on the organisations' cash flow.

Cost-Benefit Analysis

Objective:
Identify the costs involved in the digital transformation project and what the benefits will be after successfully executing the project.

Output:
The assessment indicates the costs involved in the digital transformation project and what gains can be expected.

Case Study Output:

1. **List every expense for the digital transformation project.**

   The expenses identified for this project include:
   - Investment costs,
   - Installation costs consisting of educational and training workshops and the time that is required to install the software and attend the workshop.

2. **List every benefit for the digital transformation project.**

   The benefits identified for this project include:
   - Accurate stock levels and improved inventory control,
   - Automated data management which leads to faster process execution,
   - Improved customer experience.

3. **Assign monetary values to the expenses and benefits.**
   (Assign the benefits and costs with their present value, as the value of money may often change due to factors such as inflation).

   To assign monetary values to the benefits and expenses, the following factors have been taken into consideration:

Expenses:

The monthly subscription cost of the software is roughly R4 300 per month which translates to R51 600 per year. Three individuals have been sent to a workshop, which costs R3 000 per person, hence R9 000 in total. Additionally, time was required to install and train the individuals that are working with the software. These individuals earn an hourly rate of R130 and required 5 hours each to complete the training and installation (resulting in R1 950).

Benefits:

The accurate stock levels and improved inventory control is estimated to save the organisation R1 000 per year. The automated data management allows faster execution of the process and also eliminates one individual that would have been required to complete the process of updating the stock levels manually. By estimating a monthly salary of R20 000, the money that can be saved results in a total of R240 000. Since the customer can order directly from the platform, it enhances the customer' experience with the organisation. Furthermore, they save time on their side, as the ordering process has been simplified for them. The monetary value has been calculated by using a conservative approach: The organisation has seven customers who issue at least one order per month. Initially, the ordering process was 10-15 minutes, now it is at most two minutes. Therefore, by using an hourly rate of R130, the money saved when using the system has been calculated as R2 730 (7 customers x 12 months x R130/hr / 60 min x 15 min).

4. , 5. and 6.

The Figure B.3.3 summarises the information discussed above. The total costs amount to R62 550, and the total benefits equal to R243 730. The cost-benefit ratio, therefore, equals 3.90. It is marked in green, as it is larger than 1, meaning that the benefits exceed the costs.

Cost-Benefit Ratio	**3.90**
Total Costs	62550
Investment Costs (yearly)	51600
Installation Costs	
Education and Training Workshops	9000
Time for Installation and Training	1950
Total Benefits	243730
Accurate Stock Levels	1000
Improved Inventory Control	
Automated Data Management	
Faster Execution of Process	240000
Improved Customer Experience	2730

Figure B.3.3: Cost-Benefit Analysis of the Case Study

Risk Analysis

Objective:
Identify, assess, and manage the risks involved in the digital transformation project.

Output:
The assessment indicates the steps required to protect the business and what situations need to be addressed and avoided.

Case Study Output:

1. **Identify the risks.**

The risks identified are listed below:

- **Technology risk:** The software can fail, which can contribute to possible losses. Furthermore, the software requires internet access, and therefore depends on reliable internet access.
- **Malfunctioning Software:** The software can contain bugs that would contribute towards showing wrong numbers.
- **Cyber:** Online platforms are always exposed to potential hackers.
- **Data Leakage:** The data can be intersected by external sources if not encrypted properly.
- **Third-Party:** Potential risks exist that the vendor (TradeGecko) controls the data of the organisation inappropriately (eg. Data sharing).
- **Privacy:** Potential risks exist that the organisation shares sensitive data on the platform that is not intended to be shared.
- **Unskilled Staff:** Lack of skills may contribute towards the capturing of the wrong data or in the wrong format.
- **Uneasy access for customers:** Customers may not be able to work with the system or understand the information.

2. and 3. Table B.3.5 summarises the risk assessment and risk management.

Table B.3.5: Case Study Risk Assessment

Item #	Risk: Condition likely to occur	Probability (1-10)	Impact (1-10)	Exposure (max 100)	Rank	Effect: Consequence if risk occurs	Preventative action to reduce risk
1	Software Failure	1	5	5	4	Loss of data	Back up data regulary
2	Unreliable Internet Access	3	6	12	2	Ineffective use of the software	Find a more reliable internet provider
3	Software Malfunctions	1	5	5	5	Wrong data	Back up data regulary
4	Cyber	1	6	6	3	Hackers retrieving sensitive data	Ensure strong passwords
5	Data Leakage	1	4	4	7	Sensitive data exposed to external parties	Unavoidable
6	Third Party (TradeGecko)	1	4	4	8	Data is controlled inappropriately.	Unavoidable
7	Privacy	1	4	4	9	Sharing of sensitive data	Double chack data before uploading
8	Unskilled Staff	1	5	5	6	Capturing incorrect data or in the wrong format	Education and Training
9	Uneasy Access to Customers	3	8	24	1	Loss of customers	Education and Training

The highest risk item has found to be “Uneasy Access to Customers (indicated in red). If the customers cannot use the software, the order will not be placed, leading to fewer sales. The “Unreliable Internet Access” has found to be a medium risk item. Since the organisation is located on a farm, the internet signal is not the strongest, and therefore, causing the probability of occurrence to rise. The other seven items have found to be low-risk items. The items “Software Failure”, “Software Malfunctions”, “Cyber”, “Data Leakage”, “Third Party”, and “Privacy” are all dependent on the software provider itself. However, some preventative actions can be undertaken to reduce the impact of the risk occurrence such as regular backups, strong passwords, or quality checks of the data before uploading. Data may, however, be captured in the wrong format, leading to incorrect numbers. This can be prevented by schooling the staff who is working with the software.

Step 9: Visualise To-Be Process

Objective:
Visualise the To-Be Situation of the newly defined process to compare against the As-Is Situation.

Output:
A process map allows a visual representation of the sequence of the process steps involved in the transformed process of the organisation.

Case Study Output:

1. , 2. and 3. Identify the activities involved in the process, the sequence of the activities, and the individual or machine that completes the task.

The new process works as follows:
The **customer** places the **order** directly on the TradeGecko platform. The **software** will **determine** if the **required inventory and packaging material is available.** Similar to the as-is process, if no stock is available, the **purchasing department** will be contacted. If, however, the stock is available, a **packing order** is **issued** by the system and sent to the production manager. The production manager **receives the packing order** on the computer and **compiles a packing list**, which is sent back to the system. Once the **packing list is received** by the system, a **sales invoice is generated and issued** to the customer. Once the **sales invoice** has been **sent** out, the **stock levels** are automatically **updated** by the TradeGecko software.

Table B.3.6: Summary of Activity Sequence and Individuals completing the Process

Activity	Individual/Machine
Receive Customer Order	TradeGecko Software
Determine if Stock is Available	TradeGecko Software
If no: Contact Purchase Department	TradeGecko Software
If yes: Contact Production Manager	TradeGecko Software
Issue Packing Order	TradeGecko Software
Receive Packing Order	Production Manager
Compile and Send Packing List	Production Manager
Receive Packing List	TradeGecko Software
Issue and Send Invoice to Customer	TradeGecko Software
Update Stock Levels	TradeGecko Software

4. To create a flow chart for this process, Microsoft Visio was used and is presented in Figure B.3.4. A short description will follow, discussing the flow chart symbols used.

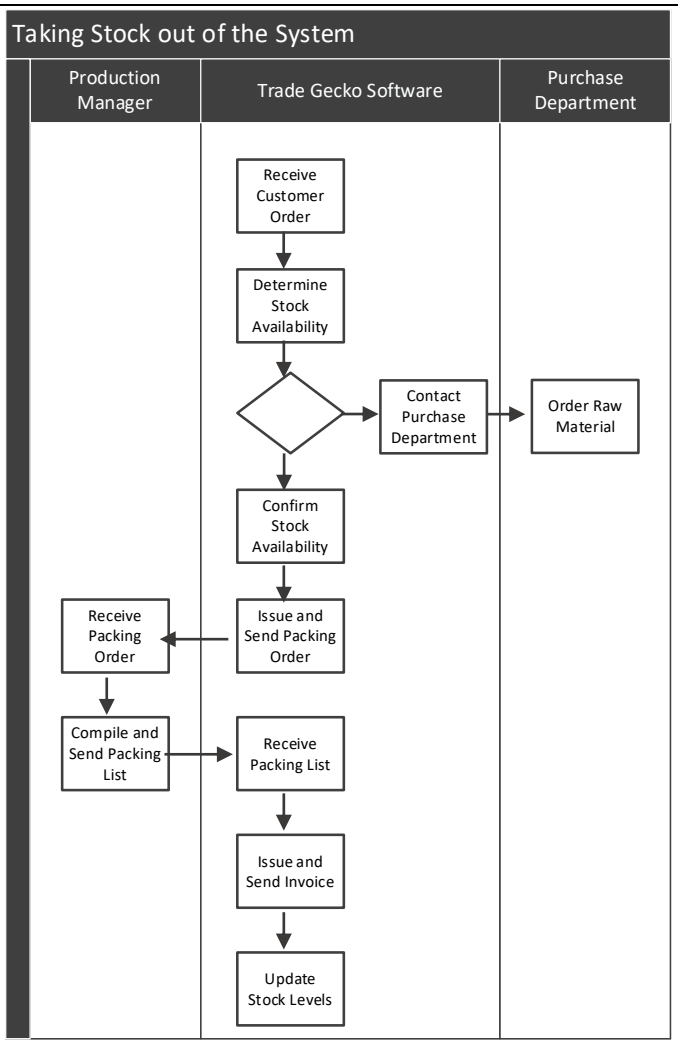

Figure B.3.4: Flow Chart of Future Process

The employees, business department, or software involved in the process is represented by means of the vertical rectangle, called a swim lane. This makes it easier to indicate who or what is responsible for completing which task. The steps or tasks of the process are presented in the small rectangles, of which each indicates the task performed. The diamond shape represents a decision node, where, in this case, the software system needs to determine if stock is available or not. If no, then the purchasing department will be contacted. If yes, the sales department will be contacted. The arrows in the diagram represent the sequence in which the process flows.

Step 10: Analyse To-Be Process

Objective:

Analyse the visualised To-Be Situation of the newly defined process to compare against the As-Is Situation.

Output:

The data can be used at a later stage to compare the transformed process with the current state of the process.

Case Study Output:

By making use of the same level of detail, the to-be analysis will follow the same procedure as the as-is analysis of the process.

The Table B.3.7 summarises the analysis results.

Table B.3.7 includes the person who is responsible for the task and the input and output of each process step (as well as its type).

Table B.3.7: To-Be Process Analysis Results

Activity	Person/Machine	Input	Input Type	Output	Output Type
Receive Customer Order	TradeGecko Software	Customer Order	Data	Customer Order	Data
Determine if Stock is Available	TradeGecko Software	Stock Level from Database	Data	Stock Level	Data
Confirm Stock Availability	TradeGecko Software	Stock Leve	Data	Order Confirmation	Data
Issue Packing Order	TradeGecko Software	Order Confirmation	Data	Packing Order	Data
Receive Packing Order	Production Manager	Packing Order	Data	Packing Order	Data
Compile and Send Packing List	Production Manager	Packing Order	Data	Packing List	Data
Receive Packing List	TradeGecko Software	Packing List	Data	Packing List	Data
Issue and Send Invoice to Customer	TradeGecko Software	Packing List	Data	Sales Invoice	Data
Update Stock Levels	TradeGecko Software	Sales Invoice	Data	Updated Stock Levels	Data

The new process is much faster and also leaves less room for errors or mistakes. To complete the process, two parties are involved (highlighted in green): the production manager and the TradeGecko software (excludes the purchasing department, as it was only included for completeness sake and is not directly involved in the process itself). No documents are required in the system, all information is transferred in the form of data. It takes a total of approximately 1-2 minutes to complete this step.

In summary:
Total Number of Workers: 1
Total Number of Documents: 0
Total Process Time: 1-2 minutes

Step 11: Select Opportunity

Objective:

Determine if the defined DT should be selected or not.

Output:

Determining if the DT goal is suitable or not.

Case Study Output:

To complete the case study, the excel templates have been used. Once all data has been inserted, an output summary has been generated on the "Select Opportunity" sheet. Each output will be discussed in more detail.

1. Your planning team consists of the following:

Planning Team	
Resource Option	**# of Individuals**
Internal	4
Partner	0
Vendor	0
Hire New	0

Figure B.3.5: Case Study Planning Team Summary

The summary shows, that the planning team consists of four individuals, who are all available in the business itself. Therefore, no external sources need to be consulted or hired to plan the DT project.

2. Study the results derived from your Process Analyses.

As-Is Process vs To-Be Process		
High-Level Process Analysis	**As-Is**	**To-Be**
Process steps.	10	9
Different individuals required to complete the task.	3	1
Different machines required to complete the task	0	1
Different types of documents.	5	0
Total time required to complete the task.	15	2
Detailed Process Analysis		
Bottleneck Process	#N/A	#N/A
Capacity Utilisation (Max)	0	0
Cycle Time	0	0
Flow Time	0	0
Takt Time	#DIV/0!	#DIV/0!
Theoretic Output	0	0
Actual Output	0	0
Efficiency	#DIV/0!	#DIV/0!
Machine Productivity	#DIV/0!	#DIV/0!
Labour Productivity	#DIV/0!	#DIV/0!
Direct Material Cost	0	0
Total Manufacturing Cost	0	0
Cost of Manufactured Goods	0	0
Cost of Goods Sold	0	0
Manufacturing Cost per Unit	#DIV/0!	#DIV/0!
Profit Margin per Product	#DIV/0!	#DIV/0!
Contribution Margin per Product	0	0
Product Contribution Margin per Bottleneck Time Unit	#DIV/0!	#DIV/0!

Figure B.3.6: Case Study Process Analysis Summary

As discussed earlier, a high-level process analysis has found to be sufficient for this DT project. This explains why the data in the "Detailed Process Analysis" table on the excel sheet contains no values. The high-level process analysis table, however, shows a summary of the number of process steps required to complete the process, the number of individuals and machines, how many different documents are required, and the total time it takes to

complete the process. In this case study, the objective was to optimize the inventory control process. From the data, it is clear that this can be achieved if the DT project is implemented, as it reduces the overall time of the process, and also only requires one individual instead of three. Furthermore, fewer documents are required between the process steps, as the new process only includes data that is sent and received between the different parties. The data recorded in the table also indicates that the to-be process requires a machine (in this case software) to complete the task.

3. The results of your cash flow analysis are presented below.

Cash Flow Analysis					
Period	1	2	3	4	5
Net Cash Surplus (Deficit)	ZAR 0.00	ZAR 0.00	ZAR 0.00	ZAR 0.00	ZAR 0.00

Figure B.3.7: Case Study Cash Flow Analysis Summary

As mentioned, no cash flow analysis has been conducted. If, however, a cash flow analysis would have been conducted, the table summarises the cash flow for the current period, as well as for previous or forecasted ones (depends on how the to-be process was chosen to be analysed)

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4. The results of your cost-benefit analysis are presented below.

Cost-Benefit Analysis	
Total Costs	62550
Total Benefits	243730
Cost-Benefit Ratio	3.90

Figure B.3.8: Case Study Cost-Benefit Analysis Summary

The cost-benefit ratio presented in a green format, as it is above one and, therefore, indicates that the benefits exceed the expenses. Otherwise, if the value would be below 1 (meaning expenses exceed benefits), the field would be presented in red.

5. The table below summarises the risks and their respective effects. The risks have been ranked, starting with the items with the highest risk.

Ranked Risk Analysis		
Rank	Risk	Effect: Consequence if Risk Occurs
1	Uneasy Access to Customers	Loss of customers
2	Unreliable Internet Access	Ineffective use of the software
3	Cyber	Hackers retrieving sensitive data
4	Software Failure	Loss of data
5	Software Malfunctions	Wrong data
6	Unskilled Staff	Capturing incorrect data or in the wrong format
7	Data Leakage	Sensitive data exposed to external parties
8	Third Party (TradeGecko)	Data is controlled inappropriately
9	Privacy	Sharing of sensitive data
10	0	0

Figure B.3.9: Case Study Risk Analysis Summary

The table summarises the risks involved in the DT project and presents them in a ranked order. Depending on the exposure value (product of the risk likelihood and risk impact), the highest risk item is placed at the top, followed by the medium and low-risk items.

After analysing the summarised data, the organisation decided to select the DT goal. Apart from the software subscription and the training costs, no additional investments are required by the organisation. The organisation has all physical and technological infrastructure required for the project in place. Furthermore, no new individual needs to be hired. The new process only includes the software as well as the production manager. Therefore, the administrator and the sales department is not directly involved in this process anymore. They are not excluded completely, as the data produced by the software needs to be evaluated and controlled regularly.

Step 12: Create a DT Project Plan

Objective:

Identifying the time, tasks, and actions required to create a DT project plan.

Output:

A rough DT project plan that summarises the tasks and actions required to realise the DT goal and to allocate a rough time estimate to the project.

Case Study Output:

The following text summarises the actions or tasks required to implement the DT project:

First, an individual needs to be appointed who manages the DT project. The individual contacts the finance department to arrange the monthly subscription fees of the software. Once the money is cleared, the organisation can subscribe to the software package. Next, the individuals who need to directly work with the new system have to attend a workshop. After attending the workshop, they need to introduce the new process and retrain the workforce so that they understand the changes.

The Figure below provides a Gantt chart that summarises the tasks, time, and individuals required to implement the project.

ID	Task Name	Duration	Start	Finish	Predecessors
3	Contact finance department to arrance monthly subsciption fees	1 day	16/10/20	16/10/20	
4	Subscribe to software package	1 day	19/10/20	19/10/20	3
5	Attend workshop	5 days	20/10/20	26/10/20	4
6	Introduce new process	1 day	27/10/20	27/10/20	5
7	Retrain Workforce	2 days	28/10/20	29/10/20	6

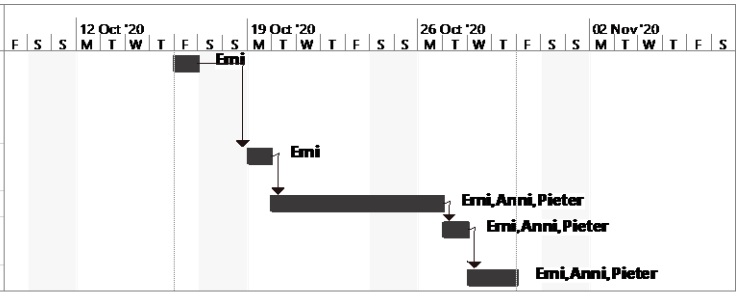

Figure B.3.10: Case Study Project Plan

Using MS Project, a project planning software, a Gantt chart was created. From the chart, it can be seen that all activities have predecessors, and therefore need to be completed for the next activity to start. Furthermore, the persons that are required to complete the task are also indicated in the chart.