

**Overcoming barriers to technology adoption: enhancing data accuracy and
employee productivity in rubber manufacturing**

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Abstract

The amalgamation of innovative technologies into manufacturing and production systems has transformed industry and allowed businesses to realise high levels of effectiveness and increased productivity, enabling them to achieve competitive advantage. Research on the barriers that might impede technology adoption within rubber manufacturing operations is limited. The aim of this research was to analyse the difficulties related to the use of technology in industrial processes, particularly the obstacles that may impede efficient data input, when employing a Data Management System (DMS). The study was aimed at helping determine the underlying factors contributing to employee resistance and insufficient data entry when using DMS. A quantitative study was conducted, data was gathered through surveys and made use of ordinal data . The data was analysed using the Unified Theory of Acceptance and Use of Technology (UTAUT) model. The analysis indicated that challenges such as difficulty operating the DMS, insufficient training, limited technical support, and inadequate infrastructure hindered the adoption process. These barriers were manifested with inconsistent data input, employee frustration, and reduced engagement with technological systems. The insights gained from the results are valuable for practitioners and operational specialists involved in technology implementation in business. Harnessing thorough insights of these barriers is vital for developing functional strategies to promote technology integration across sectors.

Key Words

Barriers, Technology adoption, Employee productivity, Information system, Data Management

Declaration

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

1 April 2025

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1. Chapter 1: Introduction to Research Problem

1.1 Introduction

The integration of advanced innovative technologies into manufacturing and production processes has transformed industry and allowed businesses to realise high levels of effectiveness, increased productivity, and competitive advantage in the chosen markets of operation. These technological innovations include the usage of automated systems, data analytics tools, and digital management platforms that improve operational processes and deliver valuable insights for better decision-making.

In the modern manufacturing environment, successful adoption and incorporation of technology are essential components which determine the success of an organisation. Businesses that have successfully embraced the adoption of these technologies have emphasised the importance of accurate data harvesting and analysis, which in time has to be collected in real time, as well as the necessity to fully harness its value (Mogos et al., 2019).

Businesses utilising technologies like Data Management System (DMS), Internet of Things, (IoT), and big data in manufacturing, value sustainable performance, resulting in numerous benefits of significant data-driven industrial collaboration (Kamble et al., 2021). Justy et al. (2023) suggest that businesses are implementing data analytics to improve transparency and accuracy in company management, while also improving decision-making, financial management, and operational monitoring. This is particularly relevant as modern businesses are increasingly interested in acquiring not only technical expertise in data analysis but also the skills to effectively utilise information and generate innovative insights from available data (Kuntoğlu et al., 2020), as they seek to leverage this information to inform their strategic decision-making, operational processes, and innovative thinking.

Ultimately, according to Çalış et al., (2021), technological solutions, which are at the most recent stage of the industrial revolution, are attracting significant attention and providing several advantages to organisations – including enhanced efficiency, accelerated speed, improved quality, customised production, and decreased costs. Nevertheless, despite these benefits, the shift towards a technologically advanced work environment is fraught with obstacles. It therefore follows that given the technology's expansive nature, businesses must address a wide array of concerns (Culot, et al., 2020).

1.2 The Research Problem

The specific problem of insufficient data being captured occurs when operational staff, who are responsible for inputting the information into these intricate management systems,

such as the DMS, fail to accurately and effectively input operational data. This inadequacy results in problems where vital information required for making well-informed decisions is either distorted, or not provided, making the data practically worthless for strategic objectives.

According to Shamim et al. (2020), businesses cannot effectively utilise the potential of data analysis unless they have a culture that appreciates and depends on data-driven decision-making. Consequently, this non-availability of data leads to decision-making, which can result in costly operational inefficiencies. The broader ramifications of this issue go beyond simple operational complications; they directly affect an organisation's capacity to function and adapt in a highly competitive market.

Accurate data is crucial for senior executives and managers to make timely choices that enhance productivity and profitability. Chen (2024) emphasises that organisations with better analysis capabilities have a greater understanding of market dynamics than their competitors, giving these organisations the ability to use this edge to analyse data, understand consumer needs, improve decision-making, and ultimately provide better offerings for their customers, as their organisational performance improves.

Accordingly, barriers to the successful implementation of technology, such as unsatisfactory data input, directly affect the overall efficiency of a business. These challenges affect multiple domains, including the distribution of resources, strategic planning, and competitive positioning. Insufficient data input by production personnel, which is often linked to possible refusal to use new technology, insufficient training, and the evident difficulties of new systems, poses significant problems for operations (Raj et al., 2020).

In addition, Glyptis et al. (2020), suggest that the main obstacles to adopting technology often include limited long-term objectives, reluctance to change, lack of qualifications and training, and inadequate managerial skills. Furthermore, Rauch and Ansari (2022) indicate that technological advancements can introduce a new and unfamiliar environment that can cause individuals to feel disconnected from some areas of their job and may prevent them from adhering to their valued beliefs. These claims hinder the complete achievement of the advantages that technology can provide in production environments.

Therefore, the primary objective of this research is to investigate the reluctance shown by factory employees at the Howick Rubber Manufacturing facility to accept the DMS, a technological platform specifically formulated to streamline operational data, augment process

efficiencies, thereby improving data accuracy input from workers to ensure productivity of the business improves whilst improving employee motivation.

1.3 Purpose of the Research

This field of this study is technology adoption and organisational behaviour in an Industrial management environment. The aim of this research was to analyse and tackle the difficulties related to the use of technology in industrial processes, particularly the obstacles that impede efficient data input methods. The study was aimed at helping determine the underlying factors contributing to employee resistance and insufficient data entry when using the Howick factory's DMS. The study also intended to create a strategic framework that addresses these obstacles while improving employee engagement and overall productivity.

The DMS should provide executives and senior management with critical operational insights. In order to achieve that, it is essential that timely and accurate data entry into the DMS by senior management and business executives takes place in order to offer crucial operational insights. Consequently, this study was guided by the view that examining the variables that influence the acceptance of technological advancements may improve decision-making in both corporate and personal contexts (Sharma et al., 2023).

1.4 Scope of the Research

While many studies regarding technology adoption largely concentrate on wide-ranging organisational frameworks, this research furnishes a detailed assessment of industrial management within manufacturing operations (Kruger & Steyn, 2024). In particular, this study analysis the deployment of the DMS at the Howick manufacturing facility, offering a comprehensive viewpoint on technology adoption within this particular industrial setting (Fuentes et al., 2022). Consequently, although the results may be applicable to more extensive contexts, this study concentrates on the distinct challenges and dynamics inherent to the Howick factory. The DMS and its related operational frameworks serve as the representative model for similar management of information systems within industrial manufacturing environments.

This study examines the behaviours and attitudes of operational personnel as they interact with and utilise the DMS within the Howick Rubber manufacturing operation. Although the system is available to employees at multiple organisational levels, the research mainly investigates the variables that affect data entry and system engagement among operational staff and their managerial counterparts (Cimini et al., 2021; Kruger & Steyn, 2024).

The study is grounded in current data and empirical observations rather than historical benchmarks. Its objective is to furnish a snapshot of current challenges and to formulate forward-looking strategies rather than conducting a longitudinal examination of technology adoption across historical spans. To ensure comparability and reliability, the research utilises standardised measures of technology acceptance and organisational behaviour, explicitly customised to the perspective of the DMS and the industrial environment of the Howick factory.

Ultimately, while the investigation encompasses various dimensions of technology adoption and organisational behaviour, it places particular significance on the factors that shape data entry practices and their consequential impacts on operational insights and decision-making processes (Cimini et al., 2021). This focused approach supports a thorough analysis of the obstacles to technology adoption within an industrial environment, generating insights that may be applicable to comparable contexts in diverse manufacturing industries (Kruger & Steyn, 2024).

1.5 The Theoretical Need for the Research

The academic need for this study builds on the work of Cimini et al. (2020) that investigates the business implications by the adoption of technology and the ultimate sustainability of the solutions after these adoptions. The focus is specific within the rubber manufacturing industry with a focus on the DMS at the Howick factory. The distinctive conditions inherent in the rubber manufacturing sector, along with the challenges encountered in the adoption of these advanced management systems, highlight the imperative for the replication and expansion of such research initiatives to improve understanding and address these industry-specific issues.

The adoption of Industry 4.0 technologies produces significant organisational impacts, especially for the manufacturing industry (Cimini et al., 2020). Nevertheless, a deficit of empirical research offers a comprehensive analysis of smart factory evolution, particularly within specialised industrial sectors such as rubber manufacturing (Saleem et al., 2024). This research bridges this gap by thoroughly analysing the DMS implementation within the Howick manufacturing facility.

Earlier studies have pinpointed obstacles to technology adoption in industrial settings (Kruger & Steyn, 2024). However, researchers still need to understand better how these obstacles affect employee actions and organisational results in rubber manufacturing operations. This research explores these interconnections, primarily focussing on the elements that influence data entry practices and their impact on operational insights and decision-making processes.

The rubber manufacturing sector poses distinct challenges that influence technology adoption differently from other industries. Unique operational processes and workforce characteristics in this sector shape how advanced management systems, such as the DMS, are accepted and implemented. This research examines these industry-specific factors to understand technology adoption in specialised manufacturing environments better. It also emphasises the need for research on the actual performance of manufacturing companies that have adopted smart factory technologies (Saleem et al., 2024). In focusing on the implementation of the DMS and its impact on manufacturing performance and sustainability, the study will deliver significant insights into the measurable impacts of technology adoption in the rubber manufacturing industry.

This study also contributes to the continued discussion about the importance of psychological dimensions in technology acceptance. Noriega Del Valle et al. (2024) strongly underscore the critical importance of taking into account and effectively addressing the various psychological barriers that may hinder individuals and business in order to ensure a successful and seamless adoption and implementation of advanced technologies. Through an extensive analysis and investigation of the various components that have a significant bearing on the adoption of technology, particularly DMS in the sphere of rubber manufacturing, this research improves and deepens our understanding of the psychological elements that are essential in the adoption of technology across diverse industrial contexts.

Ultimately, this research fills critical gaps in scholarly works on technology adoption in specific industrial settings, providing empirical insights into the deployment of advanced management systems in rubber manufacturing, and enhancing models for understanding technology adoption in the industry 4.0 era. These contributions make the study both academically robust and practically relevant for researchers, managers, and policymakers involved in industrial technology adoption.

1.6 The Business Need for the Research

Incorporating improved technological advancements to physical equipment has revolutionised manufacturing processes, allowing organisations to obtain unprecedented efficiency, productivity, and competitive advantage (Boppana, 2024). Businesses have become highly reliant on technological advancements, data analysis solutions, and digital platforms, and the importance of accurate data has become a high priority for businesses (Mogos et al., 2019). Despite the numerous benefits offered by these advancements (Rodríguez-Espíndola, 2022), challenges associated with the incorporation of technology persist, as demonstrated

by the reluctance of personnel at the Howick Rubber Manufacturing facility to engage actively with the DMS.

Overcoming these barriers is crucial not only for improving operational effectiveness, but is also essential for guaranteeing the organisation's long-term sustainability. The crucial significance of technology in modern manufacturing technologies such as DMS, IoT, and Big Data have emerged as essential components in harvesting sustainable performance within the manufacturing sector. These technologies enable data-driven collaboration and improve operational visibility (Kamble et al., 2021).

The DMS is designed to improve data entry, improve process efficiencies, and provide senior management with actionable insights that facilitate informed strategic decision-making. However, precise, timely, and thorough data input into the system is necessary to effectively utilise these benefits. Ineffective data entry procedures not only skew crucial insights but also make it more difficult for the company to stay flexible and keep a competitive edge in a changing market (Chen, 2024).

1.6.1. Obstacles to the Adoption of Technology

The challenges faced at the Howick facility reflect broader difficulties associated with adopting technology in industrial settings. Employee resistance, insufficient training, and the intricacies inherent in new systems considerably hinder advancement (Raj et al., 2020). In addition, the lack of long-term goals, poor management, and resistance to change are recognised as major obstacles by Glyptis et al. (2020). Rauch and Ansari (2022), added that the implementation of new technologies create strange surroundings, which makes workers feel alienated and resistant. If these issues are not resolved, they will impede individual involvement and the collective use of technical benefits. The problem of inadequate data intake is at the foundation of the challenges the Howick facility faces. Accurate data is necessary for successful decision-making, which aids companies in maximising resources, improving operational efficiency, and identifying opportunities for growth.

A lack of reliable data leads to operational inefficiencies, resource misallocation, and poor strategy planning (Shamim et al., 2020). Consequently, the organisation's overall effects include lower productivity, lower profitability, and a more vulnerable position in the market (Calış et al., 2021). For the purposes of getting the most out of DMS and related technologies, businesses need to cultivate a culture that values data accuracy, ongoing education and flexibility.

Through targeted activities, it is necessary to explore the root causes of worker resistance such as adequate training and difficulties using the system (Hwang & Kim, 2022). Additionally, in order to ensure that people are supported throughout the transformation, leadership must take the initiative to align technological projects with organisational goals (Sharma et al., 2023).

1.6.2. The Strategic Importance of the Research

Although prior research has explored the obstacles to technology adoption, there is a notable shortage in research investigating the specific influence of these challenges on employee behaviour and organisational outcomes within the rubber manufacturing sector. This research seeks to tackle the challenges faced by Howick operations, thereby closing the current gap. The objective is to provide actionable insights and strategies aimed at optimising data entry practices, improving employee engagement, thereby improving the overall productivity of the operations. The results will not only be advantageous for the Howick facility but will also establish a suitable framework adaptable to similar manufacturing operations, thereby constituting a vital contribution to the domains of technology adoption and industrial management (Kruger & Steyn, 2024).

1.7 Research Gap

Although previous studies have examined the obstacles to technology adoption, more needs to be known regarding the specific relationship between these barriers and their influence on employee behaviour and organisational outcomes, notably within rubber manufacturing operations. Previous research has primarily concentrated on identifying the barriers (Raj et al., 2020), investigating how they impact staff (Calış et al., 2021) and productivity benefits (Hwang & Kim, 2022), but not how they may be systematically overcome to enhance operational data quality and operational efficiency within the rubber manufacturing industry.

However, a gap exists with regard to theoretical insights and the methods by which these barriers, in a comprehensive sense, can be overcome within the manufacturing sector, particularly in the context of the rubber production sector. The rubber manufacturing industry is an essential driver of global production in many sectors, due to its ability to generate inputs and raw materials for numerous manufacturing operations which includes the automotive industry and mining operations. Its importance in developing tyres, seals, industrial products and other domestic components in a range of devices makes it essential for economic development and industrial sustainability.

Consequently, the rubber industry acts as a crucial barometer of economic advancement, and occupies a central position, especially within countries involved in its production (Fong, 2020).

This study seeks to close this gap, which is essential owing to the unique obstacles the rubber manufacturing industry faces. These include extensive industrial activities, extensive manual labour, the necessity for specialised skill sets, and considerable dependence on both traditional and cutting-edge technologies, thus distinguishing it from other industries.

1.8 Conclusion

This research addresses a salient deficiency in comprehending the obstacles associated with technology adoption within the rubber manufacturing sector, with a particular emphasis on the execution of the DMS at the Howick facility. By conducting a thorough investigation into the challenges associated with optimal data entry and system engagement, this study aims to furnish a critical understanding of the nuanced interaction between organisational practices and technological innovation in industrial settings. The findings of this study are expected to yield considerable advancements in both scholarly and academic applications in the realm of industrial management methodologies.

In order to resolve these issues, this study will identify the factors that hinder efficient data entry and assess how these affect employee engagement and productivity. Manufacturing operations that are looking to make use of advanced technological solutions to improve their operational effectiveness and decision making, this change will be particularly beneficial. Furthermore, this research endeavours to aide in closing the gap between the theoretical paradigms of technology adoption as well as the tangible challenges encountered by enterprises.

By focusing on the unique circumstances of the rubber manufacturing sector, the study will produce focused insights that can direct tactics meant to reduce resistance to technological change and enhance data-driven decision-making abilities. Ultimately, this research aims to enhance the overall understanding of how an organisation can skilfully navigate the obstacles of technology adoption within manufacturing environments. The Howick facility will benefit immensely from the insights of this research, which should also provide guidance for similar manufacturing entities facing similar challenges of technology adoption. Consequently, this study represents a significant breakthrough in the conceptualisation and implementation of technological adoption strategies within modern manufacturing environments.

2. Chapter 2: Literature Review

2.1 Introduction

Technology adoption in manufacturing operations, is a critical factor for organisational success, directly influencing decision-making, employee motivation, and overall productivity for many organisations. Technology can support manufacturing employees in resolving complicated problems and provide critical information that can be used for crucial decisions (Grover et al., 2022). Information Technology peripherals are essential resources for business that wish to achieve long-term sustainability, as these tools facilitate the development of valuable competencies within organisations, enabling them to offer sustainable benefits to stakeholders and establish competitive advantage (Jabbour et al., 2019).

Technology implemented within a manufacturing operation can extract data to predict future process behaviours, thereby assisting in making better business decisions (Kinkel et al., 2022). Consequently, it is difficult to dispute the claim that benefits associated with the incorporation of technology in the production environment are evident in the ensuing operational results.

Although the adoption of technology has been a success with significant benefits being realised, research has found that the introduction of technology is still not seamless and/or wholly accepted by many users (Adebanjo et al., 2021). In their research, Horváth and Szabó, (2019) discuss many standardisation obstacles, integration challenges, and data security concerns that might be a hindrance to the implementation of these technologies. Kouhizadeh et al., (2021) suggest that organisations should be aware of the various barriers and limits that may impede the effective implementation and application of this technology. These obstacles contribute to employee demotivation and decreased productivity.

Whether rooted in the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003) or other models, the literature on technology acceptance identifies elements like the apparent ease of use and usefulness as key components of successful implementation of new systems. Research in organisational behaviour has also examined how employee resistance often emanating from fear of change or lack of sufficient training can cause such implementations to fail. The phenomenon of 'mistaken resistance', which refers to resistance that is not based on valid concerns but rather on misconceptions or lack of understanding, is not just an individual preference. However, it can lead to systemic issues, such as poor and sub-par data entry practices, that decrease overall operational effectiveness.

When employees resist new digital systems, one common symptom is decreased accuracy in the data they enter. Operational inefficiencies have been associated with data entry problems, such as higher rates of errors and non-uniform input methods. Nevertheless, although a good amount of literature has documented the overall relationship between technology acceptance and operational performance, the extent to which employee resistance obstructs accurate data entry in industries remains undiscovered.

This literature review seeks to analyse the existing literature surrounding the historical barriers to technology adoption and the implications on data entry methods and motivation and productivity of workers in the manufacturing sector. Additionally, the review will delve into the literature concerning strategies that mitigate data entry obstacles employees face when implementing technological solutions such as DMSs.

Additionally, the aim of the review is to lay a foundational academic grounding within which the study will operate, to interface with the most appropriate theories and present strengths and weaknesses of those theories to drive the resulting research questions. The research will meticulously evaluate the existing literature and situate it within the larger framework of technology management and organisational behaviour.

In order to achieve this, a systematic literature search was conducted across various search databases such as Emerald Insights , Springer link, Digital library, Science Direct and IEEE Xplore , using keywords such as “technology adoption”, “barriers” , “information system”, “employee productivity” and “overcoming barriers to technology”. Peer-reviewed articles of publications published in the past five years were also included in the search parameters, along with selected seminal papers use as search references.

The literature review will be structured into topics dealing with Barriers to Technology Adoption in Manufacturing; Motivational Theories in Organisational Settings; Theoretical Foundations of Technology Adoption; Investigations on Employee Productivity; and Technology Adoption in the Manufacturing Industry. The study will critically review the literature and show how the research fits into a wider paradigm of technology management and organisational behaviour. Finally, this review will include reflections based on literature on possible approaches to overcome some of these barriers..

2.2 Technology Adoption Definition

Outlining technology adoption requires an in-depth comprehension of how individuals and organisations begin integration of innovative technological strategies within their operations.

The adoption of technology encompasses more than the simple employment of novel instruments; it necessitates a significant evolution in the organisational culture and the attitudes of personnel (Martinez-Caro et al., 2020). This principle underscored the critical role of combining innovative technologies with current work methodologies to bolster operational productivity and efficiency.

Kamble et al., (2019) defined the adoption of technology as the “stage of selecting a technology for use by an individual or an organisation”. Whereas Salahshour et al., (2018) defines it as the identification or the initial application of a developing technological innovation or commodity. The amalgamation of advanced technological solutions has the capability of exponentially improving the operational efficiency and effectiveness of any operation, functioning as technology is a vital factor in establishing a sustainable competitive advantage for businesses (Neumeyer et al. 2020).

The adoption of technological solutions within an organisation necessitates the collaboration and alignment of all involved stakeholders. The successful implementation process encompasses the management of various elements that transcend mere interaction with the technology; however, individual factors such as attitudes, apprehensions regarding job displacement, and deficiencies in technological proficiency can significantly influence the degree to which a technology is embraced and utilised in a manufacturing context. An enabling work environment must be fostered by the relevant stakeholders to ensure that these variables do not obstruct this critical adoption process.

2.3 Importance of Technology in rubber Industry

Technology has become critical in rubber manufacturing, especially with most firms aiming to improve productivity and operational efficiency. Technological advancements are touted as a central role player in rubber manufacturing processes, as organisations aim to enhance productivity and operational effectiveness. Leveraging advanced technologies such as machinery automation and data analytics within the manufacturing sector enable operational experts to assume real-time tracking and operational data management, minimising operational downtime while boosting overall operational efficiency.

According to empirical research, the use of Industry 4.0 technologies, accompanied by the Internet of Things (IoT) and Artificial intelligence (AI), exhibits a strong correlation with improved decision-making and optimised resource allocation in manufacturing environments (Teck et al., 2019; Karmaker et al., 2023). As sectors such as the automotive industry and consumer goods change and undergo technological transformation, rubber manufacturers must adapt to emerging demands by embracing innovative technologies and sustainable

practices, greatly supported by technological advancements (Mahmood et al., 2021). Organisations can leverage modern technological innovations to overcome material wastage and cost variances and create a sustainable and cost-effective production system.

Additionally, the psychological factors related to technology adoption in rubber production play a vital role, especially in creating employee engagement while facilitating resistance to technological adoption. Numerous manufacturing employees experience anxieties when faced with the realities of using modernised technologies, predominantly due to concerns about job security and the ability to adjust to new operational frameworks (Ito et al., 2021).

Training programmes are required to address these challenges, and they need to be extensive, along with open lines of communication that foster trust and support workers' confidence in working with these technologies (Del Valle et al., 2024). According to research, recognising employees as key contributors to success, by creating a conducive environment helps to improve operational efficiency and paves the way for technological adoption (Molino et al., 2020; Nimran et al., 2024;).

Therefore, technology's role in the rubber manufacturing industry is not only to provide tools; it demands an organisation's culture of improvement or resilience. As such, the use of technology in rubber manufacturing also plays an important role in adapting to changing market needs while meeting regulatory requirements. Including technological advancements would foster improved quality assurance and traceability along the manufacturing process, boosting product safety and customer satisfaction (Tams et al., 2020; Alrae, 2024). Additionally, the shift towards a circular economy pushed manufacturers to adopt better waste management practices, maximising the utilisation of resources and reducing environmental effects (Kamble et al., 2021; Karmaker et al., 2023).

Rubber manufacturing operations will be sufficiently equipped to foresee potential consumer behaviour shifts and adjust their production strategies when harnessing Big Data and predictive analytics solutions. As sustainability and environmental interests increase, technology becomes increasingly integral in driving business practices in line with societal interests and ensuring the long-term viability of firms in a fiercely competitive market (Mahmood et al., 2021; Karmaker et al., 2023).

2.4 Data Management System (DMS)

The Data Management System (DMS) is an advanced platform that uses programmable logic controllers (PLCs) to collect data from various machinery components. The PLC forms part of

an operational control system used to collect data within manufacturing systems (Das et al., 2020). The PLC facilitates the collection and merging of operational data from various equipment through sensors and actuator systems compatible with the DMS, an Information System (IS)-based platform (as per Figure 2.1) shows a basic multi-layered architecture for the communication systems.

An information system (IS) structure, as outlined in Figure 2.1, constitutes a collection of interconnected elements that gather, process, retain, and distribute information while also offering a feedback mechanism to facilitate the attainment of objectives; furthermore, this feedback mechanism aids organisations in realising their objectives by enhancing profitability, augmenting customer service, and bolstering decision-making and governance within organisational frameworks (Zemmouchi-Ghomari, 2021).

An Information System (IS) represents a comprehensive integration of peripheral devices and software applications, characterised by its advanced capability for interconnectivity that is designed to enhance the processing of a variety of components. Zemmouchi-Ghomari, (2021) defined an IS as a structured assembly of related entities that accumulate, analyse, preserve, and relay information, while concurrently implementing a feedback loop to fulfil a specific goal.

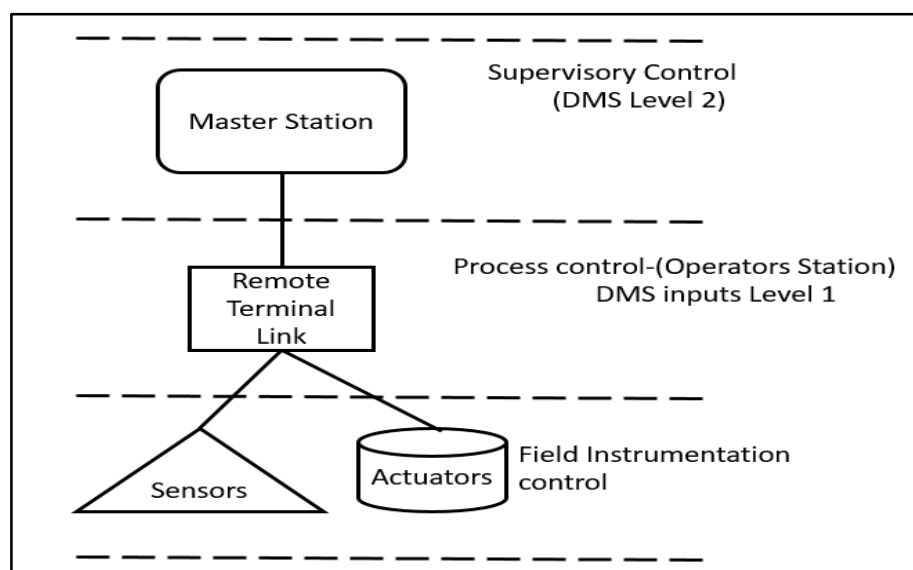


Figure 2.1: The Multi Layered System Architecture

Note: Adapted from: Endi & Elhalwagy (2010)-Three-layer PLC/SCADA system architecture in process automation and data monitoring

From this aspect we see that information systems provide operational frameworks that facilitate both intra-organisational and inter-organisational functionalities, thereby enabling the

transmission of data and consequently delivering essential value to stakeholders (Banker et al., 2006).

The fundamental approach to the formulation of a DMS system was to capacitate it with the ability to collect and present real-time data, providing an overview of the operational conditions of integrated systems. Alzeaar & Alsaker (2024) suggested that IS development is comparable to progresses made in computing technology and, in the present context, has become one of the most important resources within the decision-making framework and available to managers. In order to optimise the prospective benefits, Kim et al. (2023) advocated for the integration of a comprehensive structure that is based on business process re-engineering and sophisticated management practices, incorporating information systems for business. Many businesses arrange their information systems as illustrated in Figure 2.2., around the four key features of structures, technology, person and task, as proposed in the 1960s by Harold Leavitt.

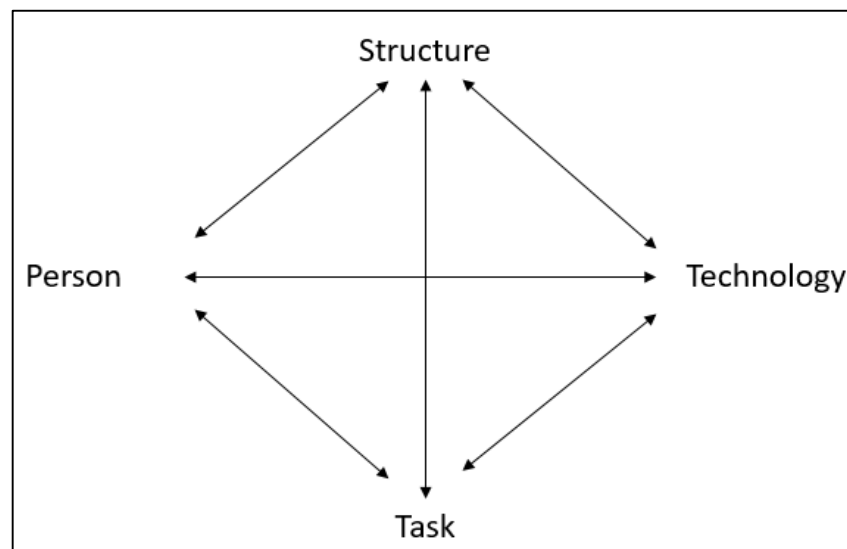


Figure 2.2: *A basic view of an information system*

Note: Adapted from: Zemmouchi-Ghomari, 2021.

Atieh et al., (2022), claimed that business information systems constitute a fundamental element in the era of technological advancement, and represent an essential factor in the execution of an intelligent manufacturing system. Such a holistic method of system management allows for greater operational effectiveness, efficiency, asset maintenance and smart operational adjustments. This constitutes monitoring and decision-making power within Howick Rubber Manufacturing.

2.5 Theoretical Framework

Several theories underpin this research study. They include the Technology Acceptance Model (TAM); the Unified Theory of Acceptance and Theory of Planned Behaviour (TPB) that collectively contribute to the emergence of the Unified Theory of Acceptance and Use of Technology. While the focus of the study will be primarily on the factors of technology adoption, it is essential to note the role played by the elements that drive individual's motivation. The Self-determination theory will also be explored in detail within this section.

2.5.1. Unified Theory of Acceptance and Use of Technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT) framework was conceptualised in 2003 as a broad model which aims to highlight the acceptance and utilisation of technology (Dwivedi et al., 2019); (Schretzlmaier, et al., 2022). The foundations of the theoretical framework that serve as its basis draws upon an aggregation, review, and contrasting of eight standalone technology acceptance frameworks that involved the Technology Acceptance Model (TAM) and the Theory of Planned Behaviour (TPB). The theory's primary objective is to evaluate the prospective success of novel technologies and to highlight the essential factors influencing acceptance, thereby enabling the proactive establishment of strategies to guarantee the acceptance and utilisation of systems.

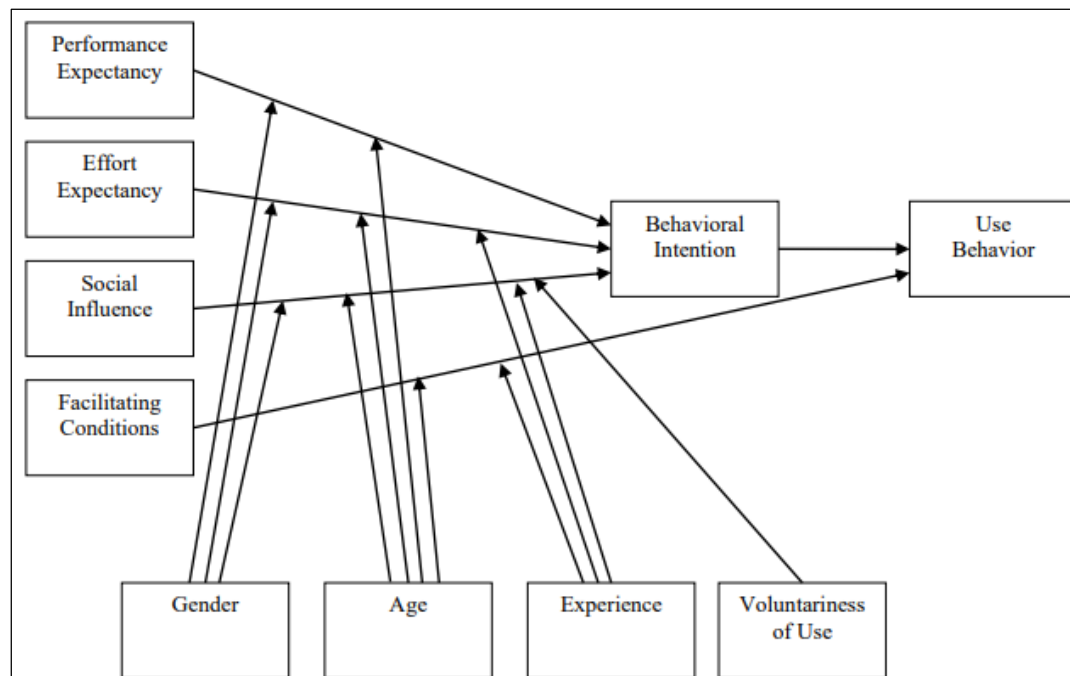


Figure 2.3: *The Original UTAUT*

Note: Adapted from: Dwivedi et al., 2022.

In their study, Donmez-Turan, (2020) indicated that the theory covers three overly determinant aspects which greatly influence the intention of using a technology, which in this case includes

performance expectations, effort expectations, and social influence, alongside two significant determinants of encountering the real technology of interest, being the behavioural intention and enabling conditions.

It also integrates four contextual components, including the user's gender; age; experience; and the voluntary nature of use, that influence the impact of these determinants on the behaviour and intentions of users (Venkatesh and Zhang, 2010; Wedlock & Trahan, 2019). Additionally, Schretzmaier, et al. (2022) posited that within the framework of the proposed UTAUT model for the study (see Figure 2.3), experience, gender, age, voluntariness and experience are the moderating factors which are the direct factors that affect behavioural intentions of the user as well as the behaviour.

Baumgarth, (2024) states that performance expectancy indicated the end user's anticipation regarding the usefulness of the system, along with the individual's function which corresponds to the usefulness construct in the TAM. The construct of effort expectancy represents that it is assumed that the system is user friendly and that it is more accessible to everyone, matching the TAM posited construct of the perceptions towards the ease at which the system can be used. Social influence is defined as how an individual interprets the expectations of peers regarding their adoption of the new system as meaningful.

In contrast, facilitating conditions explain the level to which users contend that there is enough organisational and technical hardware that supports the efficient deployment of the system (Baumgarth, 2024). Projected anticipation, perceived effort, and social pressure, all serve as positive indicators for behaviours established towards the intended utilisation of technology within the structure of the UTAUT. Combined with the facilitating conditions, this behavioural intention significantly influences the actual utilisation of the system.

By extending the existing research, Venkatesh and Zhang (2010) empirically validated the generalisability of the UTAUT model by showing its superior predictive power over eight competing theories. This validation highlights its holistic nature, where it also considered the contextual elements of the technology adoption field.

Later research in the field, including empirical validation of the UTAUT model, revealed its unification of numbers of basic theoretical models into one by researchers such as Dwivedi et al. (2019). These frameworks identified the multifaceted obstacles that hinder technology adoption in industrial settings, showing how UTAUT clarifies the challenges and complexity posed by these barriers.

In addition, as he maintained extending the model's relevance, Venkatesh (2022) stated that UTAUT has been employed widely and replicated repeatedly in a great many studies, covering not just organisational environments but also broader contexts. This can imply that the UTAUT is approach which will adapt to many technology scenarios in different organisational contexts, thus being directly perceived to the specific initiatives related to the Howick facility.

Moreover, Wedlock and Trahan (2019) show that an understanding of contextual analysis has implications for organisational technology implementation, as highlighted through the research. According to them, a holistic understanding of the unique organisational and cultural contexts behind the technology growth can greatly improve the effectiveness of extrinsic strategies. More so, it is unexpected that the acceptance model of UTAUT not only serves as a multidimensional model to encompass the various constructs and moderating variables for technology acceptance and usage, but it also rehabilitant scope of performance for use. This increases the model's value to researchers and practitioners alike who are trying to plan the implementation of these technologies in an organisation.

Essentially the UTAUT model is not only notable for its empirical rigour and broad structure considering different determinants and moderating variables in technology acceptance and use but also for its redeemable framework for numerous usages. This makes it an invaluable model for both for individuals aiming to strategise technology adoption within the organisational context.

This study is grounded on the UTAUT and Self-Determination Theory (SDT), which seek to examine the reasons to the barriers to technology adoption at the Howick facility. The UTAUT model is an essential approach for investigating the multiple variables affecting technology acceptance which emphasise productivity expectation, effort expectation, social influences, and facilitating condition (Venkatesh, 2022). Dwivedi et al. (2019) empirically validates the efficacy of UTAUT with robust evidence, suggesting that it was a carefully structured convergence of antecedent theoretical models.

These theories are used to the abstract conceptual frame that explore profound issues including diffusion technologies framework and their impact on industrial practice of technology. According to Venkatesh (2022), UTAUT is a common theory extensively and repetitively applied by many researchers successfully, repetitively. As such, it is used to evaluate a wide range of technologies and even includes scenarios outside of employee

adoption. In this research, the attempt is to adjust UTAUT framework to align with the specific operational setting of the Howick manufacturing operation.

2.5.2. Self-Determination Theory (SDT)

Self-Determination Theory (SDT) is a framework that was formulated by Deci and Ryan in 1980 and first published in 1985 (Manninen et al., 2022); it presents a nuanced psychological framework for rationalising motivation across diverse social settings, encompassing organisational behaviour and the adoption of technology. This literature review aims to consolidate and critically evaluate foundational theories alongside current research on SDT, particularly emphasising the impact of intrinsic and extrinsic motivations on technology adoption within organisational environments.

Self-determination theory is a comprehensive theoretical framework that pertains to human motivation, which has developed from empirical investigations conducted on intrinsic and extrinsic motivators and subsequently broadened to encompass studies relating to workplace organisations and various other fields of human activity.

Recent empirical research by Darner, (2012) and Ryan & Deci, (2024) indicated that SDT exists along a continuum with two extremes: intrinsic motivation and amotivation on the other extreme as outlined in Figure 2. 4. Individuals who consistently demonstrate self-motivation reside along a spectrum, with intrinsic motivation, representing participation in activities that require minimal effort for the inherent pleasure and/or fulfilment obtained from engaging in that pursuit (Leguall et al., 2007; Darner, 2012). This category classifies individuals as self-starters with the drive to execute and complete tasks without any external motivational factor.

Leguall et al. (2007) theorise that extrinsic motivation is found along the motivation channel and is characterised by a shortage or lack of purpose or rationale for involvement. This theoretical framework perceives extrinsic motivation as a driving force that compels individuals to engage in preliminary activities for advantageous purposes or to attain a reward. Often, individuals seek some means of motivation to realise a set of objectives. The assumption in this instance is that there will be a preferred or favourable outcome as a function of the activities conducted.

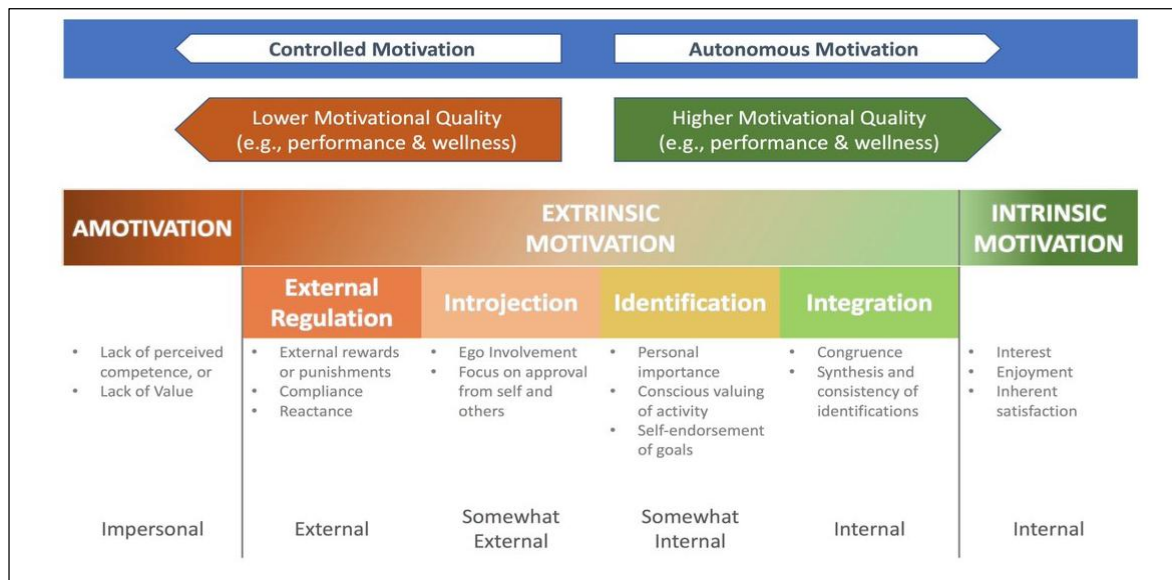


Figure 2.4: Self Determination Theory

Note: Adapted from: Ryan and Deci 2020

According to Legault et al. (2007), extrinsic motivation, which is categorised into four different classes of motivation, varies substantially in how much self-determination is involved: "Integrated regulation" signifies the most independent and affirmative expression of extrinsic motivation. It manifests when individual objectives, values, and needs harmonise with the self, thus becoming integral to our unique self-expression. An example would be a team member who continuously seeks solutions to operational problems with the main intent of ensuring they create an identity for themselves as proactive and innovative team members. The worker derives intrinsic satisfaction from contributing to operational efficiency and success, regarding these behaviours as reflections of their values and an intrinsic aspect of their identity.

"Identified regulation," less closely linked to the self-concept, pertains to objectives individuals pursue based on their recognised value or acknowledged significance. The employee or individual acknowledges the relevance or importance of an objective or recognised behaviour, value, or standard. An example would be a factory worker enrolling in a training program to enhance their capability to learn new technologies and processes to build their career development and advancement. The worker perceives this training as critical to achieving their personal ambitions, such as obtaining a promotion or transitioning to a higher-paying role within the organisation.

"Introjected regulation" represents a position on the SDT extreme where motivation is characterised by organisational forces outside the individual's position. Behavioural regulation is not entirely externally driven but is characterised by specific internal pressures and

constraints. An example would be a factory worker who feels compelled to remain late to complete the assembly of parts due to the desire to avoid feelings of guilt for leaving work unfinished or the fear of being perceived as less dedicated by colleagues and supervisors. The motivation still emanates from external pressures; however, the worker internalises these pressures as personal obligations or responsibilities.

"External regulation," the least autonomous form of extrinsic motivation internalises, fundamentally pertains to instrumental motivation; that is, behaviours are performed to attain rewards or evade unfavourable results. An example is an employee who works in a manufacturing entity as a machine operator. Their only objective is to ensure that the minimum production targets that have been set for them have been achieved, with the fear of facing disciplinary action for missing targets or forfeiting their bonus. The employee's motivation has no other driving factor than the need to avoid the adverse repercussions of reprimanding or not receiving incentives for not achieving their objectives.

"Amotivation," as described by Deci and Ryan, (2012) and further explored by Manninen et al. (2022), is positioned at the other end of the spectrum in contrast intrinsic motivation, signifying a state characterised by an absolute absence of motivation and purpose. Individuals who manifest amotivation may undergo feelings of disconnection or estrangement from their behaviours and goals and may confront a continual sense of learned helplessness (Legault, 2007).

Understanding the full spectrum of motivation, from amotivation to intrinsic motivation, is crucial in developing effective methods for increasing motivation, particularly in manufacturing workplaces (Gagné & Deci, 2005). Research indicates that increasing autonomy and competence can move people away from amotivation toward more self-determined forms of motivation. For instance, Manninen et al. (2022) emphasise supported teaching and leadership practices that nurture intrinsic motivation through the enhancement of psychological needs posited by SDT. Self-determination theory highlights how workplace conditions affect employee motivation and organisational engagement outcomes. The achievement of psychological aspirations tied to self-governance, expertise, and relational bonds is posited to cultivate intrinsic drive, which correlates favourably with superior performance and the well-being of workers (Deci et al. , 2017).

2.6 Data Management Systems Adoption

Adopting DMS in the Howick manufacturing operations is a pivotal transformation that enhances operational efficiency and improves decision-making practices within the operation. However, with the Howick operations facing growing challenges from global competitors and

supply chains of increasing complexity, the strategic supremacy of DMS should also translate into better use of data and therefore, drive further productivity and innovation. The research emphasises that successful implementation of a DMS that works, enables real-time data analytics, enhances inventory control, and promotes inter-departmental collaboration and live data management for processes. Nevertheless, moving towards adopting a data-driven operation is not without its challenges, such as overcoming resistance to change, lack of technical skills, and the need for a considerable financial outlay. For manufacturers seeking to use technology as a competitive advantage, understanding the drivers and inhibitors of DMS adoption is critical. The analysis in this research of the complexity of DMS implementation in manufacturing highlights the critical need for targeted strategies that can mitigate technical and organisational barriers.

However, the adoption of data management systems in manufacturing is often faced by several barriers that show both internal and external challenges. Research shows that intrinsic barriers such as the unavailability of technically skilled personnel and inadequate sponsorship by management are critical hindrances to the digitalisation journey of the manufacturing industry (Chauhan et al., 2021).

Moreover, external elements like the lack of government assistance and inadequate infrastructure also worsen these challenges (Eller et al., 2020). These include manufacturing and small and medium enterprises (SMEs), which face greater challenges due to financial constraints and fears of technology implementation (Majumdar et al., 2021). Advanced technology integration is partly due to resistance to change and poor understanding of the benefits where this has created an uninviting landscape for data management systems (Majumdar et al., 2021).

To overcome these barriers, a multidimensional approach that facilitates workforce skills increases managerial commitment and strengthens stakeholder partnerships among manufacturing ecosystem actors should be implemented (Alkhazaleh et al., 2022). Finely attuned interventions are critical to engaging this key sector in adopting adequately robust data management practices with the ease and coordination required for transitioning relatively seamlessly.

Generally, to successfully implement data management systems in manufacturing operations, it helps to adopt a varied technique that adjusts to internal and external barriers towards change. However, research has shown that many cases of resistance are caused by a lack of trained employees and poor management support, both of which are capable of impeding the merging of a technological innovation with operational performance (Chauhan et al., 2021).

For that reason, it is necessary to develop a framework of collaboration between industry, academy and government, which can favour an environment with the right conditions for innovation and sharing of resources (Eller et al., 2020).

In-depth customised training needs to be available to motivate employees to improve their information technology skills while management demonstrates the desire to drive digital transformation (Molino et al., 2020). The adoption process also needs to consider the culture of organisations, as social support and communication are crucial in reducing resistance to technology (Panari et al., 2021). The licensing describes a solution to this chapter by outlining how manufacturers can focus on aligning their human capital development with technology investment so they can adopt data management system, helping to improve the business performance overall (Majumdar et al., 2021).

2.7 Barriers faced by personnel in adopting Technology

Understanding the barriers to technology adoption is fundamental in addressing manufacturing firms' challenges. Scholars such as Roca and O'Sullivan (2020) have extensively studied the diffusion of innovations, outlining factors like complexity, compatibility, and trial-ability that influence the acceptance and integration of new technologies.

In the manufacturing context, these barriers may manifest in opposition from workers, insufficient skills and knowledge, lack of collaboration across departments, and absence of a clear execution plan and goals (Müller, 2019). Sharma et al., (2023) underscored the importance of identifying the obstacles that hinder the acceptance of sustainable practices and digital technology, which have the potential to convert industrial processes into intelligent, linked systems.

2.7.1. Technical Challenges

Recent academic literature underscores the urgent and significant technical challenges workers encounter while operating technology in a work context. One of the most pressing issues is data management and integration. The requirement for personnel to engage with data frequently necessitates a corresponding level of proficiency, without which, data management and analysis becomes unachievable (Justy et al., 2023). These challenges may obstruct the efficient utilisation and incorporation of these technologies across varied organisational contexts.

The review describes specific technological challenges including inaccuracies in data input, system integration challenges, and the imperative for organisations to provide the necessary technological expertise to support these technologies. Technology solutions which include IoT

, Big Data and DMS, presents a variety of technical obstacles for employees, which can greatly undermine their operational efficiency and effectiveness. These challenges encompass data entry issues, complexities related to systems integration, and the need for specialised technical skills. All of these domains come with their own challenges that need to be overcome by organisations in order to improve their data management foundations.

2.7.2. Data Entry Issues

In the modern era involving Big Data and the networking of institutions, large amounts of data are created, resulting in a complexity/diversity which makes accuracy and completeness difficult to measure. Consequently, this phenomenon heightens the likelihood of erroneous interpretations during data processing. Empirical studies indicate that errors in data entry are frequently attributed to human errors.

Employees often struggle to identify the origins of these errors, leading to inefficiencies in subsequent processes (Bernaldo et al., 2008; Kovacs et al., 2021). Raj et al. (2020) concurred, by asserting that the volume of data generated by a multitude of technologies and their processes makes it difficult to extract valuable information, which, in turn, extends to the data format and quality which includes, consistency, completeness, accuracy and redundancy, resulting in challenges for an organisation. Thus, it is clear that data is a dynamic, heterogeneous and high-dimensional phenomenon and handling such data to discover helpful information poses significant challenges (Alalawneh & Alkhatib, 2021).

Redyuk et al., (2021) suggested that data quality challenges typically encompass, among other concerns, improper formatting, incomplete data, misclassification, and inadequate data quality management during the input stage. This situation usually results in poor data quality and management at the organisation level; significantly impacts decision-making accuracy and operational efficiency, and limits the organisation's ability to fully leverage advanced technologies (Rahman et al., 2024).

Furthermore, with integrated systems, such as those operating based on Industry 4.0, ensuring integrity and consistency of data is another major challenge as data can be frequently updated and shared among several stakeholders (Raj et al., 2020). Among the challenges identified in the literature, researchers such as Molino et al. (2020) and Moldovan (2019), underscored the lack of technical and digital competencies, along with the necessity for adequate training, which emerge as critical and far more paramount than other requisites within the workplace. In addition, systematically designed training programmes equip workers with the required skills and thereby counteract the detrimental effects of continual technological evolution (Kaasinen et al., 2020).

Data integrity in digitised manufacturing has surfaced as a significant challenge, particularly concerning the accuracy of data entry into Management Information Systems (MIS). Decision-making processes predicated upon erroneous or incomplete data instigated suboptimal production processes and costly errors. In particular, the issue of poor data stems as far back as Redman (1998), who demonstrated that without sufficient data quality management protocols, even trivial inaccuracies can aggregate, leading to financial losses, operational inefficiencies, and non-compliance with industry standards and governmental regulations, whereas more recent studies by Cichy and Ras (2019) who ascertained that consequences of substandard data quality significantly shape the decision-making processes within an organisation.

These findings accentuated the critical need for focused research on ensuring high-quality data entry within MIS frameworks in digital manufacturing environments. Academic discourse increasingly emphasises that addressing data quality issues requires a methodical analysis of the data entry process, the influential factors contributing to information quality challenges, and the trajectories of information transformation within MIS.

In a contemporary study, Kim et al. (2023) highlighted the criticality of improving this system integrity phase to augment overall system reliability. Through the synthesis of these forms of analysis, academics can rigorously iterate through the consequences of failed data quality, illustrating the gap between theory and successful implementation within manufacturing decision-support paradigms.

Technology adoption within manufacturing operations has been identified as a key component for organisational success, directly impacting decision trees, workforce motivation, and productivity. Technological advancements can assist manufacturing personnel in navigating complex challenges and furnish essential information applicable to crucial decision-making processes (Grover et al., 2022).

Moreover, deploying advanced information systems is indispensable for achieving long-term sustainability and competitive advantage (Jabbour et al., 2019; Kinkel et al., 2022). However, despite these benefits, technology adoption is not universally seamless. Adebajo et al. (2021) indicated that integration challenges such as standardisation impediments, integration complexities, and data security issues (Horváth & Szabó, 2019; Kouhizadeh et al., 2021) – can hinder the effective utilisation of these systems, potentially leading to employee demotivation and reduced productivity.

Such stresses and information overload can be tackled through effective information management practices and a balanced working environment to prevent technology overload, burnout and increase employee productivity (Rasool et al., 2022). Numerous challenges associated with complexity and usability can be effectively addressed through the transfer of knowledge and the application of adaptive learning frameworks which are crucial for enabling tailored competency improvement and learning whilst performing work tasks (Kaasinen et al., 2020).

2.7.3. Productivity and Error Rates

New technologies enhance manufacturing productivity but do not consistently deliver immediate, tangible results. However, the absence or lack of training and resource preparation can lead to a temporary loss of productivity. Inexperienced employees may struggle to handle the technology, resulting in higher error rates. The integration of advanced technologies within the rubber manufacturing sector has the potential to enhance employee performance significantly.

Most organisations are adequately equipped to utilise technological components effectively to ensure they streamline operational processes through the IoT and Big Data analytics. These measures, in return, can reduce manual efforts which will result in the organisations experiencing sped up decision making in their processes. This shift facilitates the deployment of human capital into strategic roles, freeing employees to focus on mission-critical tasks instead of repetitive operations.

Recent pilot studies show that by controlling the use of technology one can be a step closer to achieving a healthy balance between work and personal life, as it reduces workload and stress from distractions and pressure caused by global demands (Tams et al., 2020; Tochia 2021; Gopinathan & Manoharan, 2022). Empirical research indicates that the judicious management of technology can foster a healthier equilibrium between professional and personal commitments by alleviating the burdens associated with overwhelming workloads and stress from interruptions (Tams et al., 2020; Ghobbeh & Atrian, 2024).

Consequently, businesses establishing a conducive and supportive environment that is defined by a robust training program as well as fostering open communication can improve employees' ability to use these technologies and strengthen a productive and effective workplace in manufacturing operations. Moreover, adopting a mindset that is open to technology implementation and use helps determine the employees' productivity rate. Well-structured training programmes and strong leadership are critical to ensure the reduction of

concerns over technological change and assisting employees in adapting to new technologies.

Studies suggest that personnel with confidence in their competencies are more inclined to embrace new technologies, thereby maintaining their engagement and productivity (Alnoor, et al., 2020; Del Valle et al., 2024; Karan, 2023) says that the development of a culture that prioritises psychological safety – characterised by mutual trust and transparent communication – serves to alleviate anxieties pertaining to job stability and work-life balance.

Similarly, Moser et al. (2021) state that certain indicators imply a significant correlation between organisational culture and organisational climate, and they explore the phenomenon, the genesis, and the impact of social contexts within organisations. Research conducted by Wahab et al., (2022), indicates that workers whose knowledge is profoundly integrated into the realm of technology, often referred to as tech-savvy individuals, possess the proficiency to navigate human-machine interactions, facilitate technology-technology interfaces, and foster creativity and innovation, thereby perpetually enhancing the instruments and equipment that confer a competitive advantage over rivals.

Therefore, encouraging employee involvement in decision making processes while providing them with the right aids stimulates creativity, innovation and maximises productivity within an operation, which is essential for the profitability of an organisation (Saleh & Auso, 2025; Ullrich et al., 2023). Finally, Technology can facilitate teamwork and collaboration within workers across not only local organisational divisions but across any number of site operations, which can increase productivity in complex manufacturing environments.

Collaborative tools enable effective communication between teams and fosters information sharing, which has the potential enhance team dynamics and elevate team efficiency (Schuh et al., 2014). Businesses that empower their employees, leverage data-driven insights and advanced analytical tools, as they are adequately resourced to make informed decisions, ultimately leading to improved production outcomes. Essentially, it is critical for organisations to acknowledge some of the difficulties that are associated with the adoption of such technologies, including the need to address skill gaps and resource constraints (Horváth & Szabó , 2019; Teck et al., 2019).

The purposeful establishment of critical strategies is capable of reducing the acknowledged challenges faced by manufacturing operations in adopting technologies. Through the intentional development of such strategies to address these impediments, rubber

manufacturing organisations can cultivate an ecosystem that harmonises technological progress with augmented labour productivity, thereby significantly improving the overall effectiveness of the organisation.

2.7.4. Interpersonal Barriers

The evolution of the manufacturing industry with technology is a complex process. It's not just about the technology itself but also the factors that interlink and create success from its adoption. Interpersonal challenges, encompassing a reluctance to embrace change, and barriers in communication, greatly affect the circumstances. Schein and Rauschnabel (2021) posited that the context of technological integration within the manufacturing sector, represents the extent to which employees exhibit a hesitance to and avoid utilising such technologies in their areas of functionality, despite being permitted or even encouraged to engage in their use.

According to Xu et al. (2023), the lack of standardised communication protocols has made it difficult for organisations to adopt their technological systems effectively, especially with external partners. Neumeyer et al. (2020) and Molino et al. (2020) continue by further noting that adverse socioeconomic conditions, typified by inadequate transportation systems, insufficient job opportunities, and limited access to information and communication, impose additional difficulties in fostering the critical competencies imperative for effectively utilising technology to enhance their operations. These barriers lower the employees' interest in adapting to the new technologies, resulting in lower productivity and more operational inefficiencies.

Such issues reinforce the need for organisations to build psychological safety cultures and ensure sufficient training to improve the acceptance and adoption of technology. Therefore, it is the obligation of the management to align themselves with employees and empower them to accept the attempted communication of the new technologies

2.7.5. Resistance to Change

Resistance to change has proven to be a significant barrier for organisations that have implemented new technology solutions. Anxiety about changes to their jobs and the new tools they will need to use, in addition to fear of job loss and additional work, is prevalent among employees. Scholarly investigations conducted by Ito et al. (2021) found that predominant sources of resistance encompassed feelings of excessive supervision, job insecurity, and inadequate organisational training, all of which impede the adoption of Industry 4.0 innovations.

Strategic communication regarding the positive aspects of advancing technologies and employee inclusion in the decision-making paradigm is vital in reducing these fears. Managers must drive initiatives to foster open and participatory discussions to establish a culture conducive to technological changes and reduce emotional and psychological resistance (Kamble et al., 2021; Ito et al., 2021).

Empirical evidence suggests that the lack of psychological safety, self-efficacy, and trust in management have significantly hindered workers' readiness to recognise a fast-changing manufacturing environment. In their research conducted in African operations, Bjorvatn and Wald (2020) emphasise organisations' need to cultivate supportive environments that encourage open communication and trust, essential for enhancing technology acceptance. Moreover, the evolution of fear of obsolescence, digital literacy shortages, and the psychology of accepting manufacturing technology has been extensive. Initially, most literature addressed technology and its implications without addressing employees' fears. Initial research suggested that the anxiety about automation and digitisation impacting job security was widespread among workers and affected their readiness to adopt new technology (Trenerry et al., 2021).

This fear has been linked to psychological factors such as increased anxiety and resistance to change, thereby affecting organisational productivity and morale (Rapaccini et al., 2020). Various studies noted that insufficient digital skills heightened redundancy fears, leading to further resistance against adopting advanced manufacturing technologies (Fraga -Lamas et al., 2019).

Recent literature elaborated that developing a culture for continuous learning and management support helped to relieve these fears, making the transition into digital environments much easier (D'Odorico et al., 2018). The relationship between psychological safety and technology acceptance is also an emerging theme.

According to research, training and trust-building enhance employee engagement with new systems. On the other hand, inadequate infrastructure and lack of strategic planning emerged as significant barriers to the acceptance of the technology, highlighting the need to address these issues for successful integration (Xia et al., 2024). Psychological impact of fearing job loss on employee engagement and technology adoption perspectives on workforce empowerment and proactive training initiatives have become central to modern discussions, emphasising the need for organisations to nurture both digital competence and psychological

resilience in their employees as they navigate the challenges posed by evolving manufacturing technologies (Xia et al., 2024).

Some critical themes in this area that affect the acceptance of manufacturing technology are fear of redundancy, digital literacy challenges, and psychological factors. The major obstacle is the fear of redundancy, where employees view technology as a threat to job security rather than a chance to upgrade their skills. Various studies have shown resistance and reluctance to new technologies due to this fear (Rapaccini et al., 2020).

The significant psychological hurdles around technology acceptance owing to cultural and contextual factors in regions like South Africa are major contributors to these fears (Dwivedi et al., 2022). The situation is complicated further by digital literacy challenges; a significant part of the workforce lacks the skills to work efficiently with new systems. Studies show that inappropriate training and support mechanisms contribute to fears of incompetence (Fraga-Lamas et al., 2019; D'Odorico et al., 2018), fostering negative attitudes toward technological change.

This cycle of low confidence leads to low motivation, which leads to resistance to change and back again, staged by the tension between fear of repeating oneself and a lack of older generations' digital literacy. Organisations need to invest in holistic training that fills skill gaps while developing a culture of psychological safety and trust to foster a communication mechanism that is becoming increasingly necessary (Baydeniz et al., 2024). Additionally, psychological factors such as self-efficacy are essential elements for technology acceptance, as employees with higher level of belief in their abilities are more likely to engage positively with new technology (Dwivedi et al., 2022).

This dynamic only reiterates the need for organisational support systems that allow employees to feel empowered to participate in and innovate with their technologies, adapting them as tools to support their growth rather than viewing them as adversaries. This synthesis points towards a need for multiple avenues to help support technology acceptance through training and support, addressing psychological needs, and addressing fears around job security. Qualitative methods, often used in studies exploring psychological factors, offer rich contextual data and a nuanced understanding of employee fears regarding technology adoption, particularly the anxiety associated with job loss and the impact of digitalisation on skills (Krauser, 2000; Rapaccini et al., 2020).

This fear can escalate with low digital literacy, where individuals feel overwhelmed by new technologies, leading to resistance rather than acceptance. Realising how psychological factors interplay with these concerns, studies indicate that individuals' emotions, specifically anxiety and frustration, can hinder their technological engagement and exacerbate feelings of redundancy (Fraga -Lamas et al., 2019; D'Odorico et al., 2018).

Individuals lacking confidence in their digital skills are less likely to perceive themselves as capable agents in adopting new technologies, thus experiencing heightened anxiety around potential job loss (Xia et al., 2024; Baydeni et al., 2024). Moreover, it emphasises the role of fostering a supportive environment that nurtures trust and psychological safety, where training initiatives can mitigate fears surrounding technological advancements.

The context-dependent nature of these factors aids in understanding the barriers to technology acceptance in manufacturing since contextual factor influences, such as socio-economic backgrounds and organisational culture, drive how people may respond to technological transitions. This multifaceted approach underscores the necessity of concurrently addressing psychological and educational obstacles to foster a successful transition to advanced manufacturing technologies.

Organisations can alleviate anxiety surrounding technological advancements by implementing mindfulness initiatives and establishing transparent feedback mechanisms. As the standardised sense of security, their engagement and willingness to adopt new methodologies are likely to increase, underscoring the critical role of a positive organisational climate in surmounting resistance to change in rubber manufacturing (Mahmood et al., 2021; Del Valle et al., 2024).

Businesses must introduce focused training sessions to effectively manage resistance to change and empower employees with the key competencies required for thriving in a technology-forward workplace (Ajayi & Udeh, 2024; Li, 2024). Organisations that deploy technological solutions should however, also guarantee that their personnel possess the requisite skills to seamlessly incorporate these innovations into routine operations.

A comprehensive and collaborative approach that integrates technical training components and interpersonal competency cultivation, has the potential to improve employee self-efficacy and organisation markedly. Continuous learning and resource allocation should be focused on developing workforce adaptability so that employees can navigate the looming challenges of the manufacturing industry. Organisations can therefore, identify these complex barriers and

address them to obtain maximum chances for enhanced productivity and change, thereby enabling effective technology adoption (Molino et al., 2020; Teck et al., 2019).

2.7.6. Communication Challenges

For any technological transition to be successful, effective communication is not just critical; it is empowering. Poor communication can create pockets of confusion and amplify resistance. For instance, if employees are not clear about the oversights or advantages of new technology, they will hardly engage with it effectively.

If organisations fail to brief employees about errors of judgment, shortcomings, or the benefits of new technology, employees will rarely consider it productive. Tams et al., (2020) analysed how the implementation of technology adoption-related policies has implications on technology use and argues that limited communication regarding the use of technology policies increases work-life conflict and stress, thus reducing the motivation for the adoption of technology. On the contrary, when organisations give clarity and get employees involved in the adoption process, technostress decreases and productivity increases.

Transparent communication ensures employees feel informed and part of the process. Research has shown that effective communication in organisations leads to lower resistance and higher rates of successful technology adoption (Tams et al., 2020; Molino et al., 2020).

2.7.7. Optional Use

Business aiming to achieve positive outcomes for technology need to create the correct environment and cultures to ensure the technology roll out is a success. For technology to actually work, and for it to be adopted, organisations need to support, shepherd, and show the business value of using it, instead of leaving it up to the user, or giving orders and not following through. Elbanna and Linderroth (2015) support this view indicating that Individuals do not adopt a new technological tool merely because it is accessible or user-friendly. The employee's decisions to adopting technologies are shaped by how well it aligns with their role, the workplace culture, past experience with similar tools and the organisation they work in. These individual and organisational factors together inform the decision-making process.

It is imperative therefore to adopt a holistic approach to technology that involves consideration of both the technical and human aspects. However, organisations must also navigate those layers in order for meaningful engagement to occur, because users will build perceptions of novel technologies through the interplay between their understanding of the tool, their professional identity, institutional norms, and actual work arrangements. Without technology

initiatives being aligned with users' roles, workplace culture, and existing practices, even the best systems run the risk of being underused or rejected

2.8 Organisational Support Factors

Investigations into how organisational factors influence technology adoption in rubber manufacturing operations reveal a progressive understanding of management's pivotal role in technology adoption initiatives. Early literature often highlighted leadership commitment as a potential facilitator or barrier to technology integration.

2.8.1. Resistance to Change

Resistance to technology implementation may be significantly reduced by engaging employees in the deployment process and ensuring they comprehend the advantages, thereby fostering confidence and a willingness to adopt new systems (Beckers & Geurts, 2019). While technologies that increasingly blur work-life boundaries can intensify both physical and psychological stressors, more ergonomic solutions and wellness initiatives can aid in reducing these stressors and improve overall well-being among employees (Gajendran & Harrison, 2007). Nevertheless, these technologies also have the potential to provide more autonomy and flexibility for employees, that, if managed well, increase job satisfaction (Cook, 2020; Ipsen, et al., 2021). Organisations can efficiently utilise technological solutions by providing a scope for actionable strategies that can yield enhanced employee productivity leading to optimised workplace outcomes for the organisation by bypassing these enduring challenges in work tech.

2.8.2. Training

For instance, studies suggested that initiatives tended to falter without strong leadership support due to insufficient staff motivation and vague strategic direction (Amin et al., 2024; Hassan, 2024). Notably, research pointed to aligning resource distribution with technological strategies to maximise operational efficacy (Alsolmy et al., 2023; Verma et al., 2022). Hence, organisations that provided training, realised improved employee competency and encouraged them to adapt to new technologies they intend to use (Aloqaily, 2021). This aligns with theories of organisational change that argue that holistic training creates a culture that is conducive to the use of technology (Ullah et al., 2019).

Training programmes, such as knowledge-sharing and knowledge-mapped sessions, substantially improve employees' capabilities, lowering the change-resistant barrier while increasing confidence in using new technologies (Alsolmy et al., 2023; Verma et al., 2022). It highlights how training is necessary for technology adoption.

2.9 Leadership

Recent studies have expanded to examine the interplay between organisational elements. Leadership styles that promote open communication and collaboration, enhance employees' willingness to engage with new technology (Sasangohar et al., 2020; Ivanov et al., 2021). Moreover, recent studies highlight that an integrative approach combining leadership engagement, proper allocation of resources and adequate training plans is still required in organisations (Ivanov et al., 2021; Trencher et al., 2020).

This perspective indicates the significance of the different elements of a successful technology implementation in the rubber manufacturing sector. Thus, it is evident that exploring these aspects is crucial for facilitating successful technological transitions in production environments (Ullah et al., 2019; Trencher et al., 2020).

In the existing body of literature, an additional pivotal thematic element arises, illustrating the impact of organisational determinants on the adoption of technology within rubber manufacturing processes, with particular emphasis on leadership endorsement and the allocation of resources. The commitment exhibited by leadership is widely acknowledged as a crucial factor, given that robust governance fosters a favourable conditions for integrating novel technologies.

According to Amin et al. (2024) and Hassan (2024), organisational leaders are the key behind innovations. They convincingly prompted their organisations to adopt new systems metaphors, that everyone appreciates whilst creating a culture of innovation that inspires the drive for automation.

2.9.1. Resource Allocation

Resource allocation also plays a crucial role, particularly in financial investment in technology (Aloqaily, 2021; Heslina & Syahrini 2021). Trencher et al. (2020) suggested that organisations that successfully adopted advanced technologies were the ones that had managed to persuade their executives to free up sufficient capital, suggesting that lack of funding was a significant barrier to adopting technologies.

Moreover, previous studies (Ullah et al., 2019) suggested that organisations that strategically managed their resources better leveraged technological developments to achieve improved operational efficiencies. Training programmes significantly facilitated skills development (including technical competencies) and provided user support. Sasangohar et al. (2020) and

Ullah et al. (2019) showed that structured training initiatives supported by organisational leaders are instrumental in addressing barriers to technology adoption.

A comprehensive analysis of the impact of organisational variables such as management commitment and resource allocation on organisational options in manufacturing operations exposed the intricate and multifaceted relationship contingent on different methodological frames. Qualitative research implied that commitment from leadership is paramount, using top-level management involvement as a crucial factor in organisations' potentially higher success rates in technology integration. For instance, qualitative interviews with industry leaders underscored the role of visible support in fostering a culture conducive to change (Amin et al., 2024).

Conversely, quantitative research generally flourishes on survey methods about the interdependence of financial resources with technology adoption. Research findings illustrated that the more firms successfully allocated their resources, the more effectively they implemented technologies in their operations (Hassan, 2024).

Additionally, case studies of specific regional practices in rubber production indicate that contextual variables, including local economic conditions and regulatory generalisations, can influence organisational behaviours concerning technology adoption. Although leadership and resources are key, these studies show they are often conditioned by external factors (Verma et al., 2022).

By integrating these diverse methodological frameworks, a more extensive comprehension of the organisational determinants critical for fostering technology adoption within the rubber manufacturing industry may be attained. This would highlight the necessity for strategic coherence between leadership endeavours and operational resource allocations (Sureeyatanapas et al., 2024). Resource allocation is equally critical in tandem, as adequate financial and training resources are essential for effective technology implementation.

The Resource-Based View (RBV) suggested that organisations leveraging their resources strategically, particularly in the context of financial and human capital, can achieve competitive advantages through enhanced technology usage (Alsolmy et al., 2023; Hwang & Kim, 2022). Research also underscored the importance of nurturing a principle of acquiring knowledge on a continuous basis through structured training programmes, directly linking leadership support to technological advancement (Trencher et al., 2020; Ivanov et al., 2020).

Conversely, impediments such as insufficient resource distribution or ambiguously articulated strategic objectives can obstruct adoption initiatives, as analysed by Sureeyatanapas et al. (2024). Consequently, a realistic understanding becomes essential in understanding these frameworks that guide the mechanisms by which organisational variables may either promote or impede the integration of technological innovations within rubber manufacturing processes.

2.9.2. Collaboration

Additionally, the need for collaboration among departments and an integrated approach to change management is underscored, as highlighted in Hwang & Kim (2022) and Ullah et al. (2019). Thus, it is clear that organisational aspects, particularly leadership and resource management, significantly shape the global landscape of technology adoption in the rubber manufacturing sector. An organisational theoretical lens is best for understanding the influence of leadership support, resource allocation, and other organisational characteristics on the willingness to adopt technology in the manufacturing industry.

2.10 Strategies for Success

Organisations need to take a proactive approach to overcome these barriers. These preparatory approaches create a sense of preparedness and confidence, thereby increasing acceptance of the changes proposed. Tams et al. (2020) and Del Valle et al. (2024) posit that organisations can mitigate these challenges with sufficient support by implementing training programmes to set clear parameters. Investing in employee development significantly improves productivity (Tams et al., 2020; Del Valle et al., 2024). Investing in employee development significantly improves productivity.

Organisations can mitigate these challenges by providing sufficient support and implementing training programs that set clear parameters. Comprehensive training helps workers prepare to use new technology or adapt to disturbed workflows. Address all possible fears, and assure that it will be worthwhile to work together.

Research indicates that entities that emphasise these strategies have an inclination to effectively adopting novel technologies while reducing disruptions (Molino et al., 2020; Tams et al., 2020). The research highlighted that proactive organisational practices can mediate the negative impact of interpersonal barriers on technology adoption. These issues highlighted the need for organisations to create environments of psychological safety and provide sufficient training to promote technology acceptance. Understanding these barriers and forming suitable strategies to overcome them, businesses can transition smoothly to new technology and achieve their goals.

2.11 Employee motivation impact

When analysing the limitations that influence employee motivation in manufacturing workplaces, a temporal analysis allows us to understand the progressive nature of these impediments to motivation. According to early studies like Herzberg (1959), many environmental and organisational factors impact job satisfaction and motivation, paving the way for more in-depth research in this area (Schmid & Dowling, 2020). As technology began to permeate manufacturing, research expanded to address how resistance to technological adoption directly correlates with motivation levels. Research highlights that employees often experience anxiety regarding new technologies, leading to decreased motivation (O'Driscoll et al., 2010; Pfaffinger et al., 2020).

Further examining this relationship, researchers cautioned that technological advances could impact intrinsic motivation if employees feel out of control with their work processes (Thomas, 2009; Adeel & Batool, 2023). Additional studies supported this new focus, by examining workplace culture and its central role in hopefully fostering or detrimentally impeding technological adaptation. Findings showed that a positive culture can ease feelings of doubt, thus boosting motivation (Namunane et al., 2019; Ryan & Deci, 2020).

Studies have added to the conversation by examining how these changes in motivation affect productivity. One consistent theme established across the literature was the negative impact of technological challenges on employee morale. In essence, literature indicated a stark transition from examining the basis of motivation towards the usage of factory automation, towards a broader movement which investigated the basis of motivation and its impact on technology and productivity. The relationship between technological constraints and employee motivation falls within the manufacturing ambit, which is highly interrelated and significantly affects productivity.

The impact of technological constraints on workers in the manufacturing sector is complex but has considerable repercussions for productivity. One common thread from the literature is that technological barriers act as a drag on employee morale. When technology is compromised due to interruptions and inadequacies, workers lose motivation and become frustrated and less engaged (Schmid & Dowling, 2020). For instance, it has been shown that when employees face frequent interruptions or inadequacies in technological infrastructure, their motivation declines significantly, leading to increased frustration and disengagement (Schmid & Dowling, 2020). This is further corroborated by research indicating that workers who believe they lack support in adjusting to new technologies are less likely to exert effort

toward their work, and this has a definitive impact on overall productivity (Lakhwani, 2020; Asghar et al., 2023).

2.12 Technology culture

An important success factor comes from within the cultural context of the manufacturing environment. Sapta and Setini (2021) suggested that organisations that cultivate a culture of technological acceptance and innovation can significantly enhance employee motivation, advocating that leadership and strategic vision are vital in addressing technological constraints. Combining these paradigms gives a multi-faceted perspective on the correlation between technical restraints and the motivation of the workforce, which can, therefore, be leveraged to advance productivity in the manufacturing industry.

Through various methodological lenses, this study draws out the causal interlinkages between technological constraints and employee motivation in manufacturing life. Moreover, technology encourages learning, impacting both productivity and work satisfaction, highlighting the need to embed methodological cross-cutting measures to understand the underlying mechanisms better (Sanchez et al., 2013; Adeleye et al. 2001). Studying technological constraints and employee motivation in the manufacturing sector is key to understanding how technological barriers impact the workforce.

According to research, adopting technology can be a double-edged sword that leaves workers feeling anxious and ill-equipped to operate new systems. This anxiety can serve to depress motivation levels and foster resistance to change, as suggested by various theoretical frameworks. As an example, the UTAUT model posits that perceived usability and perceived utility significantly affect individual motivation to adopt technological changes (Schmid & Dowling, 2020). Moreover, inadequate training has worsened these motivational declines, reinforcing the direct correlation between the employees' technology readiness and subsequent productivity (Lee et al., 2022).

Diverse theoretical perspectives converge when considering that the reduced autonomy driven by technological constraints can be countered with strategic interventions that create a more motivated workforce and high-quality production at a single workstation. Research also points to the role of organisational culture in shaping attitudes toward technology. A culture that promotes innovation and values employee input can bolster motivation, even in the face of technological obstacles (Hessari et al., 2024).

Meanwhile, Sanchez et al. (2013) illustrated that perceived organisational support plays a significant role; when employees feel backed by their management, motivation tends to remain

robust despite external hurdles. Conflicting theoretical perspectives converge and highlight how to facilitate motivation and overcome technological constraints within a contextualised manufacturing sector, yet targeted intervention can help downplay the hindrances posed by technology.

2.13 Enhancing behaviour

This study aims to provide relevant new insights into how a smooth transition to new technologies could be achieved and what mechanisms could specifically facilitate this process to circumvent these widespread challenges. The following sub-sections will unravel the complex relationship between employee behaviour and technological development by exploring ways to overcome employee resistance and adopt technology. These insights will ultimately assist academics and practitioners as they seek to drive new technology adoption.

2.13.1. Employee engagement

As organisations have recognised the interconnectedness between employee engagement and technology implementation, initiatives to boost morale such as involving employees in the decision-making process about technology deployment have become more prevalent (Surroca et al., 2009). Recent studies have further emphasised the strategic importance of addressing the psychological aspects of technology adoption, mainly focusing on fostering a culture of trust and open communication (De Souza, 2009; Ştefan et al., 2008).

These initiatives have shown promising results, with studies indicating that participatory change management procedures significantly reduce employee challenges and boost morale regarding technology adoption (Makala et al., 2024; Syamsuddin et al., 2024). Most notable is the critical issue of employee morale that has also led to a renewed focus on co-workers and management creating a conducive and supportive workplace/working environment, where innovative solutions are seen as a collaborative effort, rather than a top-down directive (Molino et al., 2020).

With most companies facing rapid technological change, these learnings have underscored the importance of cultivating an environment that harnesses an adaptive culture that promotes continuous learning and resilience over time (Majumdar et al., 2021). This emphasis on continuous learning and resilience can help the audience feel prepared and adaptable in the face of technological change.

However, the intersection of these multiple strands, which covers everything from training and morale-boosting initiatives to leadership strategies, implies that successful technology adoption in manufacturing requires a holistic perspective. This approach integrates these

elements to create an environment where employees are accepting and enthusiastic about new technologies (Majumdar et al., 2021; El Maraghy et al., 2021).

Understanding the themes involving employees and their resistance to adopting technology in manufacturing operations requires a multi-layered understanding. training, morale, and willingness to adopt technology are some of these themes, and a thorough understanding of each sub-theme is imperative for successful technology adoption.

2.13.2. Cultivating a positive and engaging workplace culture

When employees feel valued and engaged, they become less resistant. According to the literature, one of the key predictors of openness to new technology in employees is employee morale, which significantly affects their willingness to embrace and utilise new technology (Del Valle et al., 2024). One countermeasure was for organisations to prioritise transparent communication and joint involvement of employees in the technology implementation process and to encourage a culture of proprietorship (Bondin et al., 2024; Makala et al., 2024).

According to Dieste et al. (2021), proper communication and leadership commitment were among the most critical factors in reducing fear of new technology contributing to resistance. This underscored the influential role that leadership can play in shaping employee attitudes towards technology. Participatory decision-making and inclusive training programs also helped to improve employee morale and inform their willingness to engage with new systems (Verma et al., 2022; Jerbi et al., 2024).

2.13.3. Effective change management

Incorporating theories that address change management, which aim to communicate strategies that facilitate smoother transitions, is imperative for mitigating resistance. A series of communication strategies that help facilitate smoother transitions. One way to do this was by including employees in the implementation process and offering them extensive training programmes, which has yielded positive results (Syamsuddin et al., 2024; Sintharapantorn et al., 2023). Offering sufficient training and compassionate care helped to balance the burden of technological requests, which increases engagement and may lower resistance (Erena et al., 2022).

Addressing these challenges effectively starts with improving communication, obtaining feedback, and cultivating an inclusive culture. Taking into account all of the factors identified above will allow organisations to create strategies that are far more tailored to their unique situations, enabling them to drive not only tremendous enthusiasm for embracing new technologies among employees but also engender a culture that is committed to the pursuit of continuous improvement in the rapidly changing world of manufacturing operations.

2.13.4. Employee involvement

Ensuring the involvement of employees in the technology implementation process and providing complementary comprehensive training programs has shown significant positive outcomes (Syamsuddin et al., 2024; Sintharapantorn et al., 2023). Moreover, ensuring sufficient training and emotional support alleviated the burden of technological demands, leading to enhanced engagement and lower resistance among employees (Erena et al., 2022).

Ensuring that employees are actively engaged in the projects entailing the implementation of new technology, will not only foster a sense of ownership but also significantly reduced resistance to change, making the technology adoption process smoother and more effective for all stakeholders. Furthermore, when businesses purposefully invested in comprehensive training programmes, employees tended to gain the confidence that was required to navigate new systems, ultimately leading to higher levels of efficiency and productivity.

Beyond technical skills, providing emotional support throughout the adoption process can help reduce feelings of uncertainty or frustration for employees, allowing employees to adapt more easily and remain motivated. A well-supported and well-trained workforce is far more likely to embrace technological advancements, contributing to long-term innovation and organisational success.

2.13.5. Improve Communication

Enhancing communication, soliciting feedback, and creating an inclusive culture, are integral to addressing these challenges effectively. By integrating these perspectives, organisations can develop tailored strategies that not only elevate employee acceptance of new technologies but also foster a resilient workforce prepared for continuous improvement in the evolving landscape of manufacturing operations.

2.13.6. Training programmes

Systemic training regimens significantly increase job spirit and eagerness to onboard technology, backed by linkages between employee involvement initiatives and enhanced technology acceptance figures (Del Valle et al., 2024; Bondin et al, 2024). Studies indicated that structured training programmes considerably improved employee morale and willingness to adopt technology, as supported by findings that linked employee engagement initiatives with improved technology acceptance rates (Del Valle et al., 2024; Bondin et al., 2024). Furthermore, many researchers have described a relationship between extensive training programs and an improvement in technology adoption (ElMaraghy et al., 2020).

Not only does training allow employees to learn valuable skills, but it also makes them feel confident enough to adopt innovative processes. The differences in the effectiveness of training and employee readiness have led to disputes among academics about the best practices for attaining a high level of technology engagement (Argyropoulou 2013; Molino et al., 2020). These measures are crucial for solving the training gap. In addition to raising employee awareness of new technologies, effective training programmes equipped employees with necessary and relevant skills, improving their confidence and competence levels – both of which have been shown to impact employee performance significantly (Syamsuddin et al., 2024; Sintharapantorn et al., 2023).

Several studies have demonstrated that extensive training on new technologies reduces associated anxieties, which in turn improves adoption willingness (Erena et al., 2022). More profound acceptance and a smoother transition into new operational practices can be encouraged through the organisation of job-focused, tailored training sessions (Al-Madadha et al., 2022).

Focusing on employee needs also helps companies to develop a culture of acceptance. Research models which integrate a cycle of testing with an iterative approach have provided evidence that continuous training and support based on real-time employee feedback can accelerate technology integration and adoption (Majumdar et al., 2021; Sintharapantorn et al., 2023).

2.13.7. Mentorship initiatives

Peer learning is an essential element within the structure of learning approaches that businesses can employ to make learning effective. Implementing mentorship programs can support peer learning, as established workers can guide their colleagues in navigating new technologies (Majumdar et al., 2021). Overall, a strategic blend of support, training, and communication is pivotal in overcoming adoption challenges in manufacturing environments, thereby creating pathways for successful integration of technology into operational practices.

2.13.8. Task-specific engagement

Linking the benefits of technology adoption to job performance can significantly influence employee attitudes. When employees understand how new technologies can facilitate their workflows and lead to improved outcomes, their willingness to adapt increases (Surroca et al., 2009; De Souza, 2009). Workplaces are encouraged to have feedback systems implemented at the workplace, allowing staff to speak up and show that their concerns and suggestions matter (Majumdar et al., 2021).

Nevertheless, it is critical take note that there are considerable gaps in the literature on the long-term sustainability of these strategies or their generalisability to different organisational contexts. For example, although significant attention has been focused on training and management support, relatively little focus has been given to the complex interplay between employee satisfaction, technological adaptation, and organisational culture in general (Majumdar et al., 2021).

Furthermore, external factors, including industry standards and regulatory frameworks influencing technology acceptance, are underexplored (ElMaraghy et al., 2021; Panari et al., 2021). Understanding how behavioural and motivational factors influence an employee's willingness to embrace, or in contrast, resist new technologies, continues to be an area for further research.

Research shows that a more holistic approach, that considers psychological factors alongside other change management practices, could provide an excellent foundation for incremental improvement in results. (Del Valle et al., 2024; Bondin et al., 2024; Makala et al., 2024; Syamsuddin et al., 2024). Applying measures based on positive triggers and the use of gamification within training programmes constitute examples that could optimise the engagement of employees as indicated by the literature (Sintharapantorn et al., 2023; Erena et al., 2022) occupying those segments.

2.14 Employee motivation

Studies have highlighted novel ways to combat data entry challenges by drawing on motivation, gamification, and behavioural economics theories. For example, the Self-Determination Theory (SDT), suggests that individuals are driven by intrinsic, extrinsic, and social motivators, highlighting the significance of autonomy, proficiency, and connectedness (Chen, 2009). The Self-Determination Theory identifies six motivation types that map onto its contents, demonstrating the complexity and dynamic nature of motivation and giving individuals the ability to notice shifts in motivation type (Chen, 2009). This framework allows for the exploration of contextual conditions, such as instructor practices or social interactions, thereby amplifying or undermining employee motivation.

2.15 Gamification

Operations can harness the power of gamification to significantly boost employee motivation for prescribed activities, thereby fostering the desired learning outcomes (Dicheva et al., 2020). The transformation of monotonous tasks into highly interactive activities through gamification has been proven to yield positive results. For instance, the introduction of a point

system and a leaderboard for data entry tasks has led to higher accuracy while maintaining a stable decrease in task duration (Dicheva et al., 2020).

The incorporation of progress bars and achievement badges have also led to immediate increases in voluntary overtime for data entry tasks by engaged employees (Dicheva et al., 2020). Nah et al. (2019) further explored the effects of progress visualisation in gamified data entry systems, demonstrating the potential of gamification to revolutionise the workplace. This has been found to result in an increase in voluntary overtime for data entry tasks, and thereby incorporating elements like progress bars and achievement badges into the data entry process. This suggests that for repetitive tasks where one may become bored, it is necessary to provide immediate feedback as well as a feeling of achievement to keep people interested.

Nah et al. (2019) also argued that gamification can foster collaborative efforts among team members, support the measurement of progress, endorse project initiatives, supervise project management, contribute to change management, enhance software development and testing processes, and promote performance assessment throughout the implementation stage to optimize the efficiency of a business's systems. However, it is essential to ensure a balance is maintained in gamification implementation. Extrinsic gamified incentives should not be relied upon too much, according to Nicholson (2013), as they risk damaging long-term motivation. Mauroner (2019) suggested that meaningful gamification, in which the goals of the task are aligned with the interest and value of the user, would be far more useful when it comes to keeping people engaged long-term.

2.16 Behavioural Economics

Finally, behavioural economics offers valuable insights into how people make economic decisions in various contexts (Baddeley, 2011). Levitt et al. (2016) demonstrated through a series of field experiments that interventions result in individuals exerting more effort on low-stakes tests that have ramifications beyond the learning directives of a business.

By bringing together these perspectives, organisations can create more effective strategies to engage and motivate data entry workers through:

- Designing gamification systems that offer a point system tailored to the users that can track progress based on individual outcomes.
- Utilising loss aversion principles in framing incentives for maximum commitment from employees.
- Instead of deferred bonuses, provide immediate milestone-based rewards.
- Creating intrinsic motivation and a sense of purpose by focusing on how data entry work creates change.

- Offering consistent feedback and visual reports of progress to strengthen engagement.

2.17 Conclusion

This literature review employs a rigorous thematic approach to delve into the challenges employees face in technology adoption, particularly in the context of business implementation and employees' resistance levels. The literature suggests that the main issue of insufficient data entry can be traced to operational staff through overburdened input of operational data into an equivalent management system such as DMS. These issues reveal the problems in introducing Industry 4.0 technologies due to workforce resistance, psychological factors, and poor training programmes at the foundation of these challenges. The literature review supports this issue by showing that other studies have previously highlighted the same problems.

Ito et al. (2021) and Kamble et al. (2021) state that resistance is associated with three key contributors: job insecurity, lack of management, and lack of training, which are the problems of new technologies' low adoption rates. Notably, the literature review highlights studies carried out by Mahmood et al. (2021) and Del Valle et al. (2024), which indicated that a lack of psychological safety and trust in management reduced employee willingness to engage with technological change. The research findings further emphasise the research problem since they show that resistance is not just a technical concern but an employee and organisational culture concern.

On the other hand, training and skills development literature (Molino et al., 2020; Teck et al., 2019) contended that reluctance to adopt new technologies was due to inadequate training and upskilling opportunities. The literature supported the research problem's emphasis on addressing barriers to implementation through training programs. Furthermore, the literature indicated that too little communication and external socioeconomic limitations can lead to operational inefficiencies, one of the critical concerns highlighted in the review.

The review also focused on engaging the workforce, having appropriate training programmes, and securing buy-in from leadership, as potential tools to overcome the human factor of employee resistance to technology adoption. For organisations to benefit from advances in technology, a crucial role in actively managing resistance to change and user adoption should be assumed. Reskilling, emotional support, and clear communication of the benefits that the new systems will are all important enablers of a widespread acceptance of new systems. Commitment at the organisational top is still critical, and having a strategic readiness is key for the eventual transition.

Overall, this literature review synthesises relevant insights that aid as a foundation for addressing the research problem, highlights the importance of targeted strategies that enhance communication, training, and psychological safety, for successful acceptance of technology within the rubber manufacturing sector. Hence, this study examines the effect of technology adoption strategies on worker's adaptability in the new age of the digital evolution.

3. Chapter 3: Research Questions

3.1 Purpose of the research

The preceding chapters have successfully delineated the foundational objectives of the research, whose aim is to critically explore the impediments to technology adoption, particularly concerning the challenges associated with data entry within the DMS, and its repercussions on employee motivation and subsequent productivity in Rubber Manufacturing operations located at the Howick plant.

Manufacturing operations are strategically making decisions to transform their enterprises by enhancing their commitment to technologically sophisticated processes (Gupta et al., 2020). Consequently, these enterprises are equipping themselves to maintain their relevance amidst the ongoing technological evolution. Numerous operations are systemically evaluating the multiple opportunities presented by technological advancements and have allocated substantial resources to these initiatives (Román-Ibáñez et al., 2018).

In the examination of the literature pertaining to barriers to technology adoption and the enhancement of data accuracy and employee productivity, specifically within manufacturing operations, the review advocates for the theoretical framework illustrated in Figure 3.1. By engaging with the analysed data from the manufacturing sector, the theory was developed in accordance with the principles of the UTAUT, to augment the firms' capacity to sustain customer relevance (Donmez-Turan, 2020).

The fundamental aim of this study was to obtain comprehensive insights into how senior management could capitalise on the availability of technology to make informed decisions that would bolster the firms' competencies within the dynamic environments within which they operate.

3.2 Research Questions

To realise this objective, the study was then developed and structured to answer the following research questions:

Main research question:

How do barriers to technology adoption, particularly data entry issues in the Data Management System (DMS), affect staff engagement and productivity in the rubber manufacturing processes at the Howick plant?

Sub-Question 1:

What are personnel's main obstacles when adopting technology in the Howick rubber manufacturing operations?

This sub-question identifies and examines the main technical, organisational, and interpersonal obstacles employees encounter, specifically focusing on how these barriers directly impact their motivation levels (Herzberg et al., 1959).

What technical challenges do employees face when using the Howick plant's DMS?

This question explores specific technical issues such as data entry problems, system integration difficulties, and the need for technical expertise.

How do organisational factors, such as leadership support and resource allocation, affect technology adoption in the Howick plant?

This question investigates the role of organisational support, including leadership commitment, training programs, and financial resources, in facilitating or hindering technology adoption.

What interpersonal barriers, such as resistance to change and communication issues, impact the adoption of the DMS among employees at the Howick plant?

This question examines how interpersonal dynamics, including employee resistance, communication gaps, and team collaboration, influence the adoption process.

Sub-Question 2:

How do these constraints affect employee motivation in the manufacturing setting?

This sub-question examines the causal correlation between varying motivation levels caused by obstacles to embracing technology and the subsequent effects on productivity. It mainly measures changes in operational efficiency, quality of output, and error frequencies (Rana & Daultani, 2023).

How do technical challenges with the DMS affect employee motivation and engagement at the Howick plant?

This question explores the direct impact of technical issues on employee morale, job satisfaction, and overall engagement with their work.

What is the relationship between organisational support for technology adoption and employee motivation in the Howick plant?

This question investigates how the presence or absence of organisational support, such as training and resources, influences employee motivation and their willingness to adopt new technologies.

How do interpersonal barriers to technology adoption influence employee productivity and error rates in the Howick plant?

This question examines the impact of interpersonal issues, such as resistance to change and poor communication, on operational efficiency, output quality, and the frequency of errors in the manufacturing process. By addressing these secondary research objectives, the research intends to provide a complete understanding of overcoming the barriers to technology adoption at the Howick plant and their influence on staff engagement and productivity.

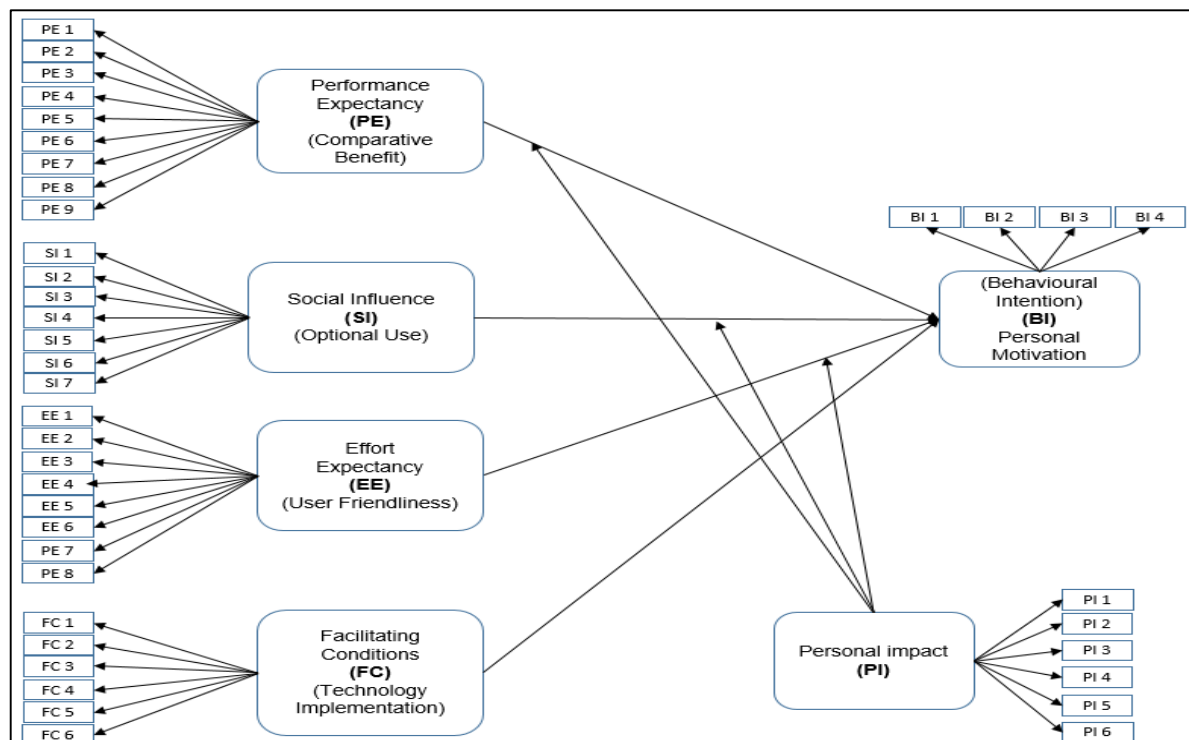


Figure 3.1: Research Model Concept

Notes: Adapted from: Bader, A. A., & Mohammad, A. Y. Y. (2019). The impact of task technology fit on employee job performance

3.3 Conclusion

Drawing on recent literature on the topic of barriers to technological adoption and the related behaviours, the current research presents the proposed model as illustrated in Figure 3.1. Within this quantitative study, each research question will be methodically operationalised through the application of structured survey instruments pertinent to the research, aiming to establish a definitive correlation between the research questions and the methodological framework employed, and will be outlined in the following chapter.

4. Chapter 4: Research Methodology

4.1 Introduction

This methodology chapter forms the basis for methodically addressing this study's research objectives and questions. In chapter two a comprehensive literature review was conducted on the barriers to technology adoption and poor data input within industrial operations. While there exists a plethora of literature on barriers to technology adoption, however, there remains limited formal information on studies being undertaken in rubber manufacturing contexts.

Within this chapter dedicated to methodology, the instruments identified during interviews highlighted the fundamental opportunities that initiate employee resistance to the technological components of DMS, as well as potential avenues for mitigation, while concurrently emphasising specific challenges related to inaccuracies in data sharing.

The chapter follows a stepwise approach to clarify and highlight the research process. The section starts by explaining the choice of methodology and design, and then justifying the choice of a quantitative method for studying the unique difficulties of technology adoption in the manufacturing industry. The next part describes data retrieval methods, including survey instrument design and sampling methods, followed by a description of the analytical tools applied to decode data.

The ethical considerations were also discussed, as were the limitations of the chosen methodology, ensuring that the appropriate professional standards are applied. Descriptions of the prescribed methods should assist the reader to understand how the study was conducted, and how the extraction of the results was undertaken, while also providing details on how the study's validity was assured, thereby ensuring its potential for further reproduction.

Data was collected by means of a 5-point Likert Scale administered by means of through a questionnaire. The subsequent evaluation of the data was conducted utilising SPSS software, which facilitated the application of linear regression techniques to determine the coefficients of the linear equations comprising the relevant variables.

4.2 Methodology Choice and Design

The study used a quantitative methodology directed by an explanatory research design and methodology for investigating the impact of technology adoption barriers on employee motivation and productivity in manufacturing operations. The choices made in the methodology aligned with the research problem, purpose statement, and insights gained from the literature review.

In this study, the explanatory research model was used to clarify the correlation between the variables and establish the causal relationships between the variables associated with the research (Rahi, 2017). This process was guided by a dialectical framework of knowledge supported by positivist philosophy, which emphasised the importance of objective, proof-tested, and substantiated measurable ways of obtaining conclusions (Turyahikayo, 2021).

Quantitative data was systematically gathered, analysed, and interpreted and conclusions focused on concrete, observable, and measurable themes. The theories for the study were identified to align research objectives with existing literary content, meaning that a solid foundation was laid to explore technology adoption barriers and motivators impacting on the productivity of manufacturing personnel.

The choice of method was a mono-quantitative explanatory design, as the chosen research design for the study measured the behaviour and interaction of the factory staff with the implemented technology at the manufacturing operations in the actual context (Saunders & Lewis, 2014). The research was explanatory reinforced by a positivist philosophy. According to Anatan and Nur (2023), quantitative research methods consist of a sequence of organised studies in which data is gathered and subsequently assessed through the application of computing or numerical techniques for statistical analysis. This approach made it a suitable choice for addressing the barriers towards technology adoption in the Howick rubber manufacturing operations (Bag et al., 2021).

4.3 Purpose of Research Design

The purpose of selecting a quantitative research design for this study was to investigate the barriers to technology adoption within manufacturing operations by systematically and empirically measuring their impact on employee motivation and productivity. The use of a quantitative study for investigating barriers to technology adoption in manufacturing operations, with a focus on enhancing employee productivity, is well-justified due to its capacity to provide objective, measurable, and generalisable insights.

Quantitative research employs structured tools such as surveys and questionnaires to collect numerical data, so that researchers can analyse patterns, relationships, and trends within a large sample of participants (Kamble et al., 2018; Sony & Naik, 2019). In this context, quantifying variables such as employee perceptions, levels of technology integration, and productivity outcomes provided a robust framework for identifying and prioritising barriers (Mittal et al., 2018).

Additionally, statistical analysis allowed for the examination of correlations and causal relationships between barriers and productivity metrics, fostering a deeper understanding of critical factors influencing technology adoption (Zhou et al., 2015). Understanding user expectations and organisational strategies through structured quantitative approaches also supported effective data-driven decision-making, enabling organisations to address adoption barriers and improve employee productivity (Sony & Naik, 2019).

This method simplifies the statistical examination of connections between identified obstacles and their outcomes (Saunders & Lewis, 2014). Therefore, for this study, the quantitative method provided an organised and structured process, ensuring that the findings from the study were based on statistical evidence rather than individual perspectives.

4.4 Philosophy

The study utilised a positivist philosophy that aligned with the researcher's point of view (Saunders & Lewis, 2014). This positivist perspective advocated for a systematic analysis of numerical data, allowing the study to successfully investigate pre-existing research questions. The goal was to provide valuable insights for organisational decision-making and improve understanding of the impact of technology adoption in the rubber manufacturing operations at the Howick plant. Park et al. (2020) state that positivist research aims to create connections or causal links that eventually enables the predictability and manipulation of the phenomena under investigation. In the pursuit of this objective, through this adoption of a positivist philosophical framework, this research sought to contribute to the accumulation of empirical evidence and objective insights, providing valuable knowledge for organisational decision-making and contributing to the broader understanding of technology adoption and its consequences in the rubber manufacturing operations based at the Howick plant.

4.5 Approach Selected

The study employed an exploratory quantitative technique, mainly guided by existing research questionnaires (Moore & Benbasat, 1991; Baskaran et al., 2020; Bader & Mohammad, 2019), which were adapted to gather information on the barriers towards technology adoption. The study aimed to uncover the barriers that inhibit the acceptance of technical advancements implemented by the company and potential ways of overcoming these.

The methodology facilitated a comprehensive examination of the data's causal connections, resulting in a thorough understanding of how technology improvements and the obstacles to their implementation affect operational effectiveness and employee involvement in manufacturing settings (Saunders & Lewis, 2014; Gunasinghe et al., 2020).

4.6 Strategy

The study used a purposive sampling strategy to select manufacturing organisations with diverse technology adoption experiences, such as manufacturing industries as well as the Rubber Manufacturing Factory in Howick. The study highlighted the need to employ a transparent and rigorous sampling technique to enhance its credibility. This study adopted a survey strategy and used the five-scale Linkert Scale questionnaire to collect participant data.

4.7 Time Horizon

The study embraced a cross-sectional design, which focused on collecting data at a single point in time (Saunders & Lewis, 2014). This design was well-suited to examining the current state of technology adoption and data entry practices and their immediate impact on employee motivation and productivity in manufacturing. A cross-sectional approach allowed for efficiently gathering data from diverse manufacturing contexts, providing a snapshot that facilitates a comprehensive analysis of the research questions.

The cross-sectional design was chosen as the appropriate time horizon for this study, enabling a comprehensive examination of technology adoption barriers, data entry challenges, employee motivation, and productivity in manufacturing operations within a specific timeframe.

4.8 Population

This study was undertaken at the Howick Rubber manufacturing plant and drew on population of employees working at the factory. The methodological details as to how the study was undertaken are described in the following section.

4.8.1. Target Population

In their studies, Saunders and Lewis (2014) and Denscombe (2017), defined population as the "complete group of members" from which the study would select respondents. Chetty (2019) posited that the population under investigation possesses a shared set of features, establishing a distinct group for targeted research analysis. This view is validated by Bell (2014), who stated that the characteristics of the entire population must be represented in a sample to provide reasonable confidence that the chosen sample sufficiently mirrors the larger population. The primary target population for this study comprised 494 factory workers employed at Howick manufacturing operations. These workers operate a spectrum of machinery, from fundamental to technologically advanced. The selection of this target population was grounded in the research problem, which aimed to explore the impact of technology adoption on employee motivation and productivity within a specific manufacturing context (Saunders & Lewis, 2014; Bell, 2014).

The inclusion criteria encompassed factory workers working with machinery within the Howick rubber manufacturing operation. This approach and involvement offered a more dynamic and adaptable contribution to the existing body of knowledge regarding the function of employees (Cetindamar et al., 2021). Janovac et al. (2021) proposed that employee motivation directly impacts productivity. Anisah and Wisesa (2021) noted that personnel needing more motivation tend to have reduced production levels, impacting overall operational efficiency.

4.8.2. Unit of analysis

Bhattacharjee (2012) advocated that a unit of analysis denotes a distinct, group, or entity that serves as the focal point of a survey in a research study. This portion of the study outlines the unit of analysis and details the rationale behind the selection of factory workers as the primary focus. The unit of analysis is crucial for understanding the impact of technology adoption on employee motivation and productivity in organisations (Kumar, 2018).

The reason for choosing the factory workers is that these technologies are predominantly utilised by factory workers. This decision is based on the specific roles and responsibilities of these workers, who are directly engaged with machinery and technologies. Factory workers are integral to the production processes, and their experiences provide valuable insights into the research problem (Müller, 2019).

The study adopted a random selection process to choose a defined sample of factory workers from a total pool of 494 manufacturing workers. This method ensured that the selected participants represented a cross-section of the entire population, enhancing the generalisability of the findings to the broader group of factory workers (Müller, 2019).

4.8.3. Sampling method and size

When conducting exploratory research, it is crucial to choose a sample size that is sufficient to have confidence that the data represents the characteristics of the population (Verma et al., 2022). This approach guaranteed that the data obtained directly applied to the study inquiries (Campbell et al., 2020).

The study emphasised transparency and rigour in the sampling method in order to increase its credibility. Kim and Seo (2013) further highlighted that determining the sample size was ethically and economically crucial to achieving the most benefit in a cost-efficient way. The sampling method used for this research was the sample calculator formula commonly known as Andrew Fisher's Formula (see figure 4.1 and figure 4.2).

The sampling frame was constructed based on 494 factory workers within the Howick manufacturing operations. The frame provided a comprehensive overview of the population from which the study drew its sample, ensuring that the selected subset represented the larger group (Saunders & Lewis, 2014).

Sample Size Calculator

Find Out The Sample Size

This calculator computes the minimum number of necessary samples to meet the desired statistical constraints.

Result

Sample size: **217**

This means 217 or more measurements/surveys are needed to have a confidence level of 95% that the real value is within $\pm 5\%$ of the measured/surveyed value.

Confidence Level: 95%
Margin of Error: 5%
Population Proportion: 50% Use 50% if not sure
Population Size: 494 Leave blank if unlimited population size.

Calculate **Clear**

Figure 4.1: *Sample size calculator*

The sampling method and size directly influenced the generalisability of the findings to the broader population of factory workers within the Howick manufacturing operations. The sampling method of the participants chosen for this study was random selection, aligning with the proposition to maximise applicability and minimise biases (Müller 2019). The study enabled the random sample selection of 219 respondents from the total pool of 494 manufacturing workers. This method ensured that each factory worker had the same opportunity to be included in the study, enhancing the generalisability of the findings (Müller, 2019).

Margin of error: 8.58%

This means, in this case, there is a 95% chance that the real value is within $\pm 8.58\%$ of the measured/surveyed value.

Confidence Level: 95%
Sample Size: 100
Population Proportion: 60%
Population Size: 494 Leave blank if unlimited population size.

Calculate **Clear**

Figure 4.2: *Margin of Error*

Random selection was employed to minimise selection biases and ensure that the sample was representative of the entire population of factory workers within the Howick manufacturing operations. This method increased the likelihood that the selected participants provided diverse perspectives, contributing to the validity and reliability of the study (Müller, 2019). The selection of 219 factory workers was adequate to capture diverse experiences and perspectives within the specific context of the Howick manufacturing operations.

4.9 Study Features

Recent research on the barriers to technology adoption in manufacturing processes has primarily relied on survey methods to study the presence of this issue. For example, Stornelli et al. (2021) undertook a methodical study exploring the difficulties and enablers of using advanced technologies. Their review consolidated findings, thereby indicating critical insights into the determinants affecting technology adoption within manufacturing contexts (Stornelli et al., 2021).

The survey employed in this survey comprised of two principal sections: The initial section encompassed demographic analysis, as illustrated in Annexure B, intended to collect descriptive insights regarding the sample population, with a particular emphasis on the characteristics of respondents engaged in the manufacturing entity at the Howick plant. Such demographic information was necessary for creating meaning in the contextual conditions in which technology adoption occurs and ensuring that the results correctly reflect the organisation's makeup (Perdana et al., 2023).

The subsequent section of the survey was devoted to evaluating three pivotal research constructs: the primary challenges faced by personnel when utilising technology implemented in the Howick rubber manufacturing operations, how these constraints influenced employee motivation in the manufacturing contexts and how these factors impacted employee performance. The formulation of these questionnaires was meticulously crafted using established frameworks derived from previous studies, including modifications informed by Moore and Benbasat (1991), Baskaran et al. (2020), and Bader and Mohammad (2019). Thus, the research could be replicated with objectivity.

This consideration of the diffusion of advanced technologies and the barriers to their adoption was significant since they have been linked with better performance outcomes for operations and workers in manufacturing organisations. Evidence indicated that the incorporation of innovative technologies possesses the capacity to considerably enhance both operational efficiency and effectiveness, acting as a vital factor in the formation of a sustainable competitive advantage within organisations. (Neumeyer et al., 2020; Zheng et al., 2021). As

such, grasping the dynamics of how these capabilities engage with organisational processes is crucial for promoting innovation and enhancing competitiveness in the manufacturing domain.

Thus, the survey approach utilised to obtain technology adoption in manufacturing provides insight into demographic details as well as the specific dimensions of technology. By building on established classic frames and matching specific capabilities, the researchers provide important insight into the factorial circumstances of technology adoption in this crucial domain.

4.10 Measurement instrument

This study's chosen measurement instrument was a 5-point Likert scale survey questionnaire. The Likert scale is a highly effective method for assessing the extent of a participant's views and perspectives concerning statements presented in surveys (Baskaran et al., 2020). This instrument was ideal since it methodically captured quantitative data on factory workers' perceptions of technology adoption, employee engagement, and productivity. The questionnaire which is attached in Annexure A, was adapted from Moore and Benbasat, (1991); Baskaran et al. (2020); and Bader and Mohammad (2019) where the scale ranged from one to five with one representing "extremely disagree" to five representing "extremely agree".

Given the potential difficulties with language that arose from the geographical location of the operation, it was essential to ensure that the questions were clear, unambiguous, and devoid of any confusion. The survey was subjected to translation from English to IsiZulu and then translated back into English to verify semantic consistency (Prause, 2019). Survey questionnaires were deemed appropriate for this study as they allowed for standardised data collection, ensuring consistency in measuring variables.

As mentioned earlier in the study, the pilot study of eight individuals that was initially conducted with the limited sample of workers to determine the dependability of the survey questionnaires, aligned with the method suggested by Gaddekar et al. (2022), who emphasised that prior to the administration of the survey, the formulated questionnaire should be subjected to a trial assessment to establish and authenticate its transparency, trustworthiness, and content legitimacy. These eight samples were not included in the surveys that were returned for analysis.

The researcher thoroughly reviewed the survey questionnaires to ensure content validity. The questionnaire design prioritised ethical considerations, ensuring that the questions were clear and unbiased and did not infringe on the privacy or rights of factory workers. The researchers

selected the measurement instrument for this study based on its appropriateness, reliability, and potential for capturing quantitative data on the impact of technology adoption on employee motivation and productivity. The pre-testing process, involvement of subject matter experts, and ethical considerations contributed to the robustness of the measurement instrument.

4.11 Data gathering process

The researcher designed the data-gathering process for this study to ensure the systematic and ethical acquisition of data aligns with the research objectives. The data collection for this study involved administering structured surveys specifically developed to quantitatively evaluate the influence of barriers to technology adoption on staff engagement and productivity. In total, 219 respondents from 494 factory workers participated in the study. The respondents were handed an informed consent form integrated with the questionnaire. The form required the individual to complete the consent form before participating in the survey.

4.12 Pilot Study

Ibrahim et al., (2020) described a pilot study as a “small-scale study to test a questionnaire, interview checklist or observation schedule, to minimise the likelihood of respondents having problems in answering the questions and of data recording problems as well as to allow some assessment of the questions’ validity and the reliability of the data that will be collected.”

A pilot survey was run using eight respondents to ensure that the data collected would be valid and reliable. The aim of the pilot study in this research, was to aid in identifying possible issues within the research framework and/or the tools employed while also assuring that the measurement devices utilised in the study yielded reliable and valid assessments of the relevant constructs (Bhattacharjee, 2012). The pilot ensured that questions would be refined and that adaptations would be made to ensure clarity. Such an approach agrees with the survey-based research methods by Sim and Wright (2005). After running the pilot surveys, none of the survey questions needed clarification.

The duration of each survey response took an average of 18 minutes each. During the pilot phase. The surveys were administered in different ways depending on the respondents’ connectivity to email. Forty-three of the surveys were sent through e-mail to staff in the factory who had access to e-mail connectivity. Six of the surveys were manually conducted on a one-on-one basis during the pilot to ascertain the most feasible method of conducting the interview. The balance of the interviews were conducted to groups of between 17 to 32 respondents.

4.13 Data type

The research employed ordinal data that assessed the responses provided for closed-ended questions which gave the respondents various options to select from, according to the Likert Scale. Norman (2010) posited that items derived from the Likert scale type questionnaire can be accurately classified as ordinal. South et al., (2020) further contended that individual Likert items should be viewed as inherently ordinal, regardless of the particular configuration of the Likert scale.

4.14 Data analysis

The data analysis process is a phase wherein the data that had been gathered during the surveys, underwent statistical evaluations or alternative quantitative analyses (Denscombe, 2017). The data analysis was carried out using the statistical software SPSS. To investigate the structural composition of the elements within each factor and to authenticate the recommended scales associated with the model, factor analysis utilising Promax rotation was carried out on the variables pertaining to each construct.

Throughout this procedure, certain items were omitted either due to inadequate loading on any given factor or due to their substantial cross-loading across various factors. The reliability of amalgamating items from factor into a singular latent variable was evaluated through Cronbach's alpha, with an acceptable alpha threshold established at a minimum of 0.7. As the correlation among other items within the construct deemed to have been inadequate and adversely impact reliability, those items were discarded. The success of factor extraction was considered a success as the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) surpassed 0.6 and Bartlett's test of sphericity produced meaningful outcomes for the constructs under analysis.

4.15 Data Storage

In accordance with established protocols, all records of the data and the transcripts from the report pertinent to this study will be archived within a drive repository for a period of ten years, in conjunction with a secure cloud storage drive that solely contains data associated with this research. All information gathered via the survey will be preserved in a digital format, with physical copies being destroyed through shredding to ensure compliance with ethical standards.

4.16 Ethical Considerations

The study was rigorously considered to maintain the highest standard of research integrity and participant safety. The researchers afforded the participants every opportunity to

understand the purpose and process of the research and their rights in the research in an informed and voluntary manner.

Since most people on the Howick operations speak isiZulu, researchers translated the survey into isiZulu to assist those who might struggle to understand the questionnaire in English. Even though the translated version was available, all the respondents completed the survey in English and were comfortable with the language. The decision ultimately kept them as participants and prepared them to overcome potential language barriers.

A consent letter detailing the study's aims, methods, and purpose was linked to the questionnaire and sent to the respondents. It further explained that a translated version of the survey was available in isiZulu on request, thus enabling all target populations to partake in the study in their preferred language. In line with the principle recognised by Brooks et al. (2021), the informed consent process involved participants reviewing and signing a comprehensive consent document before commencing participation. This informed consent included information about the purpose, methods, risks and benefits of the study and the respondents' rights, including the right to withdraw at any point and that no one would be negatively affected by the withdrawal from the probe. The study stressed the necessity of protecting and safeguarding participant identities. To this end, this chapter systematically deconstructs and reinforces the research methodology.

This subsection discusses the basis of the selected methodology and design, combined with the reasons for selecting a quantitative methodology to explore the individual barriers that manufacturing entities experience in adopting such technologies. The researchers made sure that no personal information was collected or reported. When respondents were known to the interviewer, the researcher removed their names from all records for anonymity.

The researcher further collected the data related to the study and stored it securely, ensuring it was unidentifiable and that there was no way to track information back to any specific individual. The researcher ensured that access to the data that was gathered was limited to the study lead only to ensure controlled handling of sensitive information. The data was stored securely, in accordance with ethical guidelines, and were reported only in aggregated form to allow identification of individual participants.

Participants were informed through the consent forms in full about their rights, including the ability to opt out from the research at any stage of the research without giving reasons and

facing no punitive consequences. Their participation was voluntary, and they had an informed, comprehensive understanding of the study.

4.17 Quality controls

The data collection for this study involved administering a structured survey specifically developed to quantitatively evaluate the influence of obstacles to technology adoption on staff engagement and productivity. The preparatory phase aimed to identify potential issues with the survey questionnaires such as ambiguities or misunderstandings.

Therefore, the research team commenced the survey by undertaking a preliminary research study with a small cohort of eight factory workers. This was conducted to guarantee the accuracy and credibility of the gathered data. This test allowed for the opportunity to refine and adjust the questions, where necessary, to ensure clarity and comprehension during the main survey. This approach aligned with survey-based research methodology, for example, Sim and Wright (2005).

Throughout the data gathering process, continuous data quality checks were conducted to monitor the completeness and consistency of survey responses. These checks served to identify and rectify any anomalies or outliers in the data, ensuring the accuracy of the collected information. All data gathered within the survey, was uploaded and stored in an electronic format. Adherence to ethical considerations was a fundamental quality control measure that was prioritised.

4.18 Potential Biases

To ensure the credibility of the survey, the research aimed to tackle possible biases inherent in survey responses by applying measures to mitigate response bias. Particular emphasis was placed on concerns regarding potential management repercussions by ensuring the respondents' anonymity and confidentiality. Respecting participants' rights, ensuring informed consent, and maintaining confidentiality were all crucial considerations that contributed to the trustworthiness of the study to prevent bias.

4.19 Limitations of the Study

Recognising and addressing the following limitations was crucial for accurately deducing the study's findings and ensuring transparency in the research process. The study's approach, which focused on a cross-sectional quantitative design, naturally restricted the capacity to track changes over time or demonstrate a causal relationship between variables. Recent methodological reviews commonly criticised this limitation (Smith, 2021).

In order to address these constraints, the study utilised strong statistical controls and carefully analysed the results within the cross-sectional framework, as suggested by Lee and Schwarz (2020). Moreover, the dependence on data provided by respondents had the potential for bias, such as the tendency to present oneself in a socially desirable manner and the limitations of memory, both of which would have impacted the precision of the data. To address these biases, researchers implemented measures such as conducting anonymous surveys and utilising verified question scales to ensure the accuracy and honesty of replies. Researchers based these measures on the recommended procedure provided by Thompson et al. (2019). Furthermore, even though the researchers used random sampling to enhance representation, there were still non-response biases to some of the questionnaire.

A further limitation was that the research did not intend to study the holistic rubber industry comprehensively; consequently, it seemingly overlooked various perspectives and geographical contexts. The study was constrained by certain limitations, notably that it was conducted exclusively at the Howick facility (Lakhwani et al. 2020). As noted by Vermeulen et al. (2001), a risk of sampling bias arises when the research is confined to certain geographical areas, risking the neglect of important differences across sectors of activity. Noriega Del Valle et al. (2024) ultimately indicate that an exclusive focus on a singular site or a constrained viewpoint may overlook critical psychological impediments to the adoption of technology, thereby suggesting that the study's conclusions might be subject to bias.

The data gathered solely from respondents within the manufacturing environment of Howick restricted the depth of responses throughout the sector and diminished the overall understanding of the industry. Finally, out of the 219 respondents who chose to complete the surveys, nineteen returned incomplete surveys. Therefore, this yielded only 196 completed surveys which were ultimately analysed.

4.20 Conclusion

This methodology chapter highlighted the procedural format and structure which was used to undertake this study. First hand data was gathered by way of surveys utilising a five-point Likert scale from 219 respondents that were randomly selected within the Howick Rubber manufacturing site at which the study was conducted. Some limitations of the study were noted, mainly due to the fifteen incomplete manual surveys that were returned. The outcomes from surveys will be discussed in following chapter.

5. Chapter 5: Results

5.1 Introduction

The primary aim of this study was to investigate the reluctance exhibited by factory workers at the Howick Rubber Manufacturing plant to embrace the DMS, a technological platform designed to optimise operational data, enhance process efficiencies, and refine the accuracy of employee data input to ensure an increase in business productivity while also boosting employee motivation.

This study was informed by previous research carried out by Baskaran et al. (2020). To ensure the validity of our outcomes, a sample calculator was used to define the sample size that would represent the population that the survey is directed towards. This study sample calculator suggested a sample size of 217. Consequently, the research aimed to collect 217 valid surveys from factory employees based at the Howick plant with a total population of 494 workers.

The results chapter will resume by presenting an outline of the demographic make-up of the sample, which was selected to ensure the representativeness of the sample. Next, this chapter presents the information collected from participants who partook in the study, as specified in the preceding chapter. The chapter further presents the outcomes of the data analyses as well as the results. The arrangement of the findings corresponds with the research questions that were informed by the literature review, and designed to answer the objectives of this study.

5.2 Statistical description

The descriptive statistics presented a vital component of the study, offering a comprehensive overview of the population features of the subjects alongside fundamental information pertaining to the sample. This analysis highlighted the demographic attributes of the participants, which included gender, age and educational qualifications, and also detailed the extent of the participants' conceptualisation of technological advancements. Additionally, it provided characteristics of the employer by offering insights into the workforce size. A comprehensive overview of the descriptive statistics of the variables was provided.

5.2.1. Sample Description

The study had aimed to achieve 217 responses from factory workers who were actively interacting with DMS. A subset of the respondents employed Google Forms to take the survey.

However, most participants, who typically lacked access to technological resources, completed the surveys by means of manual forms.

The selection criteria for the respondents encompassed all factory workers who engaged with technology in their daily operations, particularly the DMS, at the Howick manufacturing facility.

Table 5.1 *Response Rate versus what was planned-*

Survey	Size of Sample	%
Number of planned Respondents	217	-
Total Number of Respondents	219	100%
Incomplete Surveys	19	8.67%
Trial Survey	8	3.65%
Final number of respondents for analysis	192	87.67%

Note. Adapted from Sileyew, 2019.

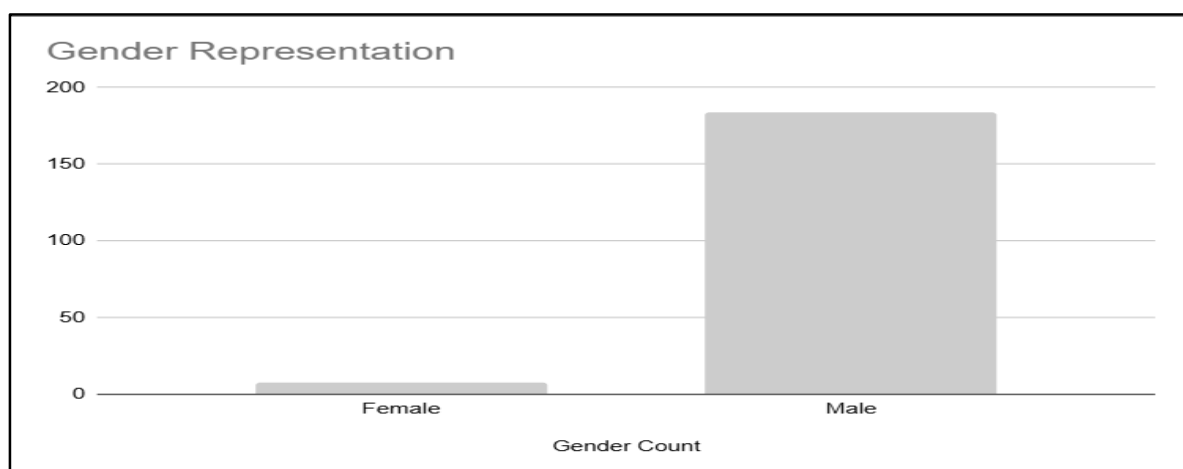
The study effectively gathered responses from 219 participants who engaged in the survey process. Table 5.1 outlined the distribution of the findings derived from the respondents. Out of the overall cohort, 19 individuals provided incomplete surveys, while the eight respondents who were involved in a preliminary trial phase, were excluded from the analytical assessment. Thus, the survey eventually resulted in 192 responses that qualified for additional analytical evaluation. This outcome constituted an 87.89% response rate relative to the total sample drawn for the survey. This level of success is regarded as adequate for the count of individuals who concluded the survey to fulfil the objectives outlined in the study (Sileyew, 2019).

Table 5.2 illustrated the analysis of the age distribution within the surveyed sample. The cohort that exhibited the greatest age prevalence was the 31–40 age group segment, which encompassed the largest representation of respondents, totalling 89 individuals, thereby constituting 46.35% of the overall respondents. Within the 18–20 age category, there was only one respondent, representing a mere 0.46%, thus indicating the lowest level of representation. The remaining age classifications were comprised of individuals aged over 50 years, and those within the 41–50, and 21–30 age groups respectively. These collectively accounted for the remaining 53.19%.

Table 5.2 Participant Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-20 years	1	0.46	0.46	0.45
	21-30 years	66	34.38	34.38	34.38
	31-40 years	89	46.35	46.35	81.3
	41-50 years	28	14.58	14.58	95.8
	Over 50 years	8	4.17	4.17	100.0
	Total	192	100.0	100.0	

There were only eight females from the total group of respondents, representing 4.17% of the overall sample. Hence it is apparent that the remaining 184 of the respondents were male, representing the remaining 95.83%.

**Figure 5.1 Gender representation**

There were only eight females from the total group of respondents, , representing 4.17% of the overall sample. Hence it is apparent that the remaining 184 of the respondents were male, representing the remaining 95.83%.

It is noteworthy that not all respondents had completed their secondary education. Out of the 192 total respondents, 25 had attained some form of high school education, representing 13.02% of the overall sample as seen in Figure 5.3. The distribution of educational attainment

among the remaining respondents included 6 individuals with postgraduate qualifications (3.12%), 115 high school graduates (59.9%), 9 holders of bachelor's degrees (4.69%), 5 individuals possessing master's degrees (2.60%), 27 with national diplomas (14.06%), and 5 individuals with trade and technical qualifications (2.60%).

Table 5.3-Employee level of education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bachelor's Degree	9	4.7 %	4.7%	4.7%
	High School graduate	115	59.9 %	59.9%	64.6%
	Master or Higher	5	2.6 %	2.6%	67.2%
	National Diploma	27	14.1 %	14.1%	81.3%
	Postgraduate	6	3.1 %	3.1%	84.4%
	Some High School	25	13.0 %	13.0%	97.4%
	Trade/Technical	5	2.6 %	2.6 %	100%
	Total	192	100 %	100%	

Table 5.4 shows the years of service of the employees within the organisation. This chart reflects that a large proportion of workers are still in the early stages of employment with the company. A larger number of the workforce, amounting to 124 (64.58%) individuals have been employed for a period that ranges between 0–5 years. The number of employees possessing longer tenures, specifically those within the 16–30 age category, is conspicuously lower, with only 6 (3.13%) individuals categorised in this bracket. The data additionally underscores a moderate level of employment tenure, as 58 (30.21%) employees are within the 6–15 age range, thereby highlighting a subset of employees who have exhibited a certain degree of stability within the organisation.

Table 5.4 *Employee years of service*

Number Years	Of Frequency	Percent	Valid Percent	Cumulative Percent
0-5 years	124	64.58 %	64.58 %	64.58 %
11-15	21	10.94%	10.94 %	75.52 %
16-20 years	2	1.04%	1.04 %	76.56 %
21-25 years	2	1.04%	1.04 %	77.60 %
26-30 years	2	1.04%	1.04 %	78.64 %
6-10 years	37	19.27%	19.27 %	97.91 %
Over 30 years	4	2.08%	2.08 %	100 %
Total	192	100 %	100 %	

5.3 Data Shape and distribution

Research examined the distributions of means, and standard deviations to understand the shape of the data for each variable. The mean and standard deviation provided key insights into how respondents perceived each construct. For this purpose, the research engaged statistical descriptors to analyse the shape of the data. The distributional patterns related to the mean and standard deviation values were employed to identify the data structure corresponding to each variable. The fundamental aim was to incorporate the optimised constructs derived from the validation assessments into subsequent statistical analyses.

The robust psychometric characteristics of the assessment affirm the dependability of the constructs for application in predictive modelling and decision-making processes. Each construct underwent prior factor analysis and was subjected to reliability testing, yielding acceptable Kaiser-Meyer-Olkin (KMO) indices, significant outcomes from Bartlett's test, and Cronbach's alphas that exceeded the requisite threshold. The research then used the validated constructs for further analyses as shown in Table 5.5.

Table 5.5 *Validated constructs*

Construct	Label	Items included
Personal motivation	PM	PM:1, 2, 4
Technology implementation	TI	TI: 11-16
User friendliness	EU (Ease of use)	UF: 2, 5-8
	CHAL (Challenges)	UF: 1, 3, 4
Comparative benefits	CB	CB: 1-3, 5-9
Work impact	WI	WI: 1-7
Optional use	OU	OU: 2-4

5.4 Mean

The mean represents the average response among all participating individuals, serving as a central tendency measure that reflects the perceptions of respondents regarding each of the constructs. It further represents the central tendency of a set of numerical values and is determined by combining all the scores within the distribution and subsequently dividing this by the number of individuals involved in the assessment (Mode, 2023). In the context of this study, it aided in determining whether respondents' express agreements, maintained a neutral stance, or exhibited disagreement with the presented statements. In the presentation of the results for this study it indicated either of the following:

- A mean greater than 3 signifies a general agreement with the statement in question.
- A mean approximately equal to 3 denotes a position of neutrality.
- A mean less than 3 indicates a level of disagreement.

The standard deviation is used as an indicator of the extent to which individual responses vary from the mean. A low standard deviation suggests that responses among individual respondents are relatively consistent, whereas a high standard deviation indicates a greater diversity in the responses provided by the participants

.Figure 5.2 represents the perceptions of respondents regarding PM in the workplace, particularly in relation to technology and satisfaction with their daily tasks. The most highly

rated factor, derived from the statement "I experience satisfaction when I believe that I have successfully completed the tasks for the day" ($M = 4.11$), signified that accomplishing daily tasks acts as a powerful motivator for employees, underscoring the significance of achievement in sustaining engagement. Likewise, taking the above statement, along with the statement referring to pride in one's work through the statement "I take pride in performing my job to the best of my abilities" ($M = 4.09$), exemplifies a robust work ethic, as employees aim to deliver their best performances, contributing to elevated job satisfaction and loyalty within the workplace.

Conversely, when employees perceived that they had not met their own performance standards, especially in relation to technology, feelings of discontent emerged, as reflected in the statement, "It makes me unhappy when my work does not meet my standards, particularly when using technology" ($M = 3.87$), indicating that unmet expectations regarding performance can adversely affect motivation and productivity.

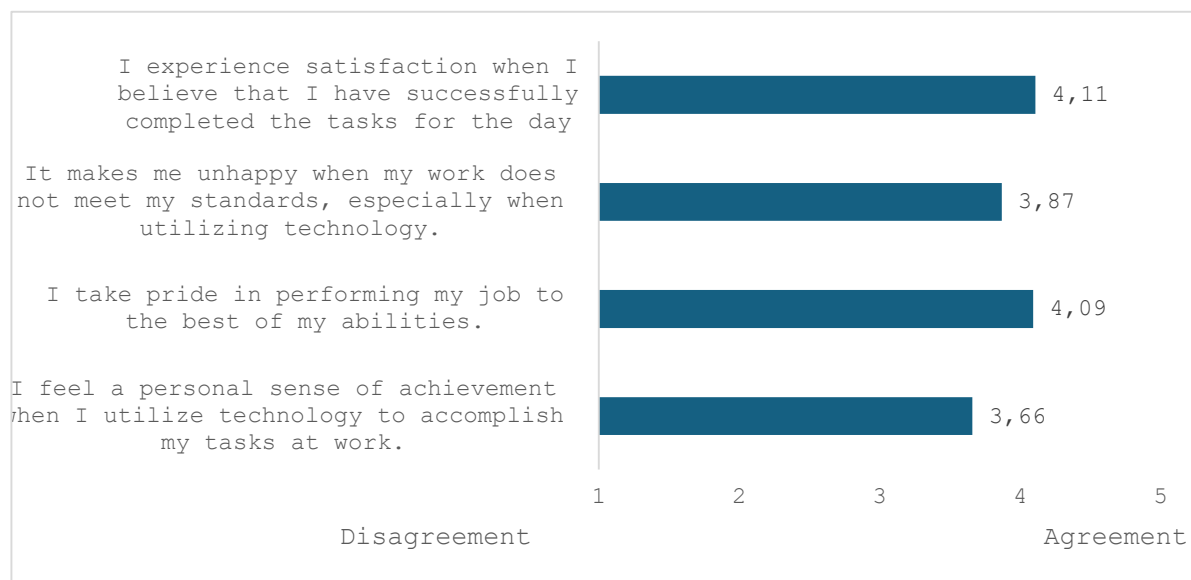


Figure 5.2 *Personal Motivation (PM)*

Employees recognised technology as a contributor to their sense of achievement, as shown by the statement "I experience satisfaction when I believe that I have successfully completed the tasks for the day," it received the lowest rating among the variables ($M = 3.66$), revealing that while technology contributed to motivation, it did not serve as a more powerful driver than task completion or personal pride in one's work. The statement indicated that while employees acknowledged the advantages of technology, its motivational influence was secondary to more intrinsic factors, such as pride in their performance and the success of task completion.

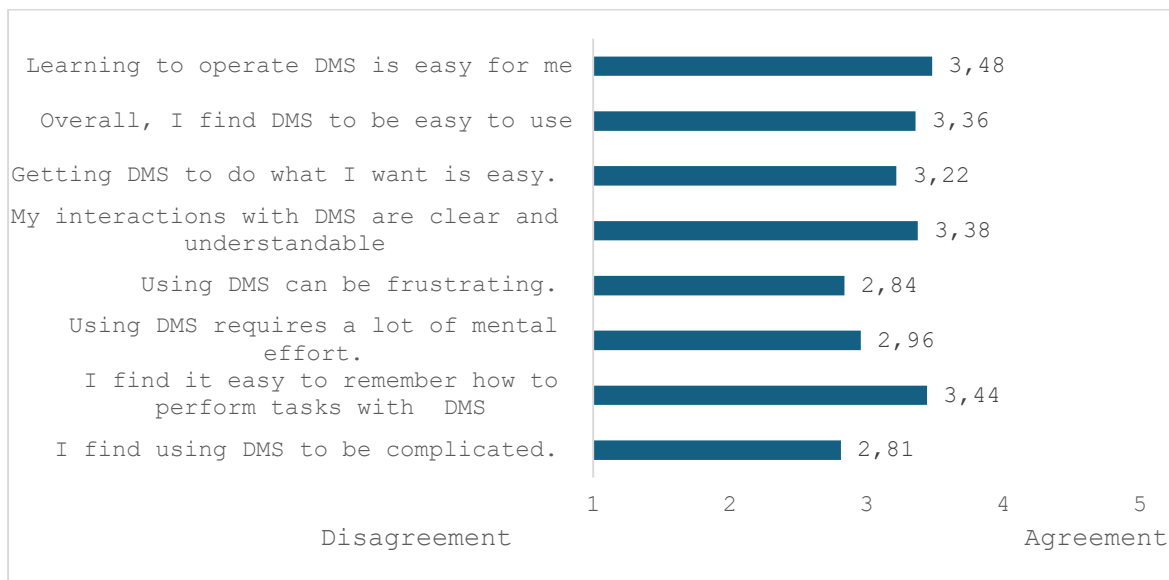


Figure 5.3 *User Friendliness (UF)*

Figure 5.3 illustrates the respondents' views on the platform's user-friendliness. The mean score of 3.48 for ease of use and an overall mean score of 3.36 for finding DMS easy to use suggested that there was agreement that DMS was indeed user-friendly.

The statement “my interactions with DMS are clear and understandable” ($M = 3.38$) reinforced that the system's operational intuitiveness is quite evident. Furthermore, in response to "I find it simple to recall how to execute tasks within DMS" ($M = 3.44$), indicated that users generally do not encounter significant challenges in remembering the operational procedures.

Challenges and cognitive load reflected through the statement, “using DMS can be frustrating” with a mean score of 2.84, along with the statement "using DMS requires much mental effort" ($M = 2.96$), lead to the suggestion that while the system is functional, a certain level of frustration and cognitive strain appeared to be linked to its use. The point, "I think using DMS is complicated" ($M = 2.81$), suggested that some basic users struggled with the system's complexity. The assertion that, "getting DMS to do what I want is easy" ($M = 3.22$), reflected that there is moderate agreement, indicating that while some aspects are straightforward, others may still present more challenges for employees.

Overall, the high scores on ease-of-use metrics suggested that the workers that used DMS generally regarded it as user-friendly; nevertheless, specific challenges persisted with the low score that may denote possible issues, potentially correlated with obstacles in task execution or inconsistencies in the system's responsiveness.

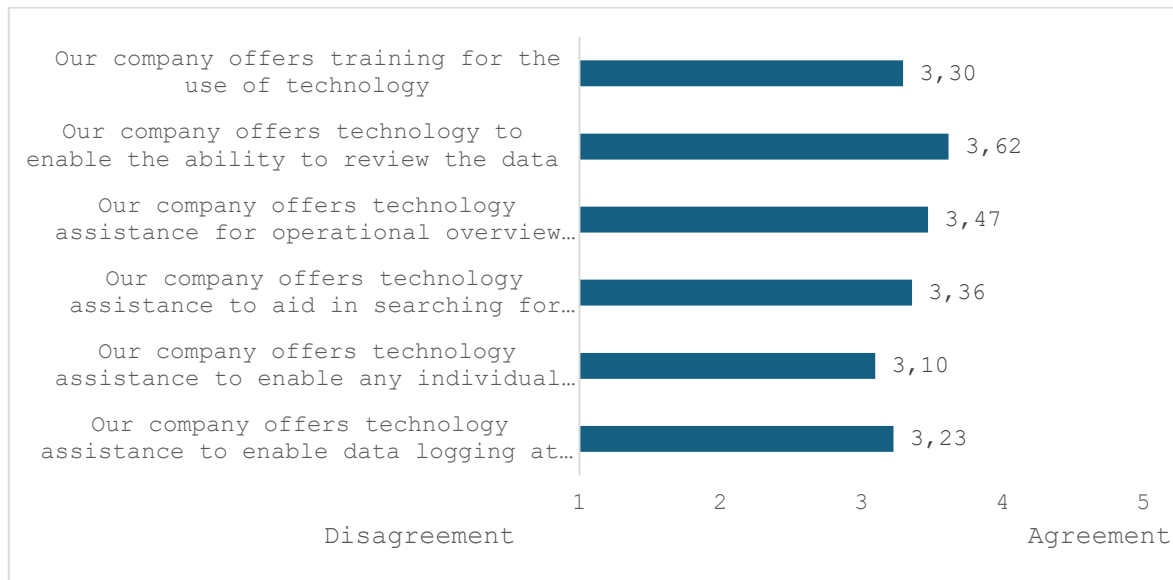


Figure 5.4 *Technology Implementation (TI)*

Figure 5.4 illustrates employees' views regarding the technological support and training offered by the company. The most substantial area of support category received the highest level of agreement on the statement: "Our company offers technology to enable the ability to review the data" ($M = 3.62$). Regarding technology-related convenience offerings, "Our company offers technology assistance for operational overview purposes" ($M = 3.47$) reflected that organisations were capable of assessing the effectiveness of the business model using technology.

Technology assistance indicated moderate confidence. A notably moderate level of satisfaction regarding data analysis retrieval, indicated by the mean score of (3.36) for the statement "our company provides technology support to help navigate capturing data and accessing relevant information" ($M = 3.36$), indicated a moderate level of satisfaction with the process of retrieving information. The statements "our company provides technology assistance so that data logging can occur anywhere" ($M = 3.23$), and "our company provides technology assistance so that anyone can log data at any time" ($M = 3.10$), implied the presence of data logging functionalities. However, there are certain limitations concerning accessibility and usability. Regarding technology use and training support, the statement "our company trains employees in the use of technology" ($M = 3.30$) obtained a moderate agreement, indicating that while the company offers training to the employees, it may not be adequate.

While observations showed that data review and operational support roles were well integrated and supported around company tech, some of the lowest were data logging and accessibility features, which could lead to users to find difficulty gaining access to recorded

data. Although specialised training in technology was being offered, it may not yet be sufficient to empower employees to fully utilise the tools available.

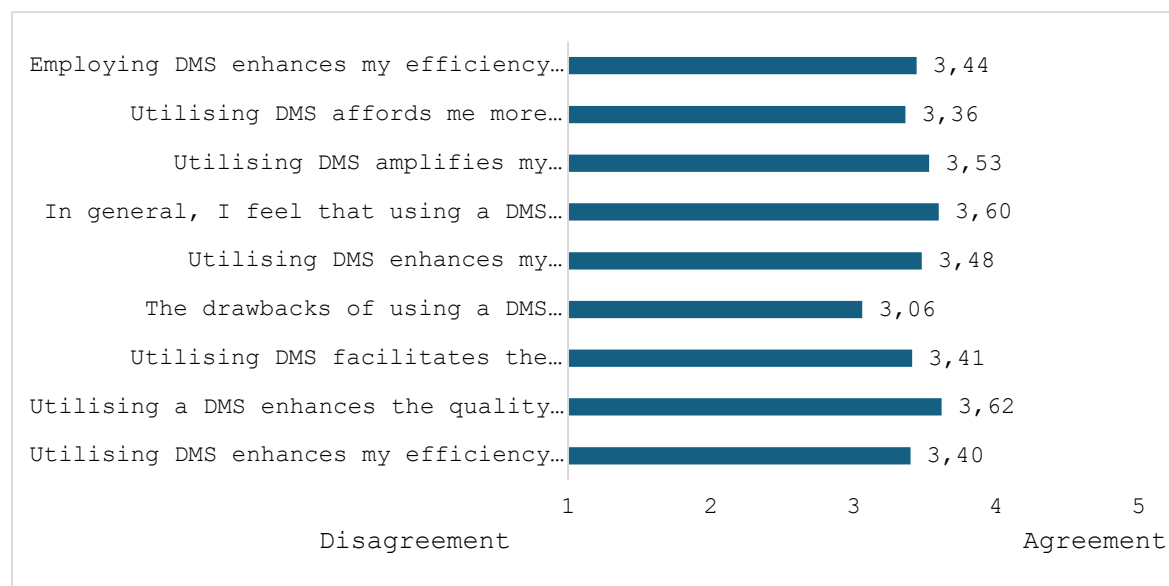


Figure 5.5 *Comparative Benefit (CB)*

As shown in Figure 5.5, employees believed that the DMS has contributed immensely to the efficiency and productivity of the employees and how they performed tasks. According to the feedback on the impact on the efficiency and productivity of employees, the majority of responses indicated strong agreement with the statement "utilising DMS amplifies my efficiency in the workplace" ($M = 3.53$) and "in general, I feel that using a DMS provides significant benefits in my job" ($M = 3.60$).

The statements "using DMS enhances my productivity" ($M = 3.48$) and "utilising DMS enhances my efficiency and output" ($M = 3.44$) demonstrated that many respondents viewed DMS as a recovery from productivity problems that they may have experienced with conventional methods of work.

Regarding task execution and work quality, "utilising a DMS enhances the quality of my work" ($M = 3.62$), suggested that employees believe that their work accuracy and output quality improved when utilising the DMS. These findings indicated a favourable effect on task management and workflow efficiency, as evidenced by "utilising DMS facilitates the execution of my tasks" ($M = 3.41$) and "utilising DMS enhances my efficiency in completing tasks" ($M = 3.40$). The statement "utilising DMS affords me more control of my work" ($M = 3.36$), suggested that, to some degree, employees felt they had greater control over their work when using DMS.

Concerns about the system's drawbacks have been raised, as shown by the following statements. The statement "The drawbacks of using a DMS significantly surpass its benefits" ($M = 3.06$) received the lowest score, indicating a neutral stance regarding potential disadvantages. The system's advantages outweigh its challenges despite a slightly negative concern.

Data Management Systems (DMS), enable employees to improve on the efficiency, productivity, and standards of the work where they are involved. Although task effectiveness and process management are regarded as reasonably positive in the overall sense, they present substantial opportunities to enhance the system's ease of use, and more specifically its adaptability. Employees rarely express concerns about drawbacks, so anticipated issues do not significantly impede progress.

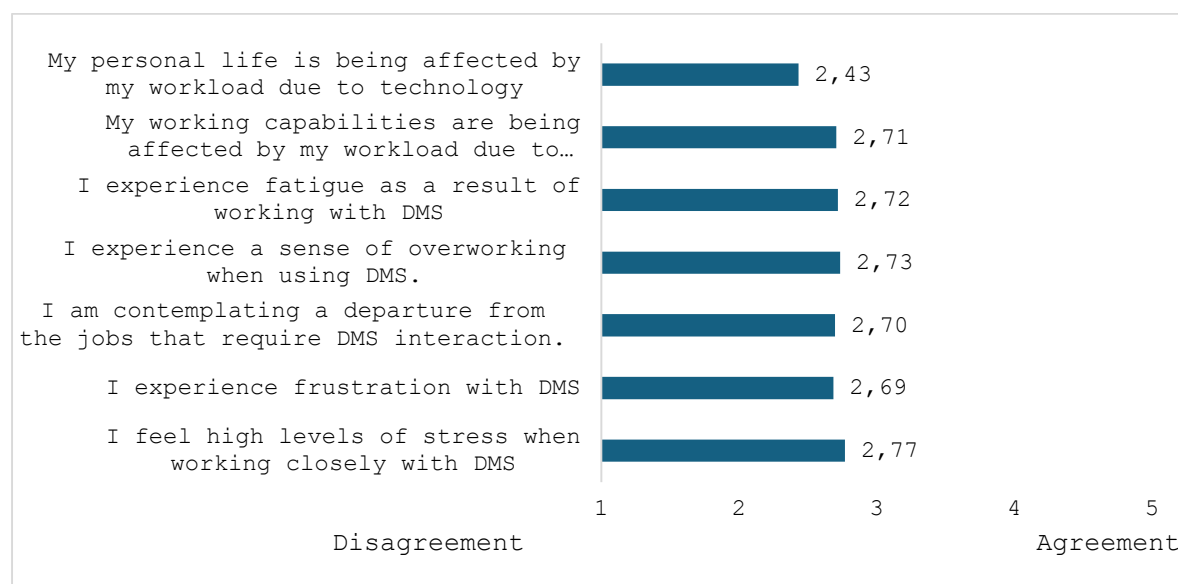


Figure 5.6 *Work Impact (WI)*

Figure 5.6 illustrates how employees perceive the stress, fatigue, and workload challenges associated with the DMS. On the other hand, even though three statements regarding this matter received high ratings, the consensus among users was that DMS did not significantly influence their personal lives, as evidenced by the lowest-rated statement: "My personal life is being affected by my workload due to technology" ($M = 2.43$). Nonetheless, moderate levels of fatigue and overextension are reported, with statements like "I experience fatigue as a result of working with DMS" ($M = 2.72$), and "I experience a sense of overworking when using DMS" ($M = 2.73$), reflecting some concerns about the intensity of the workload. The statement, "I am contemplating a departure from jobs that require DMS interaction" ($M = 2.70$), also suggests a hint of dissatisfaction. However, overall, the DMS itself did not appear to significantly impact job retention in push-type roles. Additionally, levels of frustration and stress are moderate

rather than severe, as indicated by, "I experience frustration with DMS" ($M = 2.69$), and "I feel high levels of stress when working closely with DMS" ($M = 2.77$), which again highlights some usability concerns by employees. In fact, although "my working capabilities are being affected by my workload due to technology" ($M = 2.71$) has a mean above 2, and the employees did not strongly agree that their workload had increased significantly following the implementation of DMS.

Overall, while DMS did not significantly negatively impact employees' personal lives, there was an indication of moderate level of stress and fatigue, suggesting opportunities for enhancing usability and managing workload.

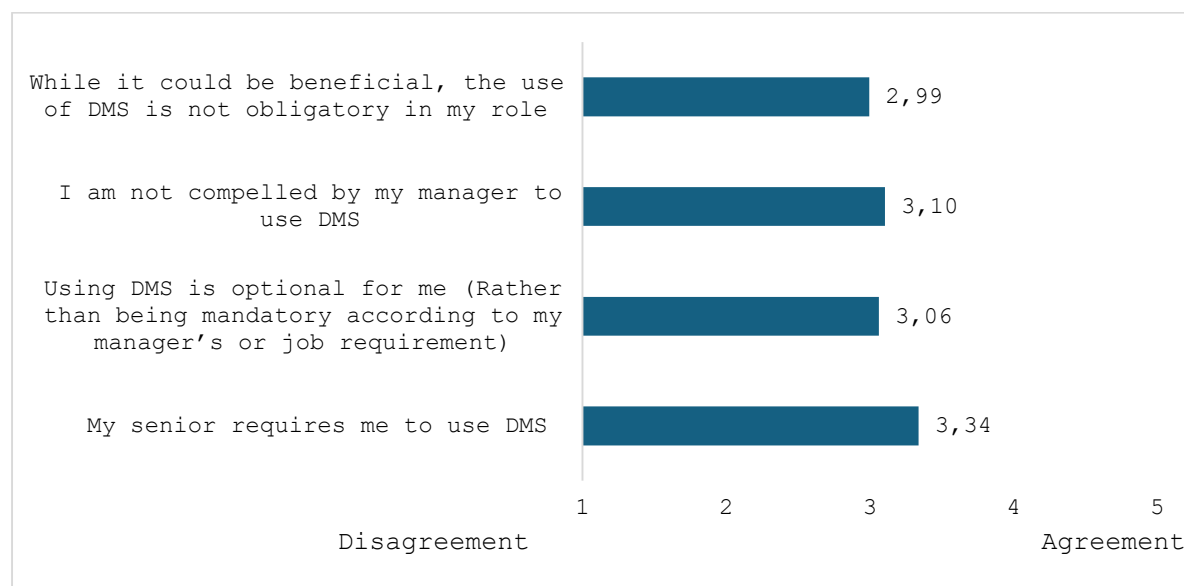


Figure 5.7 *Optional Use (OU)*

As illustrated in Figure 5.7, employees considered the usage of a DMS as mandatory or optional in their work. Managerial influence was significant, as evidenced by the strongest supported statement, "my senior requires me to use DMS" ($M = 3.34$), which suggested that most employees use DMS as a work responsibility when processing a job. However, the statistic "I am not compelled by my manager to use DMS" ($M = 3.10$) indicated that some employees did not feel that they experienced coercion from direct management, although this metric is just above neutral. The moderate agreement demonstrated the flexibility in DMS for the statement "using DMS is optional for me" ($M = 3.06$), signifying that DMS's are not used in an autocratic sense across all roles. In contrast, the lowest rated statement, "while it could be beneficial, the use of DMS is not obligatory in my role" ($M = 2.99$), suggested that although employees recognised the potential benefits provided by DMS, they nevertheless did not consider it that relevant to their role. These findings indicated that there may be

inconsistencies in the adoption of DMS, where some employees may feel forced to use DMS. In contrast, others consider it optional, likely by department or varying role.

To combat these inequities, organisations must clearly define roles in which DMS is necessary and flexible, standardize adoption policies to guard against inconsistency, and better explain to employees how DMS ultimately improves workflow and productivity. Furthermore, instead of strictly enforcing compliance, organizations should encourage voluntary adoption by promoting the measurable benefits of DMS and encouraging the dissemination and adoption of success stories and efficiency gains so that employees will dynamically integrate DMS into their daily tasks.

5.5 Reliability test for each variable

The reliability, pertaining to the internal consistency of the variables was evaluated using Cronbach's alpha. This analysis was conducted to verify how related the internal items were interconnected (Bryman & Bell, 2011). The reliability of the instrument was tested using Cronbach's Alpha with the results being depicted as indicated in Table 5.6.

A factor analysis was conducted on each of the items in each construct as mentioned in the methodology chapter. All of the 192 samples were included in the assessment. All 192 were found to be valid and non were excluded for the evaluation.

The reliability of combinations of the items that were derived from single factor using the Cronbach's Alpha test , indicated that the majority were higher than 0.70. Baskaran et al. (2020), asserted that a threshold value of 0.70 is regarded as an acceptable criterion for Cronbach's alpha. Most of the values revealed good to excellent reliability (0.7 to 0.923).

Comparative benefits (CB) demonstrated the highest level of reliability at 0.923. In contrast, Optional Use (OU) exhibited the lowest Cronbach's Alpha value of 0.623, which signified a potential area of concern.

User friendliness was categorised into two distinct factors: Ease of use (EU) and challenges (CHAL). Both factors yielded robust results and were consistent with the analytical framework. Overall, a level of reliability ranging from adequate to commendable was attained for all these variables. Composite variables were established by calculating the mean of the scores derived from the items encompassed within each variable.

Table 5.6 *Summary of the results using the Cronbach's Alpha test*

Construct	Label	Items included	Variance extracted (%)	Cronbach's alpha
Personal motivation	PM	PM:1, 2, 4	44.2	.702
Technology implementation	TI	TI: 11-16	51.5	.866
User friendliness	EU (Ease of use)	UF: 2, 5-8	36.3	.836
	CHAL (Challenges)	UF: 1, 3, 4	12.4	.686
Comparative benefits	CB	CB: 1-3, 5-9	60.6	.923
Work impact	WI	WI: 1-7	53.3	.887
Optional use	OU	OU: 2-4	37.4	.630

5.6 Validity

The construct of validity serves as a gauge that determines the appropriateness of the variables, and it relates to the evaluative procedure regarding accurately measuring what it purports to measure in relation to its relevance (Sileyew, 2019).

5.6.1. Factor Analysis

Exploratory Factor Analysis (EFA) was performed as an indicator of construct validity by estimating the variance each construct accounted for. A variance larger than 0.4 is normally considered valid, and higher numbers provide more support for construct validity.

Table 5.7 *Variance Extracted for each construct*

Construct	Label	Items included	Variance extracted (%)
Personal motivation	PM	PM:1, 2, 4	44.2
Technology implementation	TI	TI: 11-16	51.5
User friendliness	EU (Ease of use)	UF: 2, 5-8	36.3
	CHAL (Challenges)	UF: 1, 3, 4	12.4
Comparative benefits	CB	CB: 1-3, 5-9	60.6
Work impact	WI	WI: 1-7	53.3
Optional use	OU	OU: 2-4	37.4

The results (see Table 5.7) revealed that CB (60.6%), TI (51.5%) and WI (53.3%) had high explanatory power and supported strong construct validity. On the other hand, challenges (experienced with use of the system) revealed an exceptionally low variance extracted (12.4%), thereby demonstrating inadequate construct validity and highlighting a need for revision or removal from analysis.

5.7 Kaiser-Meyer-Olkin (KMO) and Bartlett's

A comprehensive investigation was conducted on KMO indices to determine sampling adequacy for every construct. According to Sürücü et al. (2022), KMO values above 0.60 are reflected as acceptable, indicating a strong factorability. These results meant data was ideal for factor analysis. Bartlett's Test of Sphericity had to be undertaken to ascertain if the correlation matrix exhibited a statistically significant deviation from an identity matrix, thereby endorsing the applicability of factor analysis (Sürücü et al., 2022).

The results indicated that all constructs exhibited KMO values higher than the prescribed minimum threshold. Work Impact (WI: 0.872) and Comparative Benefits (CB: 0.900) indicated strong sampling adequacy, as presented in Table 5.8. Moreover, Bartlett's Test also showed significant results for all constructs ($p < 0.001$), confirming that factor analysis was suitable to extract the latent constructs.

Table 5.8 *Kaiser-Meyer-Olkin measure of sampling adequacy*

Construct	Label	Items included	KMO	Bartlett's	
Personal motivation	PM	PM:1, 2, 4	0.672	χ^2	=101.07;
				df	=3;
				p value	=<.001
Technology implementation	TI	TI: 11-16	0.752	χ^2	=481.979;
				df	=15;
				p value	=<.001
User friendliness	EU (Ease of use) CHAL (Challenges)	UF: 2, 5-8 UF: 1, 3, 4	0.806	χ^2	=485.734;
				df	=28;
				p value	=<.001
Comparative benefits	CB	CB: 1-3, 5-9	0.900	χ^2	=1040.536;
				df	=28;
				p value	=<.001
Work impact	WI	WI: 1-7	0.872	χ^2	=654.532;
				df	=21;
				p value	=<.001
Optional use	OU	OU: 2-4	0.634	χ^2	=71.172;
				df	=3;
				p value	=<.001

5.8 Statistical test summaries

In summary, these findings demonstrated the validity of most constructs used in this study but highlighted certain areas that should be revised or reconsidered for further evaluation. Through reliability (Cronbach's alpha) and validity (factor analysis) testing, this study demonstrated the comprehensive measurement of the impact of DMS adoption on employee motivation and usability perceptions to contribute to the body of academic literature. The high reliability of the constructs indicated that employees were consistent in their responses to items measuring related constructs. At the same time, validity tests demonstrated that the theoretical framework on which this study was based aligned with the underlying data structure. This provided more confidence for the conclusions about the relationships between technology adoption barriers to staff engagement and productivity, thereby adding robustness to the research. Therefore, the study's findings can be interpreted with a significant degree of certainty, which informed recommendations for improving system usability, training programmes, and organisational support to enable technology adoption.

5.9 Regression Analysis

Regression analysis, a reliable tool, elucidated the fundamental relationship characteristics among two or more variables and subsequently enabled the prediction of the unknown variable (dependent variable) through utilisation of the variables that were known (independent variables) (Kafle, 2019). The analysis was systematically utilised for this research to examine each independent variable, as seen in Figure 5.8, namely (CB), (EU), (CHAL), (TI), and

(OU) and their influence on the dependent variables, (PM) and (WI). This analysis was employed to investigate the correlation between the scores of each independent variable and the scores of the dependent variables.

The average scores of all questions utilising the Likert scale for each independent variable were finally compared against the average scores of the questions employing the Likert scale for the independent variables. Kafle (2019), further points out that regression analysis clarifies the interrelationship dynamics among two or more variables and the estimation of the unknown variable (dependent variable) derived from the known variables (independent variables). Each category on the Likert scale, a crucial tool in our analysis, ranged from 1, which meant strongly disagree, to 5, which denoted strongly agree.

The research quantitatively evaluated the effect of technological barriers, organisational challenges, and interpersonal difficulties on employee motivation and operational efficiency

through regression analysis, highlighting critical insights into the obstacles to technology adoption and identifying strategies to tackle these challenges by efficiently making use of application of technology in rubber manufacturing operations.

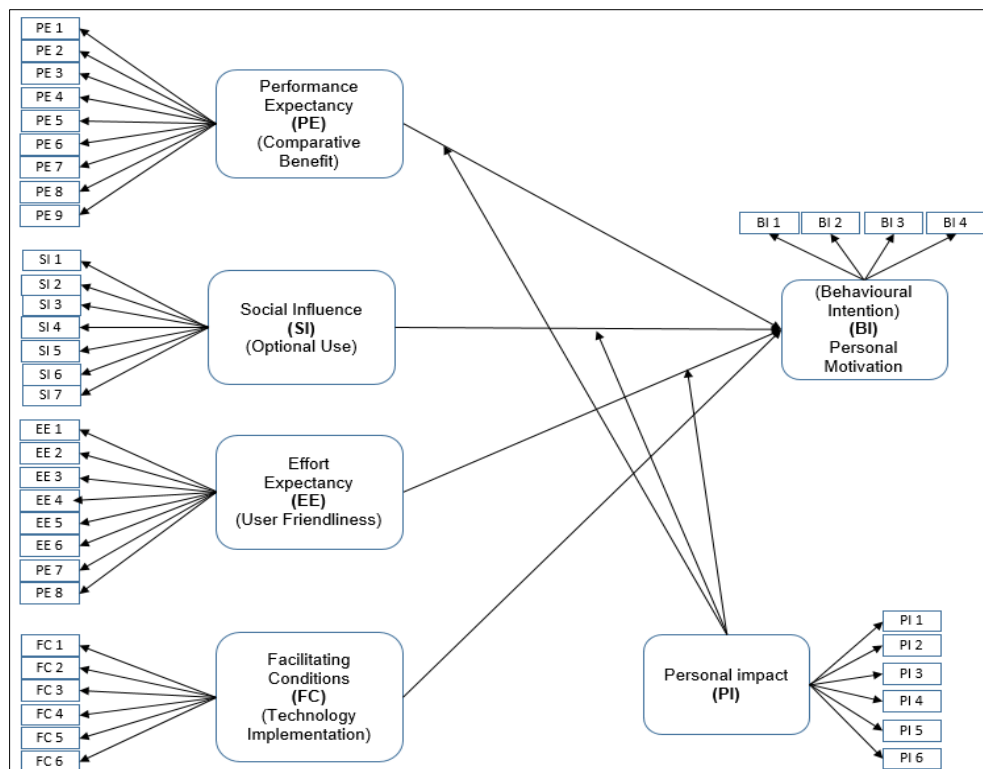


Figure 5.8 Conceptual Diagram

Linear regression analysis (see Table 5.9), was undertaken to ascertain the influences of the independent variables (IVs) on PM and WI .

- Effect of CB on PM

Comparative Benefit (CB) constituted 9.9% ($R^2 = .099$) of the PM variance, $F(1, 190) = 20.994$, $p < .001$. CB is therefore a significant predictor of PM ($\beta = .373$, $p < .001$). This indicated that employee comparative advantages in technology, such as faster data processing or easier communication, resulted in higher self-motivation.

- Effect of OU on PM

Optional Use (OU) accounted for a mere 0.5% ($R^2 = .005$) of the variance in (PM), and 3% ($R^2 = .030$, $p < .005$), $F(1, 190) = 0.990$, $p = .321$. Therefore, OU does not significantly affect PM ($\beta = -.078$, $p = .321$), providing the reassurance that optional technology use had no substantial effect on employees' intrinsic motivation.

Table 5.9 Correlation Table- Dependent Variable: PM and Predictors: CB, OU, EU, CHAL, TI

IV	R ²	F	df1; df2	p-value	B (regression coefficient)	t	p-value
CB	.099	20.994	1; 190	<.001	.373	4.582	<.001
OU	.005	.990	1; 190	.321	-.078	-.995	.321
EU	.179	41.522	1; 190	<.001	.442	6.444	<.001
CHAL	.023	4.389	1; 190	.037	-1.43	-2.095	.037
TI	.083	17.159	1; 190	<.001	.276	4.142	<.001

- **Effect of EU on PM**

Ease-of-use (EU) significantly explained 17.9% ($R^2 = .179$) of the variance in (PM), $F(1,190) = 41.522$, $p < .001$. Personal Motivation was significantly predicted by the EU ($\beta = .442$, $p < .001$), Convincingly showing that employees who find the technology user-friendly tend to have a higher personal motivation.

- **Effect of CHAL on PM**

Challenges (CHAL) explained 2.3% ($R^2 = .023$) of the variance in PM, $F(1, 190) = 4.389$, $p = .037$. CHAL is therefore a prominent negative predictor of PM ($\beta = -.143$, $p = .037$). This implied that employees tended to feel less motivated if they repeatedly struggled with the DMS.

- **Effect of TI on PM**

Technology Implementation (TI) accounted for 8.3% ($R^2 = .083$) of the variance in PM, $F(1, 190) = 17.159$, $p < .001$. Technology Implementation is therefore a strong predictor of PM ($\beta = .276$, $p < .001$). Employees with higher personal motivation tend to perceive better implementation of technology.

Table 5.10 Combined Correlation Table - Dependent Variable: PM and Predictors: CB, OU, EU, CHAL, TI

IV	R ²	F	df1; df2	p-value	B (regression coefficient)	t	p-value
TI	.187	8.576	5; 186	<.001	.067	.820	.413
EU					.410	3.784	<.001
CHAL					-.001	-.021	.983
CB					-.017	-.135	.893
OU					-.079	-1.035	.302

The five independent variables, as depicted in Table 5.10, are responsible for 18.7% ($R^2 = .187$) of the variance observed in PM, $F(5, 186) = 8.576$, $p < .001$. Although these variables were not independent with respect to one another, they did however operate concurrently. When evaluated collectively, EU emerged as a statistically significant predictor of PM ($\beta = .410$, $p < .001$).

Table 5.11 Correlation Table- Dependent Variable: WI and Predictors: CB, OU, EU, CHAL, TI

IV	R ²	F	df1; df2	p-value	B (regression coefficient)	t	p-value
CB	.181	41.878	1;190	.000 ^a	-.469	-6.471	.000
OU	.050	9.976	1;190	.002 ^a	.225	3.158	.002
EU	.207	49.491	1;190	.000 ^a	-.442	-7.035	.000
CHAL	.329	93.285	1;190	.000 ^a	.510	9.658	.000
TI	.100	21.016	1;190	.000 ^a	-.283	-4.584	.000

Comparative Benefits (CB)

$R^2 = .181 \rightarrow$ (CB) accounted for 18.1% of the variance in WI. $F(1,190) = 41.878$, $p < .001 \rightarrow$ The model is significant statistically. $B = -0.469$, $t = -6.471$, $p < .001 \rightarrow$ CB had a considerable adverse impact on WI. This illustrated that when employees view significant benefits, their work impact decreased, i.e., CB helped to mitigate work-related stress.

Optional Use (OU)

$R^2 = .050 \rightarrow$ (OU) accounted for 5.0% of the variance in WI. $F(1,190) = 9.976, p = .002 \rightarrow$ It meant that the model had statistical significance. $B = 0.225, t = 3.158, p = .002 \rightarrow$ (OU) for WI had a significant influence. Results indicated that employees who felt less impacted by work were more likely to identify technology as optional due to mandatory use.

Ease of Use (EU)

$R^2 = .207 \rightarrow$ (EU) accounted for 20.7% of the variance in WI. $F(1,190) = 49.491, p < .001 \rightarrow$ The model was statistically significant. $B = -0.442, t = -7.035, p < .001 \rightarrow$ EU had an insignificant impact on WI. This essentially meant that the easier the system, the less work it impacted, meaning that usability advancements translated to less stress on the job.

Challenges (CHAL)

$R^2 = .329 \rightarrow$ CHAL accounted for 32.9% of the variance in WI. $F(1,190) = 93.285, p < .001 \rightarrow$ This model had high significance. $B = 0.510, t = 9.658, p < .001 \rightarrow$ CHAL significantly impacted WI. This meant that if employees faced more significant challenges in using technology, this would lead to increased WI. This meant that every unit that experienced increased difficulty with using a system significantly increased workload stress.

Technology Implementation (TI)

$R^2 = .100 \rightarrow$ TI accounts for 10.0% of the variance experienced in WI. $F(1,190) = 21.016, p < .019 \rightarrow$ The model is statistically significant. $B = -0.283, t = -3.584, p < .001 \rightarrow$ (TI) significantly negatively impacts on WI. When technology is well implemented, it impacted less on work, so well-implemented systems are beneficial in this sense by alleviating work pressures.

Overall, these findings demonstrated that, at the same time, CB, EU, and TI significantly impacted on the work (negative value of B). Optional use (OU) and (CHAL) positively influence the impact of work (the B values). Challenges (CHAL) had the most substantial work effect, indicating that system challenges were the most important contributors to workload strain.

The independent variables, as depicted in table 5.12, were responsible for 43.3% ($R^2 = .433$) of the variance observed in WI, $F(5, 186) = 28.369, p < .001$. Although these variables are not independent with respect to one another, they do however operate concurrently. The constant item with a regression coefficient of 2.559 ($B=2.559, t=7.870, P<.001$) was significant in this instance which is a strong indication that when all the independent variables are maintained as constant, the predicted dependent variable remained at a substantial level.

Table 5.12 Correlation Table- Dependent Variable: WI and Predictors: Constant, CB, OU, EU, CHAL, TI -Combined Variable Impact on WI

IV	R ²	F	df1; df2	p-value	B (regression coefficient)	t	p-value
Constant	.433	28.369	5;186	<.000	2.559	7.879	<.000
CB					-.115	-1.325	.187
OU					.092	1.553	.122
EU					-.196	-.318	.022
CHAL					.391	7.109	<.000
TI					-.055	-.861	.390

The
five

5.10 Research Questions

The research questions aimed to explore the barriers to the adoption of technology, especially regarding data entry difficulties within the DMS, and its effects on employee motivation and resulting productivity at the Howick facility. The researcher addressed the research questions that shaped this investigation by applying the outcomes of the regression model.

5.10.1. Main Research Question:

How do barriers to technology adoption, particularly data entry issues in the DMS, affect staff engagement and productivity in the rubber manufacturing processes at the Howick plant?

The analysis indicated that the obstacles to technology adoption, especially data input into DMS, adversely affected personnel involvement and efficiency levels in the Howick plant.

Ease-of-use (EU) was the strongest predictor ($B = 0.442$, $p < .001$), suggesting that employee engagement was responsive to system navigation challenges (particularly data-entry-related activities), and their engagement decreases. Frustration sets in when employees face cumbersome data input processes, recurring errors, or a confusing system workflow, resulting in disengagement and unwillingness to integrate the system into their day-to-day work.

Furthermore, (CHAL) ($B = 0.510$, $p < .001$) had the strongest negative impact to WI, with the observed meaning that the more employees struggle while entering and retrieving data, the more their productivity suffered. Such challenges point to the ultimate slowing down of the operational processes, eventually leading to operational bottlenecks and higher error rates, which required further time and effort to resolve.

Sub-Question 1

What are personnel's main obstacles when adopting technology in the Howick rubber manufacturing operations?

This sub-question identified and examined the main technical, organisational, and interpersonal obstacles that employees encountered, specifically focusing on how these barriers directly impacted on their motivation levels (Herzberg et al., 1959).

The regression analysis results revealed three significant obstacles that employees encountered when integrating technology into the workplace at the Howick plant: technical issues, organisational issues, and interpersonal issues, all of which significantly undermined motivation levels.

Ease-of-use (EU) exhibited a strong positive influence within the model, with (PM) ($B = 0.442$, $p < .001$), indicating that complexity and usability concerns related to the DMS's impact on employees. Balancing data entry and system navigation alongside efforts for error rates can be demotivating, as these factors deterred users from naturally incorporating DMS into their daily routines.

The efficacy of the goals statement was negatively impacted by CHAL ($B = -0.143$, $p = .037$), affirming the idea that perceived technical difficulties were inversely correlated with enthusiasm ($p < -0.001$), while being directly linked to frustration ($p < -0.001$), which ultimately resulted in lower adoption rates.

The relationship between TI and Motivation ($TI \rightarrow M$: $B = 0.276$, $p < .001$) indicated that well-structured rollouts, training, and support from leadership enhanced employee engagement. However, resistance was connected to inadequate training and IT support, as well as a lack of resources to adequately train employees to use new technology. Uncommunicated system changes also led to uncertainty and disengagement, diminishing the motivation to utilise the technology.

Internal constraints such as resistance to change and isolated internal teams further complicated adoption efforts. Employees who perceived technology as threatening their job security or as an additional workload were less inclined to integrate DMS into their daily tasks. Such poor communication between management and employees resulted in misunderstandings, inaccurate data, inefficiencies, and an increased rate of errors.

What technical challenges do employees face when using the Howick plant's Dunlop Management System (DMS)?

This question explored specific technical issues such as data entry problems, system integration difficulties, and the need for technical expertise.

Technical challenges were one of the main barriers that hindered the use of DMS. The data revealed that EU is a crucial predictor of motivation ($B = 0.442, p < .001$), which showed that employees struggled to find and use the system well. These barriers mainly arose due to improper data entry processes, system integration gaps, and lack of technical knowledge.

One of the many technical issues that a DMS could sometimes face was related to data entry for many employees. The findings indicated that CHAL harmed personal motivation ($B = -0.143, p = .037$), affirming that recurrent failures, sluggish system responses, and laborious data input procedures diminished engagement.

Employees encountered a range of difficulties with DMS, and these include:

- Time-consuming manual data entries that increased workloads and delayed production timelines.
- Common data entry mistakes that caused discrepancies and required another verification process. Mistakes are often difficult to track down and fix, which could frustrate employees inadequate system feedback.

Another significant technical barrier to DMS adoption related to system integration challenges. Common issues raised by most of the employees indicated that there was a lack of integrated experience with other manufacturing software, which led to prolonged data transfer time and reduced process automation.

Nevertheless, inconsistent system updates and technical malfunctions disrupted workflow, and the time allocated to troubleshooting remained inefficient. Due to insufficient real-time synchronisation, decisions are made based on outdated or erroneous information. Such integration challenges culminated in interruptions to workflow continuity, increased manual workarounds, and decreased operational efficiency.

The analysis results further suggested that TI had a substantial effect on motivation ($B = 0.276, p < .001$). In contrast, derived from the outcomes, the study found empirical support ($\beta = 0.287, p < 0.001$), suggesting that DMS usage was crucially embodied through employees receiving adequate training and support, although employees were still dealing with a variety of factors:

For example, they were not adequately trained on advanced system functionality to maximise the use of DMS, there was an absence of IT support leading to enforced downtime in the

event of tech issues, and there was still a dependency on the domain experts. End-users were therefore not able to resolve errors on their own, which led to dependence on supervisors or the IT department, thus slowing down the workflow process.

The technical complications expressed by employees significantly impacted on their motivation and productivity, which ultimately influenced DMS usage. Some other notable challenges that were highlighted included:

- Manual and error-prone data entry processes leading to lower efficiency and higher annoyance.
- Interruption of flow and operational bottlenecks due to challenges in integrating systems.
- Insufficient technical insight and training, leading to very low uptake and over-reliance on IT support.

How do organisational factors, such as leadership support and resource allocation, affect technology adoption in the Howick plant?

This question investigated the role of organisational support, including leadership commitment, training programmes, and financial resources, in facilitating or hindering technology adoption

Several organisational facets, which included leadership support, technological resource availability, and organised training programs, significantly influenced DMS adoption at the Howick site. Technology implementation (TI) exerted a considerable influence on PM ($B = 0.276$, $p < .001$), suggesting that effective management methodologies and established procedural frameworks positively contributed to employee engagement with the DMS.

Management's resolve is the key to the successful integration of technology. Maximising the effect of DMS involves emphasising the system's benefits, reaching realisation, and receiving feedback from management on a continued basis. On the contrary, without any endorsement from top management, there were ambiguities and resistance, and the motivation to use the system tended to still be low.

Leaders should facilitate a technology transition that is robustly supported. Additionally, they should educate personnel regarding other strategic advantages of DMS adoption to alleviate scepticism and mitigate opposition to change. Promoting technology adoption in modern settings is necessary by creating feedback systems and getting involved directly with people.

It is the role of leadership to demonstrate how to use the technology to help make that system seem relevant and useful in everyday life.

The foundation of the workforce's confidence in embracing new technology is established through practical training. Regression analysis significantly predicted motivation ($B = 0.442$, $p < .001$), indicating that employees who received adequate training would find the system more user-friendly and would then utilise it.

The regression analysis indicated that CHAL adversely affected motivation ($B = -0.143$, $p = .037$), signifying that employees who perceived a lack of IT tools and resources necessary for optimal performance experience heightened frustration, therefore resulting in diminished engagement levels.

Some prevalent resource-related obstacles included insufficient technical support personnel which led to lingering system issue resolution. Additionally, limited access to upgraded hardware resulted in suboptimal system performance and frustrating usability. Disparate digital infrastructure, incapable of facilitating the retrieval or input of data for employees.

The facility's organisational culture reflected the employees' openness to digital transformation. Motivation is enhanced when all personnel are acclimatised to a culture characterised by innovation, collaboration, and information exchange, which enabled seamless integration of new systems and processes into their daily routines.

The regression findings indicated that motivation is elevated when employees perceived the DMS as an enhancement rather than an impediment. In contrast, a prevailing culture of resistance, apprehension regarding job security, or scepticism towards technology results in lower adoption rates. Some cultural impediments encompassed mistakes in DMS functionality learning due to peer disconnection, apprehension of redundancy arising from increased automation, and minimal incentives to cultivate digital competencies.

The Howick plant should consider fostering peer learning where employees exchange best practices amongst themselves. Furthermore, management needs to alleviate employees' concerns that technology will succeed them rather than augment their roles.

What interpersonal barriers, such as resistance to change and communication issues, impact the adoption of the DMS among employees at the Howick plant?

This question examined how interpersonal dynamics, including employee resistance, communication gaps, and team collaboration, influenced the adoption process

The analysis identified interpersonal barriers that were likely to significantly impact the adoption (DMS) at the Howick plant. The major obstacles responsible for this were resistance toward change, communication gaps between departments, and team collaboration, which ultimately led to lower motivation levels and slowed adoption of new processes/tools.

In obtaining insights into resistance to change, motivation is predicted by (EU) ($B = 0.442$, $p < .001$), suggesting that in-housing with DMS resistance was more likely if employees perceived DMS as complex or disruptive to their routine. Employees who were displaced or lacked confidence in digital tools tended to eschew using them, leading to slower adoption.

This was further amplified by the communication gaps. Technology Implementation (TI) had a positive impact on motivation ($B = 0.276$, $p < .001$), indicating that communication around system function and impact was an essential component of adoption. Lack of communication from leadership or across departments introduced apprehension, misinformation, and uneven implementation, raising frustration and disengagement. Additionally, CHAL significantly predicted (WI) ($B = 0.510$, $p < .001$), indicating that employees without peers struggled the most with technology adoption.

Potentially, poor stakeholder engagement (resistance to change), ineffective communication, and lack of collaboration inhibited the effective implementation of DMS at the Howick plant. When knowledge-sharing practices and collaborative learning were missing, there were opportunities for mistakes and low/inefficient system use. The introduction of transparent communication, bottom-up decision-making, and an engaging workforce should mitigate these barriers and improve system buy-in and usage.

Sub-Question 2

How do these constraints affect employee motivation in the manufacturing setting?

This sub-question examined the causal correlation between varying motivation levels caused by obstacles to embracing technology and the subsequent effects on productivity. It mainly measured changes in operational efficiency, quality of output, and error frequencies (Rana & Daultani, 2023).

The study results showed that obstacles to technology adoption significantly influenced employee motivational levels that induced shifts in production efficiency, output quality control and error turnover at the of the production operations. Challenges (CHAL) had a highly negative effect on motivation ($B = -0.143$, $p = .037$), which suggested that people impacted by inefficient systems and poor data entry were less engaged and productive.

Ease-of-Use (EU) had a positive effect on motivation ($B = 0.442$, $p < .001$), which indicate that when the system was intuitive and efficient, employees worked more efficiently, and production delays were reduced. Long processing times, problems completing tasks, and long tasks due to technical and usability challenges lowered the efficiency of employees' workflows.

Technology Implementation (TI) had a strong impact on motivation ($B = 0.276$, $p < .001$), demonstrating that a well-executed rollout of a system built employee confidence, resulting in more accurate data and higher quality products. However, a lack of training and system assistance has led to the same mistakes being repeated, which involved rework and quality control presence.

Comparative Benefits (CB) negatively influenced WI ($B = -0.469$, $p < .001$), implying that although employees may recognise gains associated with DMS, inefficiencies built into the system resulted in elevated error rates that diminished overall motivation. This often resulted in frequent errors and data misinterpretations, resulting in higher quality control issues and rework cycles.

Constraints on technology adoption – in particular, system inefficiencies, poor usability, and substandard implementation – sap employee motivation, resulted in reduced operational efficiency, lower quality of output, and associated higher error rates. These obstacles will require greater training, improved design of the automated system, enhanced user support, and motivation for successful production outputs at the plant in Howick.

How do technical challenges with the DMS affect employee motivation and engagement at the Howick plant?

This question explored the direct impact of technical issues on employee morale, job satisfaction, and overall engagement with their work.

Challenges with the DMS that hindered the technical aspects of the plant staff within the Howick plant were detrimental to employee motivation and engagement. The results indicated that the most important technical obstacles were system usability, inefficiencies in data input,

and inadequate support, which had an overall negative impact on morale and scores that would maintain a high engagement level.

Ease-of-Use (EU) is a significant motivational predictor ($B = 0.442, p < .001$). This is explained by employees who were unable to handle the complexity of the system and therefore experienced frustration and were demotivated as a result. Most of them faced issues while attempting to enter data. Navigation was often not clear, and there were frequent errors, which led to increased stress and avoidance from interacting with the system.

Furthermore, the results indicated that CHAL had a negative relationship with motivation ($B = -0.143, p = .037$). The study found that, when faced with recurrent technical problems, employees become disengaged, thus reducing their job satisfaction.

Users also raised concerns about solutions that were not very easy for them to use, stating that there was not enough technical support, with employees who were responsible for implementing technology feeling neglected.

Technology Implementation (TI) had a positive effect on motivation ($B = 0.276, p < .001$), showing that when technical issues were resolved through appropriate implementation and training, engagement improved. However, if system inefficiencies remained and not enough training had been done, then employees would lose interest in the system, which impacted on their entry behaviour.

What is the relationship between organisational support for technology adoption and employee motivation in the Howick plant?

This question investigated whether the presence or absence of organisational support, such as training and resources, influenced employee motivation and their willingness to adopt new technologies.

The analysis demonstrated that challenges to the acceptance of technology, especially usability issues in systems, the level of training provided in substance and delivery, and leadership support are critical because they can influence employee motivation. Results showed EU to be a significant predictor of motivation ($B = 0.442, p < .001$), indicating that employees had higher engagement when the DMS was intuitive and user-friendly. On the other hand, CHAL reduced motivation ($B = -0.143, p = .037$), implying that re-occurring technical difficulties dampened employee motivation and engagement. In addition, TI had a positive impact on motivation ($B = 0.276, p < .001$), illustrating that well-structured rollouts and effective training led to employees' greater self-efficacy in adopting the system.

Technical challenges such as complex data entry processes, slow system response times, and integration issues significantly impacted on employee morale and engagement. It was observed that employees who struggled with data input faced unclear routing, resulting in heightened stress and frustration – thus impacting engagement levels.

These results indicated that these factors directly affected job satisfaction with surfacing technical challenges creating inefficiencies for employees as they had to spend more time troubleshooting errors. Negative attitudes created by this lowered user adoption with employees feeling that the DMS was a burden instead of being viewed as a productivity tool. However, these improvements could still be achieved by monitoring system performance and implementing user-friendly improvements to solve these technical challenges and increase motivation and engagement.

Factors such as organisational support (leadership and management involvement, training programs, and sufficient resources) significantly influenced employee motivation to adopt the new technology. The regression analysis showed that leadership encouragement of technology adoption and provision of requisite support led to employee motivation (TI: $B = 0.276$, $p < .001$). Ensuring a smooth process when implementing DMS and offering guidance and proper explanations of the system's benefits were additional cognitive factors influencing employee acceptance of the DMS. Conversely, insufficient organisational support fostered resistance and low participation, hindering the adoption journey.

Lack of resources and contention with IT support impeded successful technology adoption. Challenges (CHAL) negatively affected motivation ($B = -0.143$, $p = .037$), indicating that employees were frustrated, unhappy, and less motivated if they worked without technical assistance and system upgrades. Employees benefited from well-funded training programmes, technical support teams, and troubleshooting of resources, which greatly minimised the stress that could accumulate around utilising the DMS. Having this mindset and access to available information and tools should ensure motivation and increase the system's adoption rates.

How do interpersonal barriers to technology adoption influence employee productivity and error rates in the Howick plant?

This question examined the impact of interpersonal issues, such as resistance to change and poor communication, on operational efficiency, output quality, and the frequency of errors in the manufacturing process.

The results revealed that EU was a good predictor of motivation ($B = 0.442, p < .001$), indicating that the more intuitive and user-friendly the DMS is, the more engaged employees are. On the contrary, CHAL had a negative impact on motivation ($B = -0.143, p = .037$), a finding which shed light on the fact that repeated technical problems diminished motivation and engagement. Moreover, TI had a significant positive effect on motivation ($B = 0.276, p < .001$), showing that rollout in an organised fashion and proper training improved employee willingness to adopt the system.

Technical challenges, such as complex data entry processes, slow system response times, and integration issues, impact employee morale and engagement. Employees who struggled with data input and unclear navigation became stressed out and frustrated, and their engagement levels dropped. The findings from the regression analysis indicated that all these problems eventually led to job dissatisfaction, as technical hitches must be overcome, resulting in lost time spent on error fixing. When DMS is seen as a burden per employee rather than a tool to aid productivity, employees tended to disengage, making adoption rates even lower. Motivation and engagement levels could also be increased by solving these technical issues with system optimisations and user-friendly enhancements.

Organisational support such as leadership engagement, training programs and resources significantly influenced employee motivation to adopt new technology. The analysis results further indicated that with leadership actively supporting technology adoption, motivation increased in employees (TI: $B = 0.276, p < .001$). The findings supported the theory that employees were more inclined to adopt DMS if management took active steps to ensure a seamless implementation, streamlining the adoption process by providing detailed instructional guides and promoting system benefits. On the other hand, a lack of organisational support contributed to reluctance and low engagement, slowing the adoption process down.

Lack of resources and IT support decrease motivation ($B = -0.143, p = .037$), highlighted that those employees who did not have access to the necessary technical assistance and system upgrades became frustrated with the system and lost motivation. Having the ability to fall back on well-funded training programmes, dedicated technical support teams, and troubleshooting of resources for employees should mitigate the stress connected to using the DMS. When employees have these resources available, it should help motivate them and boost adoption rates within the system.

Similarly, the importance of motivation in technology adoption is determined by training. The regression results showed that EU significantly affected motivation ($B = 0.442, p < .001$). The latter

theme was the opposite of the former ($b = -0.0262$, $SE = 0.0017$, $p < 0.001$), indicating that employees who were already well-trained, found the system easier to utilise and therefore, increased engagement. When training programmes failed to meet their needs, employees had difficulty in adopting system functionalities, which resulted in a lack of confidence in the system and an unwillingness to entirely utilise the DMS in their jobs. Structured learning and training initiatives and programmes should keep the motivation high and instil technological fluency.

5.11 The Influence of Comparative Benefits (CB) on Work Impact (WI)

Even though CB were anticipated to improve workplace efficiency, the study highlighted a surprising, paradoxical relationship, where perceived benefits of the DMS negatively impacted on work performance. This illustration from the regression analysis revealed that perceived benefits of the DMS adversely affected work performance, if major obstructions were highlighted in various forms including change pressure, inadequate training, task complexity, and administrative burdens – all inhibiting practical application.

From the regression analysis, CB significantly reduced WI ($B = -0.469$, $p < .001$), indicating that while aware of its benefits, they do not necessarily translate to enhanced performance in their jobs with the DMS. Several factors can explain this paradox.

Some employees viewed DMS implementation as disruptive rather than supportive, which led to resistance to change and reluctance to fully integrate it into their workflow.

The lack of adequate training prevented staff from making full use of the system, because potential benefits only appeared to add to their frustration rather than increasing productivity. As tasks become much more complex, over-rigorous data entry rules and procedural formalities did not help to improve efficiency as far as the employees were concerned; instead, they worked against them, placing work heavily in favour of operations, and against employee output. Moreover, if DMS adoption consumed additional administrative resources, employees felt burdened with more tasks than usual, which negatively affected their commitment and productivity instead of improving it.

6. Chapter 6: Discussion of Results

6.1 Introduction

The primary focus of this study was to assess the reluctance expressed by factory workers at the Howick Rubber Manufacturing enterprise to embrace a DMS. The essential predictors for the independent variables were identified as CB, OU, EU, CHAL, and TI in relation to the dependent variables PM and WI. This study holds significant relevance for two principal reasons. Firstly, it sought to uncover the barriers that obstructed the organisation's endeavours to enhance process efficiencies within the operations, which was pivotal for securing a competitive edge amid challenging competitive environments. Secondly, and of utmost importance, it sought to enhance the precision of employee data entry that would ensure a corresponding increase in organisational productivity, while simultaneously fostering employee motivation.

Utilising the Unified Theory of Acceptance and Use of Technology (UTAUT) as a conceptual framework, a hypothesised model was formulated to facilitate the exploration of interrelations among the constructs. The model aimed to address two primary dimensions within the investigation. Firstly, by assessing the direct correlation between CB, OU, EU, CHAL, and TI as predictors of PM. Secondly, the research intended to elucidate the mediating effects of CB, OU, EU, CHAL, and TI on WI.

This chapter offers an analysis of the results delineated in Chapter 5. The discussion structure adheres to the sequence in which the research propositions were articulated. The findings corresponding to each proposition are compared with the literature discussed in Chapter 2 and the research questions in chapter 3. This discussion chapter interrogates whether the findings corroborate, expand upon, or contradict the established theories for each proposition.

6.2 Discussion of Results

This main research question aims to ascertain the significant challenges faced during the acceptance of technology, mainly the issues regarding data fed into the DMS affecting employee motivation and productivity. This emphasises the need to study the impact of digital inefficiencies on people and processes. The goal is to uncover how technological barriers affect performance and employee morale in rubber manufacturing.

The results will be presented while linking each of the research questions, to the previous section's results obtained from the regression analysis. This section of the study will discuss the combined results of the analysis relevant to each research question by interpreting the outcomes emerging from the regression analysis based in the preceding chapter and

combination with respective statistical t-test results to be contextualised in relation to the Howick manufacturing operation and its struggle with technology original of questions related.

6.3 Research Questions

The research questions aimed to explore the barriers to technology adoption, especially regarding data entry difficulties within the DMS, and its effects on employee motivation and resulting productivity at the Howick facility. The researcher addressed the questions that shaped this investigation by applying the outcomes obtained from the analysis.

6.3.1. Main Research Question:

How do barriers to technology adoption, particularly data entry issues in the DMS, affect staff engagement and productivity in the rubber manufacturing processes at the Howick plant?

This main research question aims to ascertain the significant challenges faced by employees during the acceptance of technology, mostly the issues regarding data fed into the DMS affecting employee motivation and productivity. This emphasises the need to study the impact of digital inefficiencies on people and processes. The goal is to uncover how technological barriers affect performance and employee morale in rubber manufacturing.

Venkatesh et al. (2003) indicated that the EU was a notable challenge in workplace end-user technology adoption and use. Frustration with cumbersome, difficult-to-navigate systems equated to lower motivation and engagement. The study further indicated that DMS features complex data-entry processes, repeated errors, and a complex system workflow that discouraged employees from using the DMS in their everyday jobs. These behaviours resonate with those in the UTAUT, underscoring the role of usability in influencing user adoption and satisfaction with digital tools (Baskaran, 2020).

This analysis explores the influence of *Optional Use* (OU) of the DMS on the dependent variable WI. The aim is to establish whether perceptions of DMS as optional (rather than mandatory) predict how employees perceive the impact of their work thus having a bearing on the staff engagement and productivity of the employees. The analysis was conducted to predict Work Impact (WI) based on Optional Use (OU) of the DMS. The model was statistically significant, $F(1, 190) = 9.976$, $p = .002$, indicating that OU is a significant predictor of WI. The regression equation accounted for approximately 5.0% of the variance in WI, $R^2 = .050$. The unstandardised regression coefficient ($B = 0.225$, $t = 3.158$, $p = .002$) suggests a positive and statistically significant association between OU and WI. The positive coefficient ($B = 0.225$) indicates that employees who perceive the use of the DMS as optional are more likely to feel

less impacted by their work. This implies that optional or non-mandated technology use may be associated with reduced perceptions of job significance or organisational support.

These findings align with prior research suggesting that perceived voluntariness in system use can affect user engagement and system acceptance (Venkatesh & Davis, 2000). When employees perceive that use of a system is not integral to their role or not enforced by leadership, they may infer that the system—and by extension, their contributions—are not mission-critical Elbanna and Linderroth(2015).

While the model explains a modest proportion of variance in WI (5%), the statistically significant results underscore the importance of how technology policies are communicated. Making system use appear optional may inadvertently diminish employee motivation and perceived impact. Organisational leaders should ensure that critical systems like DMS are positioned as essential tools, not optional add-ons, to maintain employee engagement and diminishing productivity.

6.3.2. Sub-Question 1:

What are personnel's main obstacles when adopting technology in the Howick rubber manufacturing operations?

This sub-question identifies and examines the main technical, organisational, and interpersonal obstacles employees encounter, specifically focusing on how these barriers directly impact their motivation levels (Herzberg et al., 1959).

- Effect of OU on PM

Optional Use (OU) accounted for a mere 0.5% ($R^2 = .005$) of the variance in (PM), and 3% ($R^2 = .030$, $p < .005$), $F(1, 190) = 0.990$, $p = .321$. Therefore, OU does not significantly affect PM ($\beta = -.078$, $p = .321$), providing the reassurance that optional technology use had no substantial effect on employees' intrinsic motivation.

This analysis examines whether the OU of a DMS, the degree to which employees feel DMS use is voluntary, predicts their level of PM at work. PM refers to the intrinsic motivation to engage meaningfully in tasks.

The regression was performed using OU as the independent variable and PM as the dependent variable. It sought to verify whether a more voluntary view of technology use correlated with a decline in employee motivation.

The regression model showed that OU accounted for only 0.5% of the variance in PM ($R^2 = .005$). Although a marginally higher R^2 value of .030 was reported, the result remains statistically non-significant, $F = 0.990$, $p = .321$. The standardized regression coefficient was $\beta = -0.078$, and also not statistically significant ($p = .321$).

The analysis results indicate that employees' intrinsic motivation to use the DMS is statistically independent of their perception of whether or not DMS use is optional. In essence, whether an employee views the technology as mandatory or not has little substantive effect on their psychological drive to perform their job. These results are aligned with current studies, suggesting that intrinsic motivation is shaped more by personal values, task significance, and autonomy within work than by the perceived mandatory or optional use of specific technologies (Gagné & Deci, 2005; Deci et al., 2017).

The findings suggest that perceptions of technology use influence different psychological and behavioural outcomes. Work Impact appears sensitive to how technology is framed in the organisation since it ties into perceptions of value and contribution (Venkatesh et al., 2003). However, as per self-determination theory (Deci et al., 2017), intrinsic motivation may be more deeply rooted in task-related autonomy, competence, and purpose and less influenced by managerial enforcement of tools like DMS.

Optional Use (OU) of technology does not significantly impact PM, but it does influence perceptions of WI. This distinction highlights the importance of targeted strategies in digital transformation efforts, which emphasise structured integration for job relevance, in order to enhance WI while preserving autonomy in task execution to support intrinsic motivation.

How do organisational factors, such as leadership support and resource allocation, affect technology adoption in the Howick plant?

This question investigates the role of organisational support, including leadership commitment, training programs, and financial resources, in facilitating or hindering technology adoption.

- Effect of TI on PM

Technology Implementation (TI) accounted for 8.3% ($R^2 = .083$) of the variance in PM, $F(1, 190) = 17.159$, $p < .001$. Technology Implementation is therefore a strong predictor of PM ($\beta = .276$, $p < .001$). Employees with higher personal motivation tend to perceive better implementation of technology.

The target for this analysis is PM, which was predicted using the independent variable TI, which investigated whether the quality of the independent variable TI in the workplace influences PM among employees. TI refers to the effectiveness of systems such as DMS and how they are effectively introduced, integrated, and supported in the work environment. PM is the intrinsic drive and enthusiasm employees have towards their jobs.

The analysis ran a linear regression to assess the predictive relation between TI and PM. It also sought to establish whether employees with higher levels of intrinsic motivation are the result of better technology implementation processes. The resultant model indicated that TI was predictive with R squared ($R^2 = .083$), thus indicating that the model only explains 8.3% of the variance of the dependent variable PM, suggesting a moderate effect size. The model was significant, $F = 17.159$, $p < .001$, confirming that the relationship between TI and PM is not due to random chance. The standardised regression coefficient was $\beta = .276$, with a t-value of 4.142 and a p-value $< .001$, indicating that the effect of TI on PM is both substantial and statistically significant. These results indicate that employees who perceive technology implementation as effective are more likely to experience higher personal motivation. This means that employees are more engaged, driven, and enthusiastic about their work when digital systems such as DMS are implemented smoothly with proper training, user support, and alignment with job needs.

This supports findings from Venkatesh and Bala (2008), who emphasised that user satisfaction and motivation increase when systems are well-integrated and user-friendly. Consistent with this, Gagné and Deci (2005) point out that feelings of competence and autonomy, the two major drivers of motivation, increase when employees are confident that new tools will work as advertised and will feel enabling rather than burdensome. The results highlight the role of proper technology implementation in maintaining employee motivation.

Effective TI increases user confidence, promotes a sense of control, and reduces frustration among employees, which leads to intrinsic motivation (Deci & Ryan, 2000). This implies that organisations need to go beyond just adopting the tools and make sure that employees understand their purpose, provide adequate training, and support them during the adoption. This inadvertently suggests that motivation is not just intrinsic but contingent on external factors such as organisational infrastructure and the leadership view on digital transformation (Venkatesh et al., 2003). It can serve as a motivational magnifier when well implemented, multiplying employees' sense of capability and meaningful contribution.

What interpersonal barriers, such as resistance to change and communication issues, impact the adoption of the DMS among employees at the Howick plant?

This question examined how interpersonal dynamics, including employee resistance, communication gaps, and team collaboration, influenced the adoption process

This analysis reviews the relationship between challenges experienced with the use of technology systems CHAL and work impact WI in a rubber manufacturer industry. WI represents how employees feel about the impact of technology-use on their workload, productivity and stress.

A simple linear regression was conducted using CHAL as the independent variable and WI as the dependent variable. The goal was to determine whether technology-related challenges significantly predict perceived negative impact on employees' work. The regression model showed that Challenges (CHAL) explained 32.9% of the variance in Work Impact ($R^2 = 0.329$). The model was statistically significant, $F(1, 190) = 93.285$, $p < .001$, indicating a strong relationship. The regression coefficient was $B = 0.510$, with a t-value of 9.658 and a p-value $< .001$, confirming that increased challenges in using technology significantly increase perceived work impact.

These results show a strong and statistically significant association between the challenges that employees have with technology and how it negatively impacts their work. The coefficient $B = 0.510$ means that for every unit increase in perceived challenge, the work impact increases by 0.510 units, on average. This implies that when employees encounter greater difficulty using systems like the DMS—whether due to poor interface design, lack of training, system errors, or workflow misalignment—they experience higher levels of workload pressure, frustration, and task disruption.

This finding is consistent with literature on technology-induced stress ("technostress"), which links poorly implemented or complex technologies to negative employee outcomes such as reduced productivity, lower job satisfaction, and increased burnout (Tarafdar et al., 2007; Ayyagari, Grover, & Purvis, 2011). The fact that 32.9% of the variance in WI is explained by CHAL indicates that technology challenges are a major contributing factor to how employees perceive the effect of systems on their work.

These results support the argument that technological tools should not only be practical but also user-friendly and seamlessly integrated into daily work routines.

Technology can serve as a facilitator or enabler, however without enough support, clear worker interfaces, and sound training, it becomes a hindrance (Davis, 1989; Venkatesh & Bala, 2008). In addition, this is consistent with UTAUT which suggests that ease of use and perceived usefulness are essential factors in determining whether employees will use technology (Davis, 1989). When the perceived ease of use of technology is low due to system challenges, employee stress and resistance increase, negatively affecting their performance.

The analysis confirms that challenges in using workplace technologies have a strong and statistically significant negative effect on employees' work experiences. Organizations need to focus not just on the technology adoption however on how well the system will be used, training and support infrastructure. By not prioritising these, places extensive pressure on employees, adding to work stress and reducing productivity.

6.3.3. Sub-Question 2:

How do these constraints affect employee motivation in the manufacturing setting?

This sub-question examines the causal correlation between varying motivation levels caused by obstacles to embracing technology and the subsequent effects on productivity. It mainly measures changes in operational efficiency, quality of output, and error frequencies (Rana & Daultani, 2023).

$R^2 = .010$ indicating that TI accounts for 10.0% of the variance experienced in WI. $F(1,190) = 21.016$, $p < .019$. The model is statistically significant. $B = -0.283$, $t = -3.584$, $p < .001$ (TI) significantly negatively impacts on WI. When technology is well implemented, it impacted less on work, so well-implemented systems are beneficial in this sense by alleviating work pressures.

This analysis investigates the effect of TI on WI to address this research question, particularly emphasising how well-integrated digital systems' presence or absence influences employee motivation and productivity. It challenges the premise that in implementing the technology, limitations in technology deployment, including insufficient support, lack of access, and minimum training, the perception of the work-related stress and cognitive load can be further increased.

This view is relevant in manufacturing environments where operational efficiencies and employee engagement are critically dependent on the system's usability. These insights resonate with Rana and Daultani's (2023) arguments about technological complexity, which suggest that motivational differences from technological barriers are significant influencers of productivity benefits, including quality, efficiency, and error input reduction.

The analysis , indicating that TI accounts for 10.0% of the variance in WI ($R^2 = 0.100$), with the model showing strong statistical significance ($F = 21.016$, $p < .001$). The negative unstandardised coefficient ($B = -0.283$, $t = -4.584$, $p < .001$) indicates a statistically significant inverse relationship between TI and WI. When employees perceive technology to be better implemented, they feel supported through training, accessibility, and seamless integration into their tasks, and as a result, they experience less work-related strain. They are most likely to remain engaged in their tasks, which results in higher productivity.

This confirms that implementing technology in a structured manner eases pressure in the workplace, ultimately providing a buffer against digital fatigue and operational overload. The relationship is supported by Al_Kasasbeh (2024) in his findings, which suggest the importance of ensuring structured technological interventions to reduce task ambiguity mitigation and user engagement.

Consequently, Given the proper infrastructure and training to use digital tools, employees feel more control and clarity over their work processes. Similarly, Baskaran et al. (2020) argue that the effective integration of digital systems into everyday workflows can vastly enhance job satisfaction due to reduced disruptions and increased performance fluency. This framing transforms technology implementation from a functionality improvement to a strategic enabler for employee well-being.

In addition, Anisah and Wisesa (2021) mention that technology that supports workflow efficiency indirectly also improves employee behaviour by creating a friendlier and more manageable workplace. Fewer barriers and frustrations experienced with the adoption of technologies at the Howick factory led to more intrinsic motivation and proactive engagement among the employees. Further, the analysis's findings highlight the possibility of boosting motivation and productivity by deploying specific types of technology to the workplace, such as allowing mobile access and real-time data input. Work Impact is negatively predicted to be significant by Technology Implementation.

Well-implemented systems that are simple to use, well-supported, and embedded within operational workflows reduce workload stress and psychological strain, which is significant for individual and organisational performance. The results highlight the need to invest in effective technology implementation approaches as an essential lever for boosting employee motivation, minimising operational disruption and increasing productivity in manufacturing settings.

How do technical challenges with the DMS affect employee motivation and engagement at the Howick plant?

This question explores the direct impact of technical issues on employee morale, job satisfaction, and overall engagement with their work.

This analysis investigates the effect of TI on WI to address this research question, particularly emphasising how well-integrated digital systems' presence or absence influences employee motivation and productivity. The analyses challenge the premise that in implementing the technology, limitations in technology deployment, including insufficient support, lack of access, and minimum training, the perception of the work-related stress and cognitive load can be further increased. This view is relevant in manufacturing environments where operational efficiencies and employee engagement are critically dependent on the system's usability.

These insights resonate with Rana and Daultani's (2023) arguments about technological complexity, which suggest that motivational differences from technological barriers are significant influencers of productivity benefits, including quality, efficiency, and error input reduction. The results support this theoretical relationship, indicating that TI accounts for 10.0% of the variance in WI ($R^2 = 0.100$), with the model showing strong statistical significance ($F = 21.016$, $p < .001$). The negative unstandardised coefficient ($B = -0.283$, $t = -4.584$, $p < .001$) indicates a statistically significant inverse relationship between TI and WI. When employees perceive technology to be better implemented, they feel supported through training, accessibility, and seamless integration into their tasks, and as a result, they experience less work-related strain. They are most likely to remain engaged in their tasks, which results in higher productivity. This confirms that implementing technology in a structured manner eases pressure in the workplace, ultimately providing a buffer against digital fatigue and operational overload.

The relationship is further supported by Al_Kasasbeh (2024) in his findings, which suggest the importance of ensuring structured technological interventions to reduce task ambiguity mitigation and user engagement. Consequently, Given the proper infrastructure and training to use digital tools, employees feel more control and clarity over their work processes. Similarly, Baskaran et al. (2020) argue that the effective integration of digital systems into everyday workflows can vastly enhance job satisfaction due to reduced disruptions and increased performance fluency. This framing transforms technology implementation from a functionality improvement to a strategic enabler for employee well-being.

In addition, Anisah and Wisesa (2021) mention that technology that supports workflow efficiency indirectly also improves employee behaviour by creating a friendlier and more

manageable workplace. Fewer barriers and frustrations experienced with the adoption of technologies at the Howick factory led to more intrinsic motivation and proactive engagement among the employees. Further, the analysis's findings highlight the possibility of boosting motivation and productivity by deploying specific types of technology to the workplace, such as allowing mobile access and real-time data input. Work Impact is negatively predicted to be significant by Technology Implementation.

Well-implemented systems that are simple to use, well-supported, and embedded within operational workflows reduce workload stress and psychological strain, which is significant for individual and organisational performance. The results highlight the need for the Howick management to invest in effective technology implementation approaches as an essential lever for boosting employee motivation, minimising operational disruption and increasing productivity in manufacturing settings

What is the relationship between organisational support for technology adoption and employee motivation in the Howick plant?

This question investigated whether the presence or absence of organisational support, such as training and resources, influenced employee motivation and their willingness to adopt new technologies

This study tests the relationship between organisational support for technology adoption through employees' perceptions of the OU of the DMS and employee motivation, which WI represents.

This analysis investigates how interpersonal barriers to technology adoption—such as resistance to change, lack of team communication, and individual difficulties engaging with digital tools—influence employee productivity, error rates, and work strain at the Howick plant. These interpersonal dynamics are frequently underexplored in digital transformation strategies, yet they are crucial for understanding how technology shapes employee experience and operational output (Hessari, Daneshmandi, & Nategh, 2024).

In this regard, CHAL measures the interpersonal and psychological challenges faced by employees when implementing DMS.

The regression results for the model indicate that CHAL explains 32.9% of the variance in Work Impact ($R^2 = .329$). This suggests that a substantial portion of the work-related stress associated with technology can be attributed to the challenges employees face during its adoption. The model is statistically significant ($F(1,190) = 93.285, p < .001$), and the positive

unstandardised regression coefficient ($B = 0.510$, $t = 9.658$, $p < .001$) confirms a strong, direct relationship between perceived challenges and work impact. In practical terms, for every unit that increases the challenge score, the perceived work-related stress and disruption also significantly increase. These findings are consistent with recent literature related to technostress and organisational resistance. Interpersonal issues like communication gaps, poor expectations, or resistance to using collaborative technology are leading causes of digital workplace stress (Heslina & Syahrani, 2021).

These kinds of challenges can worsen exhaustion, error rates, and disengagement in manufacturing settings like Howick's. Furthermore, Mahmood, Arshad Ali, Nazam, and Nazim (2021) argue that interpersonal hurdles such as fear of change and a lack of peer support are more detrimental than technological barriers in situations with low levels of digital maturity. These psychosocial constraints heighten emotional exhaustion and undermine the productivity gains expected from digital integration.

Similarly, in their study, Atieh et al. (2022) found that in resource-constrained industries, interpersonal barriers, particularly rooted in culture and power dynamics, usually change the flow of essential operational knowledge and subsequently cause operational data errors, inefficiencies, and low morale in the team. This is critical for plants like Howick, where legacy systems and more traditional workforce mindsets can further compound the resistance to change.

This implies that CHAL accounts for nearly one-third of the variation in Work Impact and provides a compelling rationale for prioritising interpersonal barriers within the Howick plant's broader technology adoption strategy.

Rather than concentrating exclusively on technological infrastructure and system functionality, leadership should integrate human-centred approaches that address interpersonal dynamics.

Such support may include opening lines of communication to facilitate transparent conversations around implementation issues, implementing peer-support systems to build digital trust and decrease feelings of isolation, and providing conflict management and change-readiness training to address resistance. As Ghobbeh and Atrian (2024) highlight, organisations that overlook the importance of employee interpersonal readiness during digital transformation often face amplified employee burnout, high personnel turnover, and a decline in product and process quality.

These results highlight the necessity of relational leadership approaches that foster psychological safety, empower teams, and encourage adaptive behaviours. Employee engagement would increase, work-related stress would decrease, and overall operational reliability would increase if Howick operations could foster an atmosphere where workers feel encouraged and secure enough to voice concerns about technology.

Companies that neglect to incorporate interpersonal preparedness into their digital transformation initiatives frequently face more excellent rates of burnout, higher turnover, and lower process quality, as highlighted by Ghobbeh and Atrian (2024). Furthermore, these results emphasise the necessity of relational leadership, which encourages team empowerment and modifies managers' behaviours.

Seeking engagement and operational dependability necessitates the creation of a place where employees can talk about technology adoption challenges without being victimised and reprimanded. With CHAL accounting for 32.9% of WI, the Howick plant's leadership must will need to reframe its digital strategy to prioritise the human dynamics of adoption, not just the technical implementation. Addressing these interpersonal barriers can serve as a high-leverage intervention to reduce errors, enhance output quality, and support a motivated and agile workforce.

6.4 Chapter Conclusion

The study comprehensively examined the multifaceted barriers to technology adoption in the rubber manufacturing sector, particularly with respect to the Howick plant. Key findings indicated that technical challenges such as difficulty operating the DMS, insufficient training, limited technical support, and inadequate organisational infrastructure – significantly hindered the adoption process. These barriers contributed to inconsistent data input, employee frustration, and reduced engagement with technological systems. Furthermore, organisational factors, including a lack of structured support systems and misalignment between leadership vision and employee readiness, further compound resistance to change. The study highlights that while some employees recognised the benefits of technology in improving task efficiency and data accuracy, the overall effectiveness of adoption efforts was undermined by inadequate institutional preparation and support.

The discussion also covered the direct correlation between these barriers and diminished employee motivation, which in turn negatively impacted productivity. However, the study identified several actionable interventions that could bridge the gap between innovation and implementation. These included comprehensive training programmes, strategic leadership involvement, transparent communication, and the development of a supportive workplace

culture that values technological change. Moreover, a holistic adoption framework integrating motivation theories and acceptance models could facilitate a more inclusive and adaptive transition to DMS adoption. Ultimately, addressing both technical and psychosocial barriers through targeted interventions would be essential to foster a workforce that is empowered, motivated, and technologically competent, thereby enhancing data integrity and operational efficiency within rubber manufacturing operations.

7. Chapter 7: Conclusions and Recommendations

7.1 Introduction

This study sought to investigate the hesitance exhibited by employees working in the Howick rubber manufacturing operations towards the adoption of a DMS – a technological solution specifically designed to optimise business processes within manufacturing operations. Ideally this would result in streamlining operational data, improving process efficiencies and increasing the accuracy of data entered by employees in the production environment, thereby improving productivity and employee morale. Businesses that have successfully embraced the adoption of these technologies have emphasised the importance of collecting data in real time and accurate data harvesting and analysis, in order to harness its full value (Mogos et al., 2019).

This study provides initial insights into how employees perceive the obstacles towards the adoption DMS at the Howick Factory. New insights on challenges experienced by employees arose during the course of this study; including those related to inadequate skill proficiency, fears regarding employment security, and various established limitations, in particular those related to organisational barriers such as competitive interactions among divisions and a lack of effective communication. These findings were also significant from a managerial viewpoint and could prove beneficial when employing the requisite strategies.

The research established a compelling case for integrating technology within a manufacturing environment, drawing from the perspectives of factory workers who engaged daily with technology in their roles. The rationale for incorporating technology in its manufacturing operation is based on several factors on which the business is founded, as it navigates the competitive environment and propels its operations forward. Businesses utilising technologies such as a DMS, IoT, and Big Data in manufacturing to create a value sustainable performance, resulting in numerous benefits of significant data-driven industrial collaboration (Kamble et al., 2021).

This chapter elaborates on each research question's findings and relates these to what is already known. Additionally, the chapter explores the inferences of the findings for different stakeholders before concluding with a synthesis of the findings and a reflection on the problem and the significance of the findings. It also provides appropriate recommendations that flow directly from the study results. Finally, the chapter recommends other relevant research that could be conducted to further contribute to the solutions already discussed in this study.

7.2 Findings

The analysis explored how five technological variables – comparative benefit (CB), optional use (OU), ease of use (EU), system challenges (CHAL), and technology implementation (TI) affected two key dimensions of employee experience, namely personal motivation (PM) and work impact (WI). The outcomes provided essential insights for creating more effective technology deployment strategies to help mitigate the impact of barriers to technology adoption in organisational settings.

7.2.1. Influence on Personal Motivation

The relationship between CB and employee motivation demonstrated that when individuals perceived digital technologies to be offering tangible workplace advantages, they were more inclined to exhibit intrinsic motivation. The perceived CB of digital tools such as time savings or improved communication emerged as significant for employee motivation. When employees recognised the tangible improvements brought about by technology, they were more inclined to engage with the technology more meaningfully. This aligned with research that indicated that perceived value in technology amplified user content and commitment to technology adoption efforts (Leiß et al., 2022).

These findings suggest that the employee's intrinsic motivation could be leveraged as an advantage of use rather than a forced implementation by the organisation. Nevertheless, the outcomes indicated that the optional implementation of technology (as denoted by OU) did not significantly affect motivation. Researchers actively investigate the relationship between autonomy and work attitudes, typically finding a positive association. Essentially, the results demonstrated that OU does not improve employee engagement when autonomy is insignificant to the tasks performed. Schmid and Dowling (2020) supported this assertion, suggesting that unnecessary technologies may be perceived as superfluous when their functional value is ambiguous, ultimately leading to a diminished effect on employee motivation.

In contrast, the research revealed that the EU had a significantly positive influence on motivation. When employees find familiarity and user-friendliness in technology, it serves to encourage employee adoption and helps them to integrate it in their day-to-day functions with ease. It can therefore be predicted that facilitating EU improves CB, frustration, and training burden, which promotes user engagement over time by reducing user fatigue and increasing self-efficacy. This view aligns with empirical evidence by Andriani et al. (2025), which identified perceived convenience on digital instruments as a crucial factor in realising persistent motivational outcomes in organisations.

Consequently, CHAL, which included ambiguous interfaces or technical malfunctions, produced a significant negative effect on motivation. These barriers served as psychological deterrents, resulting in potential users becoming demotivated towards engaging with the technology or platform. Employees who faced challenges when attempting to execute the correct actions, felt disempowered, experiencing a loss in confidence, making them less likely to take the initiative, particularly if they repeatedly faced challenges when attempting to execute the correct actions. This assertion is corroborated by Molino et al. (2020), who stated that training and information support were major factors in counteracting the adverse effects of digital conflict within the workplace.

Finally, the effectiveness of technology implementation, which encompasses communication, training, and support, exhibited a positive correlation with motivation. The successful integration and implementation of the system effectively means that employees understood the function and value of the system, leading to a greater engagement. When organisations rolled out systems thoughtfully and supportively, employees felt supported and were much more likely to successfully embed these tools into workflows (Molino et al., 2020).

7.2.2. Effects of Work Impact

Perceived CB also had a negative impact on WI. Employees who viewed digital systems as helpful were much less likely to report higher levels of stress or workload strain. Technology is often simpler to use, hence requiring less motivation or willpower, and ultimately benefited higher levels of organisation efficiency and wellbeing (Leiß et al., 2022). However, the perception of OU had a significant correlation to WI, implying that uncertainty around the use of a system could lead to inconsistency and lower work performance. Should digital tools not be presented as necessary to employees, they do not understand how these tools apply to them, which may result in the misalignment of the function and increased perceived workload. Furthermore, according to Schmid and Dowling (2020), technologies that are not accompanied by explicit expectations will often not be used to their full potential, resulting in gaps in their realisation of objectives.

Once more, EU was linked to a reduction in perceived WI. Employees who found systems easy to navigate experienced fewer interruptions in their workflow. The smoother the interaction with the technology, the less it was perceived as a disruption. Andriani et al. (2025) noted that EU led to faster system integration and improved performance, further validating this relationship.

In contrast, CHAL had a significant positive association with increased WI. Employees who encounter obstacles frequently reported higher workload and stress issues. Such issues frequently lead to rework, delays, or use of manual interventions to ensure the conclusion of activity. de Assis Dornelles et al. (2022) claimed that technological challenges defeated the purpose of digital transformation, and also led to job dissatisfaction.

The influence of TI also exhibited a significant relationship with decreased WI. Well-planned and rolled out systems that structured training and support for users, reduced the chances of disruption and led to smoother transitions. Studies have shown that organisations focusing on the implementation phase had a greater user alignment and a minimal number of issues after deployment (Molino et al., 2020)

When these variables are combined, outcomes indicated that EU and system challenges significantly impacted on how technology influenced work. Ultimately, benefits and implementation matter; as the most useful technology can be rendered useless by poor usability, undoing anything positive and creating a large amount of indirect stress and inefficiency within the work environment.

This analysis highlights the multifaceted relationship between digital systems and workforce behaviour. Simple, beneficial, and well-implemented technology can go a long way in improving employee motivation and reducing strain on the workers. However, this is often hampered by technical obstacles and blurriness around the role of different players in the system. These insights reinforced the significance of human-centred digital strategies that not only look at the function of technology and what it can provide but, more critically, how the employees' experience in adopting technology would be the driver of transformational change and the levers that impact on most employee experience.

7.3 Recommendations

The research results revealed the key obstacles that hinder the adoption of technological innovations in the rubber sector at the Howick plant and how these barriers negatively affected employee motivation and production, providing valuable examples of potential solutions to minimise such

challenges. The most effective recommendations pertained to enhancing access to resource management support and advancing infrastructural development. Particularly, rubber manufacturing operations should be able to lobby for policies that facilitate easier access to digital systems, as well as resources for personnel with lower technical skills.

Encouraging the various business units of the Howick facility to become active participants in digital technology initiatives was likely to be supported through policies and initiatives that provided easy access to digital basics and the creation of the initiating systemic and institutional support structures. This also applied to enterprises in the rubber manufacturing sector as they considered investing in their digital infrastructure in order to have the necessary resources available to adopt and implement new technologies, and to drive competitive advantage.

The research highlighted potential strategies that could be designed to boost the integration of technological advancements within the Howick operations:

7.3.1. Training programmes

Key strategies identified included structured employee training programmes. Systemic training regimens were found to significantly increase job spirit and eagerness towards onboarding of technology. backed by linkages between employee involvement initiatives and enhanced technology acceptance figures (Del Valle et al., 2024; Bondin et al., 2024). Unless well structured training programmes were formulated and implemented at an operational level, employees would continue to face technology adoption and use obstacles further amplifying these barriers.

7.3.2. Strong communication

Businesses that provide positive and supportive environments with strong training programmes, while encouraging open communication, should increase employee's readiness to use data collection and management technology while also strengthening a productive and efficient workplace. Additionally, having a mind set that is open to the adoption and usage of technology plays a major role in employee levels of productivity. Extensive training programmes would be required to address any challenges, with open lines of communication that foster trust and support workers' confidence in working with any technologies (Del Valle et al., 2024).

7.3.3. Gamification

Operations may draw on the effectiveness of gamification to significantly increase employee engagement and thereby realise results in any prescribed activities (Dicheva et al., 2019). Gamification can also be used to convert where monotonous tasks into highly engaging activities. Gamification has been empirically proven to achieve positive outcomes, encouraging teamwork and helping to track performance during the development phase of implementing systems in an organisation.

7.3.4. Leadership culture

Organisations may also want to focus on building a supportive organisational culture. Active leadership involvement in training can help to establish a culture that is supportive for new technology adoption (Borkovich et al., 2015). Leadership bears a significant personal obligation to articulate a coherent vision regarding the strategic integration and acceptance of technological innovations. The right technical support can also foster employee engagement and a sense of ownership. Technology combined with flexible work policies can contribute to this enhancement in workforce motivation, adaptability, and performance. While these interventions might make some organisations more open to adopting technology, such external fragile factors would still hinder the ability of some organisations to adopt technological innovations fully.

These approaches should be holistically directed towards developing digital literacy, a conducive organisational culture, and access to requisite resources and infrastructure. They encourage the development of full-scale training programmes to build workers' digital skills, enabling them to comprehend and leverage the technologies adequately. Also, there is a need for collaboration with IT professionals where advice from such experts, could make the integration of technology easier as they can assist in clarifying the details of the new system.

7.4 Study Limitations

A number of limitations were identified which applied to this study when conducting the research. Identifying and discussing these subsequent limitations was key for accurate interpretation of the study results and ensured transparency in the research process.

- The research was performed within a single rubber manufacturing facility. However, acquiring perspectives from various analogous industrial operations might have proven advantageous. A broad analysis such as this would have enabled results to be obtained from a more expansive sample, thus highlighting whether these challenges were unique to the Howick operations or were dominant throughout the rubber manufacturing industry. As noted by Vermeulen et al. (2001), a risk of sampling bias arises when research is confined to certain geographical areas, thus risking a neglect of important differences that might exist across sectors of activity. Del Valle et al. (2024) concurred by noting that an exclusive focus on a singular site or a constrained viewpoint may overlook critical psychological impediments towards the adoption of technology, thereby suggesting that the study's conclusions might be subject to bias. As the data was gathered solely from respondents within the manufacturing environment of the Howick plant, the depth of

responses was restricted in terms of the entire sector, thereby diminishing an overall understanding of the industry.

- Moreover, the dependence on data provided by respondents had the potential for bias, for example, there is a tendency to present oneself in a socially desirable manner, along with the limitations of memory, both of which could have impacted on the precision of the data. To address these biases, researchers implemented measures such as conducting anonymous surveys and utilising verified question scales to ensure the accuracy and honesty of replies. Researchers based these measures on the recommended procedure provided by Thompson et al. (2019). Furthermore, even though researchers used random sampling to enhance representation, there were still non-response biases to some of the questionnaire.
- A further constraint of this research was the gender constitution of the sample. With only 4.17% females compared with a high majority of males at 95.83% implied that the results may not reflect the full spectrum of the study group's gender. One potential reason for this discrepancy is that respondents were been skewed toward a male demographic, owing to the dominant demographic makeup of the factory being comprised of males. Therefore, the generalisability and relevance of the study to multiple genders may be biased, these limitations should be considered in future studies, where technology adoption between the genders could be better addressed.
- The researcher had no prior experience in research methodology and with this being his novice study, there may have been areas that were ommitted, or better methods of analysing certain aspects which could be addressed in future studies.

7.5 Future study

This study could serve as a foundational point in the exploration of barriers towards the embracing of novel technologies by factory workers within rubber manufacturing industry. However, the results of the research should be accepted with high thoughtfulness due to the limited sample size and considering that it was only conducted on one site. Further research involving larger samples, including unique industry participants versus their counterparts in other organisations and industries, is warranted.

The current study explored technology adoption barriers faced by factory workers and their effects on employees' motivation. However, it did not account for the role of technology in managing employee turnover and the impact of employee turnover on technology.

Consequently, future studies should examine how technology adoption impacts employee turnover management and how new hires adapt to the workplace. Furthermore, addressing the effectiveness of how new methods might apply to workforce integration and whether motivational support in the first months of employment could contribute to developing new strategies that might increase the involvement of new employees and thereby assist in diminishing employee turnover.

This study was mostly focused on obstacles towards technology adoption and their effect on worker's motivation and productivity. A key challenge is that the study did not weigh up detailed alternative cultural contexts. Therefore, future studies that examine how different cultural contexts might shape technology adoption would be worthwhile.

In addition, future studies could consider cohort research that examines the ramifications of various adoption approaches on worker engagement levels, effectiveness, and overall organisational performance. Furthermore, future studies could delve into how emerging technologies and equipment automation, might affect employee attitudes and adaptability.

7.6 Conclusion

This paper addressed the aim of this research which was to analyse and tackle the difficulties related to the use of technology in industrial processes, particularly the barriers that impede efficient data input methods. The study was aimed at helping determine the underlying factors contributing to employee resistance and insufficient data entry when using the Howick factory's DMS. The study also intended to propose solutions that could address these challenges whilst refining their effect on worker commitment and overall efficiency.

Key findings indicated that technical challenges such as difficulty operating the DMS, insufficient training, limited technical support, and inadequate organisational infrastructure – significantly hindered the adoption process. These barriers contributed to inconsistent data input, employee frustration, and reduced engagement with technological systems.

Implications could be valuable for specialists and researchers who work within operations management and technology integration in business. The study of barriers to technology adoption, their influence in driving worker motivation, and potential interventions reveals interpersonal, infrastructural, technical, and organisational challenges in the local rubber manufacturing sector. Harnessing clear insights of such barriers is vital for developing functional methods to promote technology integration across sectors.

This research recognises limitations that the research was performed within a single rubber manufacturing facility, where acquiring perspectives from various analogous industrial operations might have been advantageous.

Future research could focus on conducting similar studies across various entities instead of one site, thereby enabling a wider pool of views, comparing and contrasting how employees at different rubber operations might be affected. Additionally, future studies could delve into how emerging technologies and equipment automation, may affect employee attitudes and adaptability.

In conclusion, businesses operating in today's dynamic and highly competitive conditions, can simply not afford to operate without adapting to technological advancement. Organisations must understand the correlation of changing workplace dynamics with this evolution , to continue to facilitate their workforce readiness during technology-based transitions and create a team of the future which is adaptable to these changes.

8. References

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9. Appendices

9.1 Appendix A: Research Instrument

Demographic Data

1. Gender: Male : _____
 Female: _____

 Other : _____
2. Years currently at the company:
 0 to 5 Years _____

 6 to 10 Years _____

 11 to 15 Years _____

 16 to 20 Years _____

 21 to 25 Years _____

 26 to 30 Years _____

 Greater Than 30 Years _____
3. Highest Level of qualifications:
 Primary School _____ High School _____ Diploma/Degree _____
 Other (Specify) _____
4. Job Level: Operator _____ Supervisory _____ First Line Management _____
 Middle Management _____ Senior Management _____

Section B: Technology Use

1	Extremely disagree
2	Disagree
3	Neutral
4	Agree
5	Extremely Agree

With reference to your interaction with the DMS system, use the scale to indicate the following with regards to the system:

Personal Motivation

- | | | | | | | |
|----|--|---|---|---|---|---|
| 1. | I feel a personal sense of achievement when I utilize technology to accomplish my tasks at work. | 1 | 2 | 3 | 4 | 5 |
| 2. | I take pride in performing my job to the best of my abilities. | 1 | 2 | 3 | 4 | 5 |
| 3. | It makes me unhappy when my work does not meet my standards, especially when utilizing technology. | 1 | 2 | 3 | 4 | 5 |
| 4. | I experience satisfaction when I believe that I have successfully completed the tasks for the day. | 1 | 2 | 3 | 4 | 5 |

Technology Implementation

- | | | | | | | |
|----|--|---|---|---|---|---|
| 5. | Our company offers technology assistance to enable teamwork from any location and at any time. | 1 | 2 | 3 | 4 | 5 |
| 6. | Our company offers technology assistance to enable teamwork from any location and at any time. | 1 | 2 | 3 | 4 | 5 |
| 7. | Our company offers technology assistance to aid in searching for data capturing and accessing essential information. | 1 | 2 | 3 | 4 | 5 |
| 8. | Our company offers technology assistance for operational overview purposes. | 1 | 2 | 3 | 4 | 5 |
| 9. | Our company offers technology for organized data storage." | 1 | 2 | 3 | 4 | 5 |

Use Friendliness

- | | | | | | | |
|-----|--|---|---|---|---|---|
| 10. | I find using a DMS to be complicated. | 1 | 2 | 3 | 4 | 5 |
| 11. | I find it easy to remember how to perform tasks with a DMS | 1 | 2 | 3 | 4 | 5 |
| 12. | Using a DMS requires a lot of mental effort. | 1 | 2 | 3 | 4 | 5 |
| 13. | Using a DMS can be frustrating. | 1 | 2 | 3 | 4 | 5 |
| 14. | My interactions with a DMS are clear and understandable | 1 | 2 | 3 | 4 | 5 |
| 15. | Getting a DMS to do what I want is easy. | 1 | 2 | 3 | 4 | 5 |
| 16. | Overall, I find a DMS to be easy to use. | 1 | 2 | 3 | 4 | 5 |
| 17. | Learning to operate a DMS is easy for me. | 1 | 2 | 3 | 4 | 5 |

Comparative Benefits

18. Utilising DMS enhances my efficiency in completing my tasks	1	2	3	4	5
19. Utilising a DMS enhances the quality of my work.	1	2	3	4	5
20. Utilising DMS facilitates the execution of my tasks.	1	2	3	4	5
21. The drawbacks of using a DMS significantly surpass the benefits.	1	2	3	4	5
22. Utilising DMS enhances my productivity	1	2	3	4	5
23. In general, I feel that using a DMS provides significant benefits in my job.	1	2	3	4	5
24. Utilising DMS amplifies my efficiency in the workplace.	1	2	3	4	5
25. Utilising DMS affords me more command over my tasks	1	2	3	4	5
26. Employing DMS enhances my efficiency and output	1	2	3	4	5

Impact on self on self

Work Impact

27. I feel high levels of stress when working closely with DMS	1	2	3	4	5
28. Experiencing frustration with DMS.	1	2	3	4	5
29. I am contemplating a departure from the jobs that require DMS interaction.	1	2	3	4	5
30. I experience a sense of overworking when using DMS.	1	2	3	4	5
31. I experience fatigue as a result of working with DMS	1	2	3	4	5
32. My working capabilities are being affected by my workload due to technology.	1	2	3	4	5
33. My personal life is being affected by my workload due to technology.	1	2	3	4	5

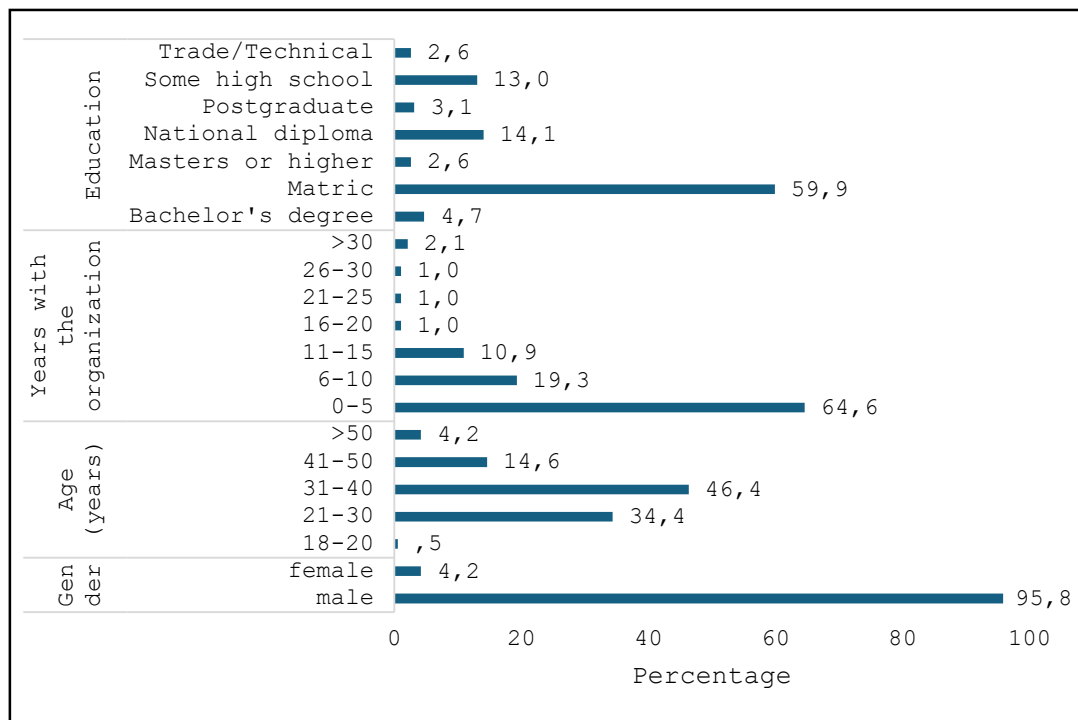
Optional use

34. My senior requires me to use DMS	1	2	3	4	5
35. Using DMS is optional for me (Rather than being mandatory according to my manager's or job requirement	1	2	3	4	5
36. I am not compelled by my manager to use DMS	1	2	3	4	5
37. While it could be beneficial, the use of DMS is not obligatory in my role	1	2	3	4	5

9.2 Appendix B: Demographics Analysis

		Frequency	Percent
Valid	Bachelor's degree	9	4.7
	Matric	115	59.9
	Masters or higher	5	2.6
	National diploma	27	14.1
	Postgraduate	6	3.1
	Some high school	25	13.0
	Trade/Technical	5	2.6
	Total	192	100.0

Employee level of Education



Demographic Chart

9.3 Annexure C: Mean Tables

Table 6.1: Personal Motivation:

<i>Personal motivation</i>	<i>n</i>	<i>Mean</i>	<i>Std deviation</i>	<i>t</i>	<i>df</i>	<i>p-value</i>
I feel a personal sense of achievement when I utilize technology to accomplish my tasks at work.	192	3.66	.968	9.468	191	<.001
I take pride in performing my job to the best of my abilities.	192	4.09	1.064	14.241	191	<.001
It makes me unhappy when my work does not meet my standards, especially when utilizing technology.	192	3.87	.965	12.493	191	<.001
I experience satisfaction when I believe that I have successfully completed the tasks for the day	192	4.11	.983	15.632	191	<.001

9.4 Annexure D: One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
TI1 Our company offers technology assistance to enable data logging at any location	192	3.23	1.116	.081
TI2 Our company offers technology assistance to enable any individual to log data at any time within the process.	192	3.10	1.147	.083
TI3 Our company offers technology assistance to aid in searching for data capturing and accessing essential information	192	3.36	1.059	.076
TI4 Our company offers technology assistance for operational overview purposes.	192	3.47	.976	.070
TI5 Our company offers technology to enable the ability to review the data	192	3.62	.952	.069
TI6 Our company offers training for the use of technology	192	3.30	1.258	.091
UF1 I find using DMS to be complicated.	192	2.81	1.081	.078
UF2 I find it easy to remember how to perform tasks with DMS	192	3.44	.953	.069
UF3 Using DMS requires a lot of mental effort.	192	2.96	1.048	.076
UF4 Using DMS can be frustrating.	192	2.84	1.073	.077

UF5 My interactions with DMS are clear and understandable	192	3.38	1.010	.073
UF6 Getting DMS to do what I want is easy.	192	3.22	1.065	.077
UF7 Overall, I find DMS to be easy to use	192	3.36	.944	.068
UF8 Learning to operate DMS is easy for me	192	3.48	.932	.067
CB1 Utilising DMS enhances my efficiency in completing my tasks	192	3.40	.780	.056
CB2 Utilising a DMS enhances the quality of my work.	192	3.62	.816	.059
CB3 Utilising DMS facilitates the execution of my tasks.	192	3.41	.827	.060
CB4 The drawbacks of using a DMS significantly surpass the benefits	192	3.06	.841	.061
CB5 Utilising DMS enhances my productivity	192	3.48	.779	.056
CB6 In general, I feel that using a DMS provides significant benefits in my job.	192	3.60	.927	.067
CB7 Utilising DMS amplifies my efficiency in the workplace.	192	3.53	.831	.060
CB8 Utilising DMS affords me more command over my tasks	192	3.36	.870	.063
CB9 Employing DMS enhances my efficiency and output	192	3.44	.842	.061

WI1 I feel high levels of stress when working closely with DMS	192	2.77	.960	.069
WI2 I experience frustration with DMS	192	2.69	.930	.067
WI3 I am contemplating a departure from the jobs that require DMS interaction.	192	2.70	.899	.065
WI4 I experience a sense of overworking when using DMS.	192	2.73	1.012	.073
WI5 I experience fatigue as a result of working with DMS	192	2.72	.968	.070
WI6 My working capabilities are being affected by my workload due to technology."	192	2.71	.964	.070
WI7 My personal life is being affected by my workload due to technology	192	2.43	.995	.072
OU1 My senior requires me to use DMS	192	3.34	.989	.071
OU2 Using DMS is optional for me (Rather than being mandatory according to my manager's or job requirement)	192	3.06	.995	.072
OU3 I am not compelled by my manager to use DMS	192	3.10	.943	.068
OU4 While it could be beneficial, the use of DMS is not obligatory in my role	192	2.99	.984	.071

	N	Mean	Std. Deviation
PM1 I feel a personal sense of achievement when I utilize technology to accomplish my tasks at work.	192	3.66	.968
PM2 I take pride in performing my job to the best of my abilities.	192	4.09	1.064
PM3 It makes me unhappy when my work does not meet my standards, especially when utilizing technology.	192	3.87	.965
PM4 I experience satisfaction when I believe that I have successfully completed the tasks for the day	192	4.11	.983

One Sample Statistics

Construct	Label	Items included	Variance extracted (%)	Cronbach's alpha	KMO	Bartlett's (χ^2 , df, p value)
Personal motivation	PM	PM:1, 2, 4	44.2	.702	0.672	101.07; 3; <.001
Technology implementation	TI	TI: 11-16	51.5	.866	0.752	481.979; 15; <.001
User friendliness	EU (Ease of use)	UF: 2, 5-8	36.3	.836	0.806	485.734; 28; <.001
	CHAL (Challenges)	UF: 1, 3, 4	12.4	.686		
Comparative benefits	CB	CB: 1-3, 5-9	60.6	.923	0.900	1040.536; 28; <.001
Work impact	WI	WI: 1-7	53.3	.887	0.872	654.532; 21; <.001
Optional use	OU	OU: 2-4	37.4	.630	0.634	71.172; 3; <.001

KMO – Kaiser-Meyer-Olkin measure of sampling adequacy

df – degrees of freedom

One-Sample Test

	Test Value = 3					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
TI1 Our company offers technology assistance to enable data logging at any location	2.845	191	.005	.229	.07	.39
TI2 Our company offers technology assistance to enable any individual to log data at any time within the process.	1.196	191	.233	.099	-.06	.26
TI3 Our company offers technology assistance to aid in searching for data capturing and accessing essential information	4.702	191	.000	.359	.21	.51
TI4 Our company offers technology assistance for operational overview purposes.	6.730	191	.000	.474	.34	.61
TI5 Our company offers technology to enable the ability to review the data	9.017	191	.000	.620	.48	.76
TI6 Our company offers training for the use of technology	3.271	191	.001	.297	.12	.48

UF1 I find using DMS to be complicated.	-2.403	191	.017	-.188	-.34	-.03
UF2 I find it easy to remember how to perform tasks with DMS	6.439	191	.000	.443	.31	.58
UF3 Using DMS requires a lot of mental effort.	-.551	191	.582	-.042	-.19	.11
UF4 Using DMS can be frustrating.	-2.085	191	.038	-.161	-.31	.00
UF5 My interactions with DMS are clear and understandable	5.143	191	.000	.375	.23	.52
UF6 Getting DMS to do what I want is easy.	2.845	191	.005	.219	.07	.37
UF7 Overall, I find DMS to be easy to use	5.275	191	.000	.359	.22	.49
UF8 Learning to operate DMS is easy for me	7.124	191	.000	.479	.35	.61
CB1 Utilising DMS enhances my efficiency in completing my tasks	7.127	191	.000	.401	.29	.51
CB2 Utilising a DMS enhances the quality of my work.	10.522	191	.000	.620	.50	.74
CB3 Utilising DMS facilitates the execution of my tasks.	6.898	191	.000	.411	.29	.53

CB4 The drawbacks of using a DMS significantly surpass the benefits	1.029	191	.305	.063	-.06	.18
CB5 Utilising DMS enhances my productivity	8.523	191	.000	.479	.37	.59
CB6 In general, I feel that using a DMS provides significant benefits in my job.	8.953	191	.000	.599	.47	.73
CB7 Utilising DMS amplifies my efficiency in the workplace.	8.861	191	.000	.531	.41	.65
CB8 Utilising DMS affords me more command over my tasks	5.808	191	.000	.365	.24	.49
CB9 Employing DMS enhances my efficiency and output	7.287	191	.000	.443	.32	.56
WI1 I feel high levels of stress when working closely with DMS	-3.309	191	.001	-.229	-.37	-.09
WI2 I experience frustration with DMS	-4.655	191	.000	-.313	-.44	-.18
WI3 I am contemplating a departure from the jobs that require DMS interaction.	-4.654	191	.000	-.302	-.43	-.17
WI4 I experience a sense of overworking when using DMS.	-3.638	191	.000	-.266	-.41	-.12

WI5 I experience fatigue as a result of working with DMS	-4.028	191	.000	-.281	-.42	-.14
WI6 My working capabilities are being affected by my workload due to technology."	-4.190	191	.000	-.292	-.43	-.15
WI7 My personal life is being affected by my workload due to technology	-7.905	191	.000	-.568	-.71	-.43
OU1 My senior requires me to use DMS	4.741	191	.000	.339	.20	.48
OU2 Using DMS is optional for me (Rather than being mandatory according to my manager's or job requirement)	.870	191	.385	.063	-.08	.20
OU3 I am not compelled by my manager to use DMS	1.530	191	.128	.104	-.03	.24
OU4 While it could be beneficial, the use of DMS is not obligatory in my role	-.073	191	.942	-.005	-.15	.13