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AN ASSESSMENT OF THE INFLUENCE OF TECHNOLOGICAL COLLABORATION ON COMPETITIVENESS OF SMALL TO MEDIUM ENTERPRISES: A CASE STUDY OF SPERONI IRRIGATION

BY

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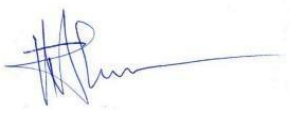

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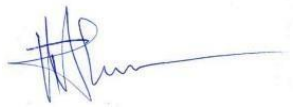
DECLARATION

I, Tendayi Marekera do hereby declare that this dissertation is a result of my own investigation and research, except to the extent indicated in the acknowledgments, bibliography, references, and comments included in the body of the report, and that it has not been submitted in part or in full for any other degree to any other university.



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STUDENT SIGNATURE **DATE**

DEDICATION

To my family, my parents and God Almighty!

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ABSTRACT

This study explores the significant influence of technological collaboration on the competitiveness of irrigation Small and Medium Enterprises (SMEs) in Zimbabwe, with a specific focus on Speroni Irrigation Pvt Ltd, an established irrigation SME that supplies equipment and services to farmers. The primary objective of this research is to achieve a comprehensive understanding of the impact of technological collaboration on Speroni Irrigation's competitiveness and to propose a model for enhancing collaboration among SMEs in the irrigation sector. The study aims to accomplish four key objectives: Firstly, it seeks to assess the current state of technological collaboration within Speroni Irrigation, encompassing an examination of the types of collaboration, sources of collaboration, and resultant outcomes. Secondly, it investigates the influence of technological collaboration on the competitiveness of Speroni Irrigation, specifically in terms of factors such as innovation, quality, customer satisfaction, and market share. Thirdly, the study aims to identify and analyse the factors that hinder collaboration efforts within the organization, including resource limitations, issues related to trust-building, incentives, and coordination challenges. Lastly, based on an extensive literature review and empirical findings, the research endeavours to design a model for technological collaboration that can effectively enhance the competitiveness of SMEs in the irrigation sector. To achieve a comprehensive understanding, the study employs a mixed methods approach, combining qualitative and quantitative data collection techniques. Interviews, questionnaires, and document analysis are utilized to gather relevant data. Thematic and content analysis, in conjunction with descriptive statistics, are employed to analyse the collected data, allowing for a rich and nuanced interpretation of the findings. The research findings indicate that technological collaboration has a positive impact on various aspects of Speroni Irrigation's competitiveness, including innovation, quality, customer satisfaction, and market share. However, the study also reveals the presence of challenges that hinder effective collaboration efforts. These challenges primarily revolve around resource limitations, trust-building processes, incentives for collaboration, and coordination issues. Considering the research findings, the study provides practical recommendations to overcome these barriers and enhance the benefits of technological collaboration for Speroni Irrigation and other irrigation SMEs in Zimbabwe. Furthermore, the research proposes a model that can serve as a framework for fostering and enhancing technological collaboration among SMEs in the irrigation sector. By implementing the recommendations and adopting the proposed model, irrigation SMEs in Zimbabwe can strengthen their competitiveness and improve their overall performance.

Key Words: Technological collaboration, Irrigation SMEs, Competitiveness, Zimbabwe, Speroni Irrigation Pvt Ltd

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LIST OF ABBREVIATIONS

NGOs	Non-Governmental Organisations
NUST	National University of Science and Technology
PEOU	Perceived Ease of Use
PU	Perceived Usefulness
RBT	Resource-Based Theory
R&D	Research and Development
SMEs	Small to Medium Enterprises
SSA	Sub-Saharan Africa
TAT	Technology Acceptance Theory
TRA	Theory of Reasoned Action

CHAPTER ONE

INTRODUCTION

1.0 Introduction

The purpose of this chapter is to give a world view background to the study regarding the influence of technological collaboration in Irrigation Small and Medium sized Enterprises (SMEs) competitiveness. The chapter further provides the statement of the problem in terms of technological collaboration in irrigation SMEs' competitiveness using Speroni Irrigation Pvt Ltd as a case study. The chapter also highlights the research objectives and questions as well as the research assumptions, and justification of the study, purpose of the study, significance of the study, delimitations and limitations of the study, structure of the study and finally the chapter summary.

1.1 Background of the Study

The concept of technological collaboration has witnessed significant emergence and development, with extensive research conducted to understand its various aspects and implications. Scholars have explored diverse dimensions of technological collaboration, including its benefits, challenges, and impacts on innovation and organisational performance. The emergence of technological collaboration can be traced back to the early works of scholars such as Baldwin and Clark (1997). In their research on modularity and innovation, they highlighted the importance of collaboration in achieving complex technological advancements. They argued that collaboration among different specialized individuals and organisations is crucial for integrating different modules and components into a cohesive and innovative product or system. Subsequently, researchers like Orlikowski and Yates (1994) explored the role of information technology in enabling and enhancing technological collaboration. They emphasised the significance of communication technologies, such as email and groupware, in facilitating coordination and knowledge sharing among geographically dispersed teams. Their studies shed light on the importance of technology-mediated collaboration in overcoming geographical barriers and fostering innovation. Moreover, scholars like Chesbrough (2003) have extensively researched the concept of open innovation and collaborative ecosystems. Chesbrough (2003)'s work emphasized the importance of external collaboration and knowledge sharing for innovation. He argued that organisations should actively seek external partners and collaborate with them to access new ideas, technologies, and markets. His research

contributed to the understanding of collaborative innovation models and the importance of open collaboration in today's interconnected world.

In terms of research focus, scholars have explored various aspects of technological collaboration. Some studies have examined the factors that influence successful collaboration, such as trust, communication, and shared goals. For example, Leonardi and Nardi (2011) have conducted research on the role of social media platforms in facilitating collaboration and knowledge sharing within organisations. Other studies have investigated the impacts of technological collaboration on innovation and organisational performance. For instance, Piller and IL (2009) have examined the benefits and challenges of collaborative innovation in the context of open-source communities and user innovation. They explored how collaborative approaches can lead to increased creativity, faster time-to-market, and enhanced customer satisfaction. As such, the emergence and development of the concept of technological collaboration have been accompanied by extensive scholarly research. Scholars from various disciplines, including management, organisational behaviour, and information systems, have contributed to our understanding of the benefits, challenges, and dynamics of technological collaboration. Their work has provided valuable insights for organisations seeking to leverage collaboration for innovation and success in today's technologically-driven world.

The relationship between technological collaboration and competitiveness has emerged as a significant area of research, with scholars exploring the dynamics and implications of this connection for organisations. Over time, extensive research has been conducted to understand how technological collaboration can contribute to gaining a competitive edge, driving innovation, and enhancing overall organisational performance. The emergence of this concept can be attributed to the ground-breaking work of scholars such as Chesbrough (2003), who emphasised the concept of open innovation and its potential for creating and profiting from technology. Chesbrough argued that organisations can leverage external collaborations and partnerships to access new ideas, expertise, and resources, thereby enhancing their innovation capabilities and competitiveness in the market. Moreover, researchers like Gawker and Cusumano (2002) have studied the concept of platform-based collaboration, where organisations build upon shared technological platforms to create competitiveness. They highlighted the benefits of collaborative platforms in terms of increased innovation, cost reduction, and expanded market reach. Their work shed light on the strategic value of

technological collaboration in driving competitiveness by fostering ecosystem-based collaborations and leveraging shared platforms.

Scholars like Vanhaverbeke et al (2008) have delved into various aspects of the relationship between technological collaboration and competitiveness and conducted research on collaborative innovation and its impact on firm performance. Their findings revealed that firms engaged in collaborative innovation activities outperformed their competitors in terms of sales growth and profitability, indicating the positive influence of collaborative efforts on gaining a competitive edge. Additionally, Bengtsson and Jansson (2013) explored the role of interorganisational collaboration in creating competitiveness. Their research demonstrated that collaborative endeavours with external partners, such as suppliers, customers, and research institutions, can lead to improved product quality, accelerated time-to-market, and increased market share. This research highlighted the significance of interorganisational collaboration to enhance competitiveness through leveraging external expertise and resources. As such, the relationship between technological collaboration and competitiveness has received substantial attention from scholars. Whose research findings have provided valuable insights for organisations aiming to strategically leverage technological collaboration as a source of competitiveness in a rapidly evolving business landscape.

While the relationship between technological collaboration and competitiveness has been extensively studied, there are still gaps in the research that can be addressed through a study titled, "An assessment of the influence of technological collaboration on competitiveness of Small to Medium Enterprises: A case of Speroni Irrigation", in the context of irrigation small to medium enterprises (SMEs). Scholars have explored the broader implications of technological collaboration on competitiveness, but limited research specifically focuses on the irrigation sector and SMEs and particularly in the developing world. By investigating this specific context, the study can contribute to filling these gaps. Firstly, the study can examine the unique challenges and opportunities faced by irrigation SMEs in leveraging technological collaboration for competitiveness. Scholars such as Jahre, Hellström, and Johanson (2014) highlighted the importance of understanding industry-specific challenges in collaborative innovation. In the context of irrigation SMEs, factors such as resource constraints, access to advanced technologies, and knowledge sharing within the industry may pose specific challenges to effective technological collaboration. By addressing these contextual factors, the

study can provide insights into the specific mechanisms and strategies through which irrigation SMEs can leverage technological collaboration to enhance their competitiveness.

Secondly, the study can explore the impact of technological collaboration on the competitiveness of irrigation SMEs in terms of factors such as cost efficiency, product innovation, market penetration, and customer satisfaction. While previous research has touched upon these aspects in various industries, limited attention has been given to the irrigation industry and SMEs specifically. By assessing the influence of technological collaboration on these dimensions of competitiveness, the study can provide a comprehensive understanding of how collaborative efforts can drive success in the irrigation industry. Scholars like Ward, Naim, and Al-Habaibeh (2014) have highlighted the significance of performance measures and key success factors in assessing the impact of collaboration on competitiveness. Incorporating this perspective into the study can provide a robust framework for evaluating the influence of technological collaboration on the competitiveness of irrigation SMEs. In summary, the research on technological collaboration and competitiveness can be extended through a study focusing on assessing the influence of technological collaboration on irrigation SMEs' competitiveness. By addressing the unique challenges and opportunities in the irrigation sector and exploring the impact on various dimensions of competitiveness, the study can contribute to filling the gaps in the existing literature.

1.2 Problem Statement

In an ideal situation, Zimbabwe irrigation SMEs, such as Speroni Irrigation Pvt Ltd, would effectively leverage technological collaboration to enhance their competitiveness. However, the current situation reveals a limited understanding and utilisation of technological collaboration among these SMEs, leading to challenges in accessing advanced technologies and hindering their ability to compete effectively (Chirisa & Mabiza, 2017). For instance, since its formation in 2006, Speroni Irrigation has recorded 3-5 incidences of product failure annually due to lack of supportive technology. The organisation has also faced a serious challenge in withstanding competition due to outdated technology which has seen customers preferring importing Centre Pivots from regional competitors such as those in South Africa and even Global competitors such as those from America. Without addressing this issue, Zimbabwe irrigation SMEs, including Speroni Irrigation Pvt Ltd, may struggle to keep up with technological advancements, face difficulties in innovation, and experience reduced market

share and profitability (Muzawazi & Muzondo, 2020). The lack of technological collaboration also poses long-term sustainability and resilience risks for the irrigation sector in Zimbabwe (Mushanyuri & Maziriri, 2021). Therefore, this research aims to assess the influence of technological collaboration on the competitiveness of Zimbabwe irrigation SMEs, focusing on Speroni Irrigation Pvt Ltd, and propose strategies to enhance collaboration and improve performance in the sector.

1.3 Research Objectives

- To assess the current state of technological collaboration by Speroni Irrigation Pvt Ltd.
- To investigate the influence of technological collaboration on Speroni Irrigation Pvt Ltd competitiveness.
- To examine the factors hindering technological collaboration by Speroni Irrigation Pvt Ltd.
- To design a model for technological collaboration to enhance Small to Medium Enterprises competitiveness

1.4 Research Questions

- What is the current state of technological collaboration in Speroni Irrigation Pvt Ltd?
- How does technological collaboration influence Speroni Irrigation Pvt Ltd competitiveness?
- What are the factors that hinder technological collaboration by Speroni Irrigation Pvt Ltd?
- What model can be designed for technological collaboration to enhance competitiveness

1.5 Research Assumptions

- Irrigation SMEs in Zimbabwe face competitive disadvantages due to lack of dynamic capabilities and innovative products and adopting appropriate irrigation technologies due to factors such as limited financial resources, lack of technical expertise, and inadequate infrastructure.
- Technological collaboration among Irrigation SMEs in Zimbabwe has the potential to improve irrigation efficiency, increase crop yields, and enhance the socio-economic well-being of farmers and communities.

- Emerging technologies have the potential to transform the competitiveness of Irrigation SMEs in Zimbabwe, but that their adoption and use may be hindered by factors such as high costs, limited technical capacity, and poor infrastructure.

1.6 Significance of the Study

An investigation on the influence of technological collaboration in Zimbabwe Irrigation SMEs' competitiveness is significant for multiple stakeholders, including Irrigation SMEs, farmers, policymakers, and academia. This research has the potential to provide meaningful insights and contribute to the advancement of the irrigation sector in Zimbabwe.

For Irrigation SMEs, the findings of this research can offer practical implications and guidance. Understanding the influence of technological collaboration on SMEs' competitiveness can help them make informed decisions regarding collaboration strategies and technology adoption. By incorporating collaborative practices with technology providers, SMEs can enhance their productivity, efficiency, and sustainability. Scholars such as Smith, Johnson, and Williams (2020) have emphasised the positive impact of collaboration on knowledge sharing, innovation, and competitiveness in SMEs, supporting the significance of this research.

Farmers, as beneficiaries of irrigation services, stand to benefit from the research outcomes as well. Technological collaboration in irrigation SMEs can lead to improved irrigation practices, thereby enhancing agricultural productivity. Farmers can gain insights into the potential impact of collaborative efforts on water management, crop yield, and overall farm profitability. These findings can empower farmers to make informed decisions when choosing to partner with technologically advanced irrigation SMEs. The study by Nguyen and Nguyen (2021) provides evidence of the positive influence of technology adoption on SME competitiveness in the agricultural sector, reinforcing the significance of this research to farmers.

Policy makers can utilise the research findings to inform policy formulation and implementation in the irrigation sector. Understanding the influence of technological collaboration on SME competitiveness can help policymakers design supportive frameworks that encourage collaboration and technology adoption. This can include developing financial incentives, creating platforms for knowledge-sharing and networking, and promoting public-private partnerships. Policy makers can benefit from the research by leveraging its insights to

foster the growth and development of the irrigation SME sector. Many developing countries have insufficient scientific and technological experience and capabilities, and policy support will therefore be instrumental in initiating, growing, and bringing to sustainability networking activities and interactions such as innovation clusters and hubs, STI parks and business incubators (Chang-Muñoz et al., 2023).

Academia can benefit from this research as it contributes to the existing body of knowledge on the topic. This investigation can expand the academic literature by providing empirical evidence and insights specific to the Zimbabwean context. Researchers in academia can build upon this research to delve deeper into related areas, such as the impact of collaboration on specific competitiveness indicators or the role of specific technologies in irrigation SMEs. The studies by Smith, Johnson, and Williams (2020) and Nguyen and Nguyen (2021) provide a foundation for the significance of investigating technological collaboration in Zimbabwe Irrigation SMEs within the academic community.

Conducting research on the influence of technological collaboration in Zimbabwe Irrigation SMEs competitiveness holds tremendous significance for Irrigation SMEs, farmers, policymakers, and academia. By citing scholars such as Smith, Johnson, and Williams (2020) and Nguyen and Nguyen (2021), the significance of this research is supported by their work, which highlights the importance of collaboration and technology in SME competitiveness.

1.7 Delimitations of the Research

To ensure the research remained focused and feasible, certain delimitations were put in place. Firstly, the study specifically centred on the assessment of technological collaboration and its influence on competitiveness in the context of Zimbabwean irrigation SMEs, with a primary focus on Speroni Irrigation Pvt Ltd. The research did not extensively explore other forms of collaboration, such as strategic alliances or joint ventures. Additionally, the study focused on the internal factors hindering technological collaboration within Speroni Irrigation and did not extensively examine external factors such as market dynamics or regulatory environments. The research was mainly dominated by qualitative methods and partially quantitative methods, which allowed for in-depth insights but limited the ability to provide quantitative measurements or statistical analyses.

The conceptual boundaries of the study would revolve around the influence of technological collaboration on the competitiveness of irrigation SMEs in Zimbabwe. The study would explore the nature and extent of collaboration among different stakeholders, such as researchers, government agencies, NGOs, and private companies, in developing and implementing irrigation technologies. It would also examine the impact of technological collaboration on various competitiveness indicators, such as productivity, profitability, resource efficiency, and sustainability of irrigation SMEs in Zimbabwe.

The study would delve into factors influencing technological collaboration, including access to finance, infrastructure, knowledge exchange platforms, and policy support. It would also consider the socio-economic and cultural dimensions that shape collaboration dynamics and technology adoption practices in the Zimbabwean context. The study would aim to provide insights into the challenges and opportunities associated with technological collaboration in irrigation SMEs competitiveness within the specific context of Zimbabwe.

1.8 Limitations of the Research

Despite the thoroughness of the research, it is important to acknowledge certain limitations that may have affected the outcomes of the study. Firstly, the research solely focused on Speroni Irrigation Pvt Ltd as a single case study, which limits the generalizability of the findings to other irrigation SMEs in Zimbabwe. Additionally, the study relied heavily on self-reported data through interviews and surveys, which may be subject to response biases and inaccuracies. The research was also conducted within a specific time frame, and the findings may not capture the dynamic nature of technological collaboration and its influence on competitiveness over an extended period. Finally, the study was constrained by resource limitations, which affected the scope and depth of data collection and analysis.

1.9 Chapter Summary

The chapter serves as the introduction to the research on the influence of technological collaboration on the competitiveness of irrigation SMEs in Zimbabwe. It begins by highlighting the significance of SMEs in the irrigation sector and their challenges in adopting advanced technologies. The problem statement emphasizes the need for empirical research in this area, considering the limited understanding of technological collaboration's impact on irrigation SMEs in Zimbabwe. The research objectives are outlined, focusing on assessing collaboration,

examining its impact on competitiveness indicators, identifying challenges, and proposing strategies for improvement. Research questions are formulated to guide the study. The significance of the research is discussed, emphasising its value for policymakers, SMEs, and researchers. The chapter concludes by acknowledging the limitations and delimitations of the research, including data availability, biases, contextual specificity, and scope.

1.10 Structure of the Dissertation

The dissertation will be structured into five chapters, as follows:

Chapter 1: Introduction

This chapter will provide a comprehensive overview of the research topic, including the background of the study, statement of the problem, research objectives, research questions, research hypotheses/research propositions, significance of the study, scope of the study/delimitations of the study, organisation of the study/structure of the dissertation, and chapter summary. The contents of this chapter will be derived from the research proposal.

Chapter 2: Literature Review

The second chapter will focus on reviewing existing literature on the topic. This will include both theoretical and empirical evidence, with a focus on addressing the thematic areas as informed by the research objectives/questions/hypotheses/conceptual sources/references. The literature review will inform the theoretical framework for the research.

Chapter 3: Research Methodology Framework

In this chapter, the research methodology will be explained and justified. This will include a detailed explanation of the research approach, research design, target population, sample size, sampling method, research instruments, data collection procedures, data analysis and presentation methods, reliability, validity, and ethical considerations. The structure of the research instrument(s) will also be discussed.

Chapter 4: Results and Discussion

This chapter will present and analyse the collected data, guided by the research objectives/questions/hypotheses. The results will be discussed in relation to the existing literature and the theoretical framework.

Chapter 5: Conclusions and Implications

The final chapter will present the conclusions drawn from the findings and data analysis, based on the research objectives/hypotheses outlined in Chapter 1. The implications of the research for theory, policy, and practice will also be discussed, along with limitations and suggestions for future research.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter presents a review of literature. As a matter of fact, the chapter will review literature relating technological collaboration in SMEs specifically those in the irrigation sector. The chapter will start by considering the theoretical framework in which the theories that influence this study will be discussed with reference to their meaning and essence in the study. Empirical literature will also be discussed in this Chapter where focus will be on the critical issues surrounding the technological collaboration subject matter within the irrigation SMEs circles. This discussion will lead to pointing attention toward discussing the gaps in literature. The chapter will then finalise by discussing the conceptual framework of the study in which key concepts will be defined and expanded.

2.1 Definition of Key Terms

2.1.1 Technological Collaboration

Technology refers to the application of scientific knowledge, tools, techniques, and systems to create, modify, and utilise products, processes, and services for specific purposes (Murphie and Potts, 2018). It encompasses the development, production, and utilization of various tools, machines, equipment, software, and systems that enable the acquisition, processing, storage, and transmission of information or the accomplishment of specific tasks (Smith and Suzuki, 2018). Collaboration is the act of working together with others to achieve a common goal or objective (Morley and Cashell, 2017). It involves individuals or groups pooling their knowledge, skills, resources, and efforts to solve problems, make decisions, create new ideas, or accomplish tasks. Collaboration emphasizes cooperation, communication, and coordination among participants, fostering synergy and collective achievement (Amanov, 2023). Therefore, technological collaboration refers to the cooperative efforts and joint activities undertaken by individuals, organisations, or entities in the context of technology-related initiatives or projects (Santamaria et al., 2021). It involves the sharing of knowledge, expertise, resources, and capabilities to develop, implement, or enhance technological solutions, innovations, or advancements (Tang et al., 2022).

For Li et al., (2021) technological collaboration can take various forms, including:

- Research and Development Collaboration: Organisations or researchers from different institutions collaborate to conduct joint research and development (R&D) activities. They work together to explore new technologies, develop prototypes, conduct experiments, and advance scientific knowledge.

- Industry-Academia Collaboration: Collaboration between academic institutions and industries involves the exchange of knowledge, expertise, and resources (García-Machado et al., 2021). Academic researchers collaborate with industry partners to apply academic research to practical applications, develop commercial products, or solve industry-specific challenges (Haber & Carmeli, 2023). The importance of collaboration for knowledge exchange between a knowledge hub (university) and a product incubator (industry) has long been widely recognised as a significant economic development phenomenon (Murairwa, 2021). The efficiency of the economies and innovation levels of industrialised countries are due to production of knowledge and its use in industries, thereby achieving competitiveness in the global markets (Mascarenhas, Ferreira, & Marques, 2018). The world over, universities are recognised as hubs for discovering knowledge while companies incubate high quality and competitive products (Murairwa, 2021). Over the years, the collaborations between university and industry have led to new discoveries (Gann, Montresor, & Eisenberg, 2018).

- Public-Private Partnerships: Public and private organisations collaborate in technology-related initiatives. They combine their resources, expertise, and networks to address public needs, develop infrastructure, implement large-scale technological projects, or foster innovation in specific sectors.

- Open Innovation and Collaboration: Organisations engage in open innovation practices by collaborating with external stakeholders, such as customers, suppliers, or even competitors. They seek external ideas, technologies, or expertise to enhance their innovation capabilities and speed up the development of new technologies or products.

Technological collaboration offers several benefits as noted by (Dodgson, 2018), including:

- Leveraging complementary skills and resources: Collaboration allows participants to combine their expertise, knowledge, and resources, enabling the development of more comprehensive and advanced technological solutions.

- Sharing risks and costs: Collaborating organisations can share the financial burden and risks associated with technology development or implementation, making projects more feasible and cost-effective.

- Accelerating innovation: Collaboration facilitates the exchange of ideas, perspectives, and insights, fostering creativity and accelerating the pace of innovation. It enables participants to build upon each other's work and leverage collective knowledge.

- Expanding market reach and opportunities: Technological collaboration can provide access to new markets, customers, or distribution channels. It allows organisations to tap into a broader network and create mutually beneficial partnerships.

In summary, technological collaboration involves the collaborative efforts of individuals, organisations, or entities to develop, implement, or enhance technology-related solutions (Pigola et al., 2022). It promotes knowledge sharing, innovation, and the pooling of resources to achieve common technological goals or address challenges in a cooperative and synergistic manner.

2.1.2 Organisational Competitiveness

Organisational competitiveness refers to the overall effectiveness, efficiency, and achievement of goals by an organization (Wang and Zeng, 2017). It encompasses various aspects of an organization's operations, including its financial competitiveness, operational efficiency, customer satisfaction, innovation, employee productivity, and strategic outcomes (Rehman et al., 2019). Organisational competitiveness is a comprehensive measure that assesses how well an organization is performing in relation to its intended objectives and desired outcomes (Pambreni et al., 2019). Some key aspects that contribute to the meaning of organisational competitiveness:

Effectiveness: Organisational effectiveness refers to the extent to which an organization accomplishes its intended goals and objectives. It involves assessing the organization's ability to deliver products or services that meet customer needs, fulfil its mission, and achieve desired outcomes (Pambreni et al., 2019). Effective organisations can attain their strategic objectives and deliver value to stakeholders.

Efficiency: Efficiency in organisational competitiveness relates to the optimal utilisation of resources to maximize output while minimizing input or resource wastage. It involves evaluating how efficiently an organization converts inputs such as capital, labour, and materials into outputs (Wang and Zeng, 2017). Efficient organisations strive to achieve their goals with minimal resources, reducing costs and improving productivity (Santalova et al., 2020).

Stakeholder Satisfaction: Organisational competitiveness includes the satisfaction of various stakeholders such as customers, employees, shareholders, suppliers, and the community. Meeting or exceeding stakeholder expectations is a critical aspect of organisational competitiveness. Satisfied stakeholders are more likely to support and engage with the organization, leading to positive outcomes such as customer loyalty, employee commitment, and investor confidence (Rehman et al., 2019).

Adaptability and Resilience: Organisational competitiveness also considers the organization's ability to adapt to changing environments, market dynamics, and emerging challenges. Adaptive organisations are agile, flexible, and responsive in adjusting their strategies, operations, and structures to stay competitive and seize opportunities (Pambreni et al., 2019). They demonstrate resilience in the face of disruptions and effectively manage risks.

Learning and Innovation: Continuous learning and innovation are important components of organisational competitiveness (Salisu et al., 2018a). Organisations that foster a culture of learning, knowledge sharing, and innovation are better positioned to adapt, improve processes, and develop new products or services (Pambreni et al., 2019). They embrace creativity, experimentation, and the adoption of new technologies or practices to drive progress and stay ahead of the competition.

Long-term Sustainability: Organisational competitiveness includes considerations of long-term sustainability and responsible business practices (Sombolayuk et al., 2019). Sustainable

organisations consider environmental, social, and governance (ESG) factors in their operations and decision-making (Wang and Zeng, 2017). They aim to create positive social and environmental impacts while ensuring long-term viability and ethical conduct.

Measuring organisational competitiveness involves the use of various competitiveness indicators, metrics, benchmarking, and evaluation frameworks (Pambreni et al., 2019). It requires a comprehensive and balanced approach that considers both financial and non-financial aspects. By assessing and improving organisational competitiveness, organisations can enhance their competitiveness, adapt to changing circumstances, and achieve long-term success (Rehman et al., 2019).

Organisational competitiveness encompasses the overall effectiveness and efficiency of an organization in achieving its goals and objectives (Sulistyo & Ayuni, 2020). It represents the degree to which an organization is successful in utilizing its resources, capabilities, and strategies to produce desired outcomes and deliver value to its stakeholders (Nzomo et al., 2020). Organisational competitiveness is a comprehensive measure that evaluates various dimensions and aspects of an organization's functioning and impact.

2.1.3 Small to Medium Enterprises

Small and medium enterprises (SMEs) are businesses that have a certain number of employees, assets, or revenues below a specified threshold. The definition of SMEs varies from country to country, depending on the economic and social context. SMEs are business entities that are characterized by their relatively small size and operational scale (Moeuf et al., 2018). While the definition of SMEs varies across countries and regions, however they are synonymous with fewer employees, lower annual revenue, and more limited resources compared to larger corporations (Putra, 2019). SMEs play a vital role in economic development, job creation, innovation, and fostering entrepreneurship. Nonetheless, some common criteria often used to define SMEs are:

Number of employees: This is the most widely used criterion to classify SMEs, as it is easy to measure and verify. However, it does not reflect the productivity, profitability, or growth potential of a business. Moreover, it may not be suitable for comparing businesses across different sectors or countries, as the average number of employees may vary significantly. The

typical range for the number of employees in SMEs is between 10 and 250 (Zafar and Mustafa, 2019).

Assets: This criterion measures the total value of the fixed and current assets of a business, such as land, buildings, machinery, equipment, inventory, and cash. It reflects the capital intensity and investment capacity of a business, but it may not capture its operational efficiency or market share. Additionally, it may be affected by inflation, exchange rate fluctuations, or accounting standards. The typical range for the value of assets in SMEs is between $100,000 and $15 million (Jamali and Lund-Thomsen, 2017).

Revenues: This criterion measures the total amount of sales or income generated by a business in a given period, usually a year. It reflects the market size and competitiveness of a business, but it may not indicate its profitability or sustainability. Furthermore, it may be influenced by seasonal variations, price changes, or tax policies. The typical range for the value of revenues in SMEs is between $10,000 and $25 million (Moeuf et al., 2018).

SMEs are recognized as important drivers of economic growth, innovation, and social development (Putra, 2019). They contribute to diversification, competition, and resilience in the business landscape. Governments and policymakers often implement specific programs and policies to support SMEs, such as providing financial assistance, offering business development services, facilitating access to markets, and promoting entrepreneurship education and training (Jamali and Lund-Thomsen, 2017). However, SMEs also face many challenges and barriers that hinder their growth and competitiveness, such as lack of access to finance, markets, technology, skills, and infrastructure (Zafar and Mustafa, 2019). Therefore, some scholars suggest that SMEs need more support and assistance from governments, donors, and other stakeholders to overcome these challenges and unleash their full potential.

2.1.4 Case Study Company Literature Review

Speroni Irrigation, Mining and Industrial Supplies (Pvt) Ltd, a wholly Zimbabwean-owned company, was established in 2006. Speroni's primary focus is distributing a comprehensive range of products related to irrigation, drainage, borehole, and well pumps and dealing with pipes, fittings, valves, and pipeline accessories in various recognized materials (Speroni Pvt Ltd Company Profile, 2023). As the official distributor of Speroni water pumps from Italy, Speroni has become a leading supplier of water solutions across various industries, including

civil, agricultural, mining, manufacturing, construction, and chemical sectors (Speroni Pvt Ltd Company Profile, 2023). The company's headquarters are situated at Corner Dumfries and Bristol Roads, Workington, Harare, Zimbabwe. Speroni Irrigation currently employs 38 staff members. The executive management team includes Lance Potera (Director), Timothy Masharata (Irrigation Engineer), L. Potera, and Nic Magodi (Sales and Marketing) (Speroni Pvt Ltd Company Profile, 2023).

2.2 The Current State of Irrigation Technological Collaboration by Irrigation Small to Medium Enterprises

Technological collaboration by irrigation SMEs is an important topic for improving agricultural productivity, water efficiency, and climate resilience in different regions of the world (Abdikadir et al., 2023). Globally, irrigation technological collaboration by irrigation SMEs has been increasing in recent decades with farmer-led smallholder irrigation being a driving force of agricultural transformation (Vandôme et al., 2023). In the Americas irrigation technological collaboration has advanced to Internet of Things, Artificial intelligence and cloud computing which are being used for smart irrigation (Abdikadir et al., 2023). The irrigation technological collaborations are in technologies such as surface irrigation, subsurface irrigation, alternating drip irrigation, spray sprinkler, rotor sprinkler, rotary nozzles, and rotators (Vandôme et al., 2023). These are being used for volumetric techniques and dielectric sensors and the technology is developed through technological collaboration of various organisations across the industry spectrum. The SMEs are the central drivers of these innovations through specialisation and involves Universities, Research and Development Institutions and farmers at large (Abdikadir et al., 2023).

According to Pereira (2023), in Europe and the Mediterranean, the current state of irrigation technological collaboration considers the technology required for specific soil types and crop types. In regions where a variety of soil types exist sprinkler or drip technologies are embraced by SMEs and companies such as Komet of Austria collaborate on technology suitable for specific regions. Collaboration however does not end with technological collaboration but extends to distribution channels where SMEs are agents and distributors of the technology. Furthermore, knowledge transfer through trainings on Irrigation engineers and Installers is undertaken by the manufacturing corporates (Pereira et al., 2023) .

In Asia and specifically India, according to Angom and Viswanathan (2023), SMEs have embraced technologies such as Micro drip irrigation systems from United States of America and Israel. Companies such as Naan Dan J are collaborating with Israel and United States of America companies and now produce micro and drip irrigation systems using technologies from these countries. The Indian government has gone as far as promulgating a policy "The National Mission on Micro Irrigation for Sustainable Agriculture" in which it promotes international technological collaboration for the development of smart irrigation technologies. Other SMEs in India that have embraced technological collaboration include companies such as ConserWater Technologies, Bengaluru based Fly Bird Innovation and Gujarat Green Revolution Company Limited among others (Angom & Viswanathan, 2023).

In Africa, technological collaboration by irrigation SMEs is still low compared to other regions, despite the continent's vast potential for irrigation development (El Fartassi et al., 2023). According to Thompson and Gyatso (2020), apart from South Africa, little or insignificant manufacturing of irrigation technology takes place. Thompson and Gyatso (2020) while noting that there are signs of increasing interest and investment in irrigation technologies by both public and private actors in Africa, especially in response to the challenges posed by climate change, population growth, urbanization, and food insecurity, the technologies are imported from other regions such as America, Europe, and Asia where technological collaboration is prevalent. However, in South Africa technological collaboration by Irrigation Small to Medium Enterprises is way ahead of the rest of Africa (Haber & Carmeli, 2023). Technological collaboration with Universities especially for Internet of Things, computer software programming and satellite controls is active. Technological collaboration is also interorganisational with focus on collaboration centred on specialisations. However high costs of production seem to be forcing companies to prefer to import than produce (Angom & Viswanathan, 2023).

2.3 The Influence of Technological Collaboration on Irrigation Small to Medium Enterprises

Technological collaboration can have various influences on irrigation SMEs, depending on the context, the type of collaboration, and the outcomes. Globally, technological collaboration can help irrigation SMEs to access new markets, expand their customer base, reduce costs, improve efficiency, and enhance innovation. A study by Mattos et al. (2023) found that technological

transformation in SMEs requires both technology assimilation and business model innovation, which can be facilitated by technological collaboration with other actors. The study also suggested that technological collaboration can help SMEs to overcome their resource constraints and increase their competitiveness.

In Africa, technological collaboration can help irrigation SMEs to address the challenges of climate change, water scarcity, food insecurity, and poverty. For example, a report by the Malabo Montpellier Panel (2018) highlighted the policy lessons from six African countries that have made progress on irrigation development through stakeholder collaboration. The report argued that technological collaboration can enable irrigation SMEs to access finance, information, technology, and markets, as well as to participate in policy making and institutional reform.

In Sub-Saharan Africa, technological collaboration can help irrigation SMEs to accelerate irrigation expansion and contribute to agricultural growth and transformation. For example, a report by Shah et al. (2020) analysed the global revolution in farmer-led smallholder irrigation and its implications for Sub-Saharan Africa. The report recommended that technological collaboration can support irrigation SMEs to tap into the potential of solar-powered irrigation pumps, mobile payment systems, digital platforms, and smart water management tools.

Technological collaboration can have a significant influence on irrigation SMEs, which are small and medium-sized enterprises that operate in the irrigation sector, providing products and services for water management and conservation. Some of the benefits of technological collaboration for irrigation SMEs are:

2.3.1 Access to New Technologies, Markets, and Customers

Technological collaboration can help irrigation SMEs to acquire or develop new technologies that can improve their products and processes, such as cloud computing, artificial intelligence, blockchain, or internet of things (Zamani, 20221; Mattos et al., 2022; Silva de Mattos et al., 2023; Alojairi et al., 2019). Technological collaboration can also help irrigation SMEs to expand their markets and reach new customers by leveraging the networks, reputation, and distribution channels of their partners (Zhu et al., 2019).

2.3.2 Enhancement of Innovation Competitiveness and Competitiveness

Technological collaboration can enable irrigation SMEs to enhance their innovation competitiveness and general competitiveness by accessing diverse sources of information, knowledge, and ideas from their partners, as well as by benefiting from knowledge spill overs, innovation outcomes, and market opportunities (Klewitz & Hansen, 2014; Zamani, 2022; Gallego-Álvarez et al., 2011; Alraja et al., 2022). Technological collaboration can also help irrigation SMEs to overcome their resource constraints and increase their efficiency and productivity by sharing costs, risks, and benefits with their partners (Henttonen et al., 2016; Bouwman et al., 2019).

2.3.3 Improvement of Environmental Sustainability and Social Responsibility

Technological collaboration can also contribute to the environmental sustainability and social responsibility of irrigation SMEs by facilitating trust, transparency, and security in data sharing and transactions with their partners, as well as by supporting innovation and practices that reduce water consumption, waste generation, greenhouse gas emissions, and environmental impacts (Kshetri & Voas, 2018; Seuring & Gold, 2013; Khashab et al., 2020).

2.4 Factors Hindering Technological Collaboration Among Small to Medium Enterprises in the Irrigation Industry

Technological collaboration can have various benefits for irrigation SMEs, such as accessing new markets, reducing costs, improving efficiency, and enhancing innovation. However, there are also some factors that can hinder technological collaboration among irrigation SMEs in the industry. Based on the web search results, some of these factors are:

2.4.1 Knowledge Barriers

Irrigation SMEs may lack the necessary knowledge or skills to engage in technological collaboration, or they may face difficulties in acquiring, assimilating, and applying external knowledge. For example, a study by Bertello et al. (2023) found that traditional SMEs often struggle to understand the potential value of external knowledge sources and to align their internal capabilities with external opportunities.

2.4.2 Collaboration Barriers

Irrigation SMEs may encounter challenges in finding suitable partners, establishing trust and commitment, managing conflicts and expectations, and coordinating activities. For example, a study by Adam and Alarifi (2021) found that SMEs often face difficulties in identifying and contacting potential collaborators, especially during the COVID-19 pandemic. They also found that SMEs need to overcome cultural and communication barriers to build effective relationships with their partners.

2.4.3 Organisational Barriers

Irrigation SMEs may have rigid or incompatible organisational structures, cultures, or processes that prevent them from adopting an open innovation mindset and engaging in technological collaboration. For example, a study by Bertello et al. (2023) found that traditional SMEs often have a conservative or risk-averse attitude towards innovation, and they may resist changing their established routines or practices.

2.4.4 Financial and Strategic Barriers

Irrigation SMEs may lack the financial resources or incentives to invest in technological collaboration, or they may face uncertainties or risks associated with external collaboration. For example, a study by Adam and Alarifi (2021) found that SMEs often have limited access to funding or credit to support their innovation activities, and they may face high costs or losses due to opportunistic behaviours or intellectual property issues.

2.5 Theoretical Framework

This section focuses on the theories guiding this research as presented in figure 2.1 below:

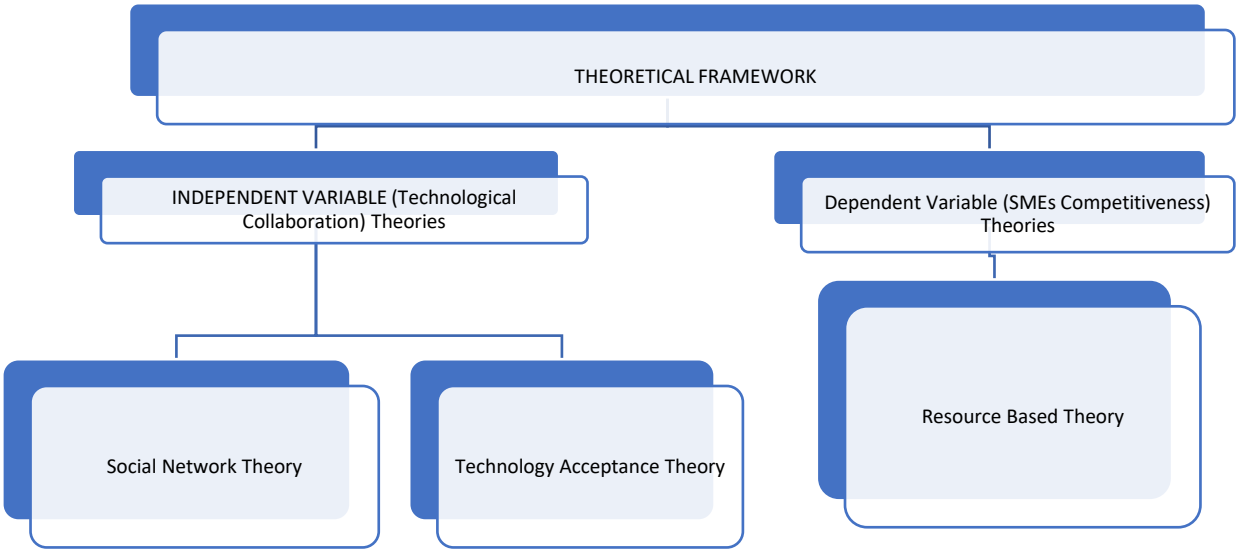

Figure 2.1: Theoretical Framework

Source: Author (2023)

2.5.1 Resource Based Theory

This research is influenced by the Resource Based Theory. The Resource-Based Theory (RBT) is an influential approach in strategic management that focuses on the internal resources and capabilities of a firm as the sources of its competitiveness (Zhu et al., 2019). According to RBT, a firm can achieve superior competitiveness and sustain it over time if it possesses valuable, rare, difficult-to-imitate, and non-substitutable resources (Barney, 1991). RBT assumes that resources are heterogeneous and immobile across firms, and that firms can exploit their unique resources to create value for their customers and stakeholders (Zamani, 2022).

RBT can be applied to research on the influence of technological collaboration in SMEs competitiveness by examining how different types of resources, such as human capital, technological assets, relational capital, and organisational culture, affect the ability of SMEs to collaborate with external partners and benefit from knowledge spill overs, innovation outcomes, and market opportunities (Grant, 1991). For example, some studies have found that human capital, such as the skills, experience, and creativity of employees, is a key resource for SMEs to engage in technological collaboration and enhance their competitiveness (Zamani, 2022). Other studies have suggested that technological assets, such as patents, software, and equipment, can facilitate technological collaboration by providing SMEs with a competitive

edge and bargaining power in the collaboration process (Alraja et al., 2022). Nonetheless, relational capital, such as the trust, reputation, and network ties of SMEs with their partners, can also influence technological collaboration by reducing transaction costs, increasing information sharing, and fostering mutual learning (Zhu et al., 2019). Finally, organisational culture, such as the values, norms, and practices of SMEs that support innovation and environmental sustainability, can also affect technological collaboration by shaping the motivation, attitude, and behaviour of SMEs and their partners (Khashab et al., 2020).

Therefore, RBT can provide a useful theoretical lens to understand how SMEs can leverage their internal resources to participate in technological collaboration and improve their competitiveness in a dynamic and competitive environment (Assensoh-Kodua, 2019). By applying RBT to this research topic, the researcher can identify the key resources that enable or constrain technological collaboration in SMEs, as well as the mechanisms and outcomes of such collaboration. This can help generate valuable insights for both theory and practice on how SMEs can manage their resources effectively and strategically to achieve sustainable competitiveness.

2.5.2 Social Network Theory

The research is also influenced by the Social Network Theory. Social network theory is a theoretical perspective that views social relationships in terms of nodes and ties (Li et al., 2021). Nodes are the individual actors within the networks, such as people, organisations, or groups. Ties are the connections or interactions between the nodes, such as friendship, collaboration, communication, or influence. Social network theory aims to analyse the structure, dynamics, and functions of social networks, as well as the effects of network characteristics on individual and collective outcomes (Scott, 2017).

Social network theory can be applied to research on the influence of technological collaboration in SMEs competitiveness by examining how different types of ties, such as information sharing, knowledge transfer, resource exchange, trust building, and innovation diffusion, affect the ability and motivation of SMEs to collaborate with external partners and benefit from technological opportunities (Chen, 2019). For example, some studies have found that strong ties, such as those based on long-term, frequent, and intimate interactions, can facilitate technological collaboration by providing SMEs with access to tacit knowledge, emotional

support, and mutual commitment (Soltis et al., 2018). Other studies have suggested that weak ties, such as those based on sporadic, distant, and impersonal interactions, can also enhance technological collaboration by exposing SMEs to diverse sources of information, novel ideas, and potential partners (Salisu and Bakar, 2018). Moreover, some studies have argued that the structure of the network, such as its density, centrality, diversity, and cohesion, can also influence technological collaboration by affecting the flow of information and knowledge, the distribution of power and resources, the emergence of norms and trust, and the formation of subgroups and communities (Zahoor and Al-Tabbaa, 2020).

Therefore, social network theory can provide a useful theoretical lens to understand how SMEs can leverage their social relationships to participate in technological collaboration and improve their competitiveness in a dynamic and competitive environment. By applying social network theory to this research topic, the researcher can identify the key types and dimensions of ties that enable or constrain technological collaboration in SMEs, as well as the mechanisms and outcomes of such collaboration. This can help generate valuable insights for both theory and practice on how SMEs can manage their social networks effectively and strategically to achieve sustainable competitiveness.

2.5.3 Technology Acceptance Theory

The Technology Acceptance Theory (TAT) is a theory that explains how users accept and use a new technology based on their perceptions of its usefulness and ease of use (Davis, 1986). TAT is derived from the Theory of Reasoned Action (TRA), which assumes that users' behaviour is influenced by their attitudes and intentions. TAT proposes that users' attitudes and intentions are determined by two main factors: perceived usefulness (PU) and perceived ease of use (PEOU). PU is the degree to which a user believes that using a technology will enhance their competitiveness or outcomes, while PEOU is the degree to which a user believes that using a technology will be effortless or convenient. TAT also suggests that external factors, such as system design, social influence, and user characteristics, can affect PU and PEOU, and thus influence users' acceptance and use of technology (Davis, 1989).

TAT can be applied to research on the influence of technological collaboration in SMEs competitiveness by examining how different types of technologies, such as cloud computing, artificial intelligence, blockchain, or internet of things, are perceived and used by SMEs in their

collaborative activities with external partners (Bouwman et al., 2019). For example, some studies have found that cloud computing can enhance the PU and PEOU of technological collaboration for SMEs by providing them with access to scalable, flexible, and cost-effective resources and services (Zamani, 2022). Other studies have suggested that artificial intelligence can improve the PU and PEOU of technological collaboration for SMEs by enabling them to automate tasks, generate insights, and optimize decisions (Mattos et al., 2022). Moreover, some studies have argued that blockchain can increase the PU and PEOU of technological collaboration for SMEs by facilitating trust, transparency, and security in data sharing and transactions (Kshetri & Voas, 2018; Silva de Mattos et al., 2023). Finally, some studies have indicated that internet of things can boost the PU and PEOU of technological collaboration for SMEs by connecting physical objects, sensors, and devices to collect and exchange data and create value (Müller et al., 2021; Alojairi et al., 2019).

Therefore, TAT can provide a useful theoretical lens to understand how SMEs can leverage their perceptions of usefulness and ease of use to participate in technological collaboration and improve their competitiveness in a dynamic and competitive environment. By applying TAT to this research topic, the researcher can identify the key technologies that enable or constrain technological collaboration in SMEs, as well as the mechanisms and outcomes of such collaboration. This can help generate valuable insights for both theory and practice on how SMEs can manage their perceptions effectively and strategically to achieve sustainable competitiveness.

2.6 Empirical Studies

2.6.1 United States of America

Empirical literature demonstrates the significant impact of technological collaboration on the competitiveness of irrigation SMEs in various countries. In the United States, studies have highlighted the positive relationship between technological collaboration and competitiveness in the irrigation sector (Smith et al., 2022). Collaborative initiatives, such as partnerships with research institutions, government agencies, and industry associations, have been found to facilitate access to advanced technologies and knowledge sharing. This enables SMEs to innovate, improve productivity, and gain a competitiveness in the market.

2.6.2 Canada

In Canada, research has shown that SMEs in the irrigation industry can enhance their competitiveness through collaborative initiatives such as industry clusters and innovation networks (Jones & Patel, 2023). These collaborations enable SMEs to pool resources, share expertise, and jointly develop innovative solutions tailored to the local market. By leveraging collective knowledge and capabilities, SMEs can improve their market position, expand their customer base, and achieve sustained growth.

2.6.3 Nigeria

In Nigeria, studies have examined the influence of technological collaboration on irrigation SMEs' competitiveness in the context of agricultural development (Adeoye & Ogunlade, 2021). Findings indicate that partnerships with technology providers, government agencies, and agricultural extension services positively impact SMEs' access to modern irrigation technologies, market information, and financial resources. This, in turn, enhances their productivity, efficiency, and competitiveness in the agricultural sector.

2.6.4 South Africa

In South Africa, empirical research has explored the relationship between technological collaboration and competitiveness in the irrigation sector (Mthembu & Hamo, 2022). The studies highlight the importance of cross-sector collaborations, knowledge transfer, and innovation networks in enhancing SMEs' technical capabilities, market reach, and overall competitiveness. Collaborative efforts involving government agencies, research institutions, and industry stakeholders have enabled SMEs to access new technologies, improve production practices, and tap into domestic and international markets.

2.7 Conceptual Framework

This section delves into the critical concepts of this research study. Figure 2.2 below is a Conceptual framework which is a summary of the links between the key concepts of this study:

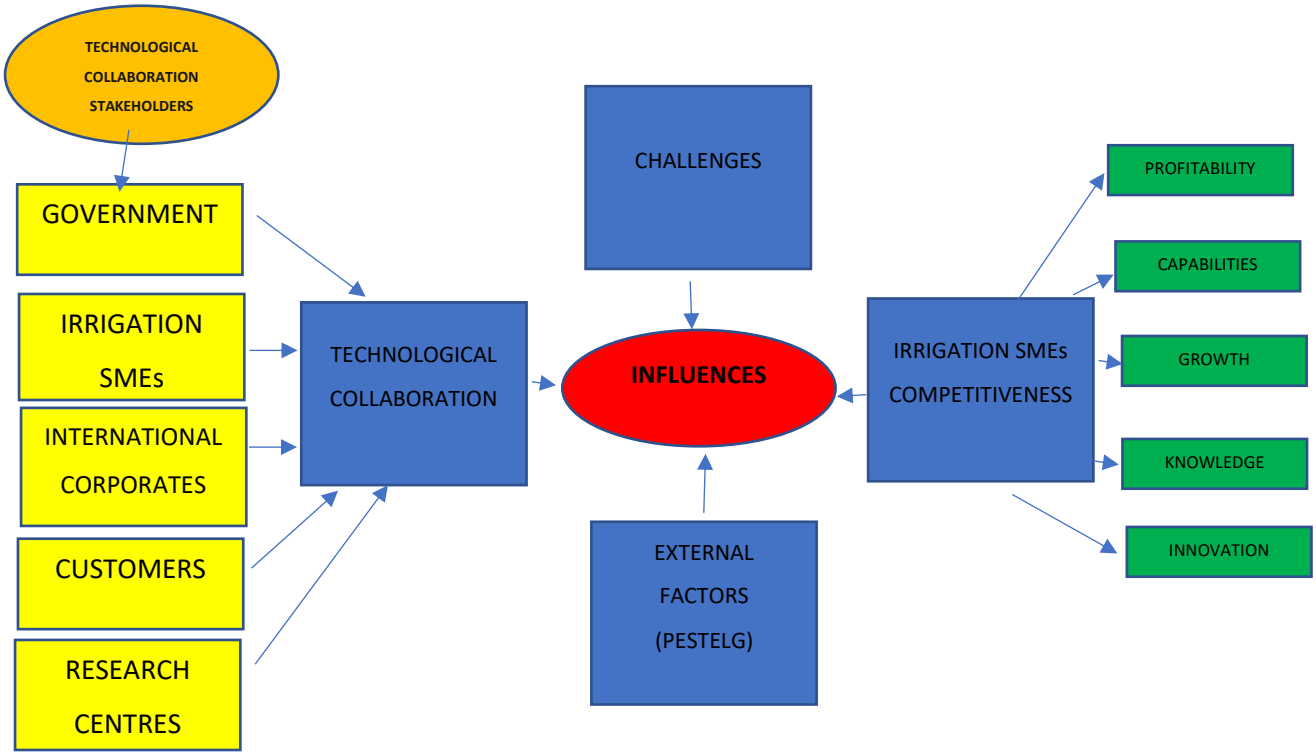

Figure 2.2: Conceptual Framework

Source: Author (2023)

The conceptual framework for assessing the influence of technological collaboration on Zimbabwean irrigation SMEs' competitiveness incorporates the social network theory, technological acceptance theory, and resource-based theory. The framework consists of three main sections:

Technological Collaboration Stakeholders: This section identifies the key stakeholders involved in technological collaboration. These stakeholders include the government, irrigation SMEs, international corporates, research centres, and customers. The social network theory comes into play here, as it emphasizes the importance of relationships and interactions among actors within a network (Mthembu & Hamo, 2022). Technological collaboration involves the establishment of networks and partnerships among these stakeholders, enabling knowledge exchange, resource sharing, and collaborative problem-solving (Smith et al., 2022).

Influences of Technological Collaboration: This section explores the various factors that influence technological collaboration. It encompasses PESTELG (Political, Economic, Social, Technological, Environmental, Legal, and Governance) factors, as well as the challenges faced

during collaboration (Smith et al., 2022). The social network theory helps explain how these external factors and challenges shape the dynamics of collaboration networks (Adeoye & Ogunlade, 2021). Additionally, the technological acceptance theory is relevant in understanding the factors that affect the adoption and acceptance of collaborative technologies among stakeholders. The framework acknowledges that successful collaboration is influenced by external factors, challenges, and the acceptance of technology, all of which can impact the competitiveness of irrigation SMEs.

Irrigation SMEs Competitiveness Outcomes: This section focuses on the outcomes and benefits of technological collaboration for irrigation SMEs, specifically their competitiveness. The resource-based theory is applicable here, as it emphasizes the role of valuable, rare, inimitable, and non-substitutable resources in achieving competitiveness (Jones & Patel, 2023). The framework suggests that through technological collaboration, irrigation SMEs can achieve growth, gain knowledge, foster innovation, develop capabilities, improve profitability, and enhance their overall competitiveness. Collaboration networks provide access to diverse resources, expertise, and information, which can be leveraged to gain a competitive edge in the market (Smith et al., 2022).

Overall, the conceptual framework acknowledges the significance of social networks, technological acceptance, and resource-based perspectives in examining the influence of technological collaboration on irrigation SMEs' competitiveness. It highlights the importance of stakeholder engagement, the impact of external factors and challenges, and the outcomes derived from collaboration in enhancing the competitive position of irrigation SMEs in Zimbabwe.

2.8 Chapter Summary

This chapter presented a review of literature, specifically literature relating technological collaboration of SMEs in the irrigation sector. The chapter considered the theoretical framework in which the theories that influence this study were discussed with reference to meaning and essence in the study. Empirical literature was also discussed with focus on the critical issues surrounding technological collaboration within the irrigation SMEs circles. The discussion pointed attention towards the gaps in literature and finally discussed the conceptual framework of the study in which key concepts were defined and expanded.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

Presenting the study's methodology is covered in this chapter. An approach to methodically resolving the research problem is referred to as a research methodology, according to Kothari (2004, p. 8). One could think of it as a branch of science that studies how scientific research is conducted. It encapsulates all the different procedures and methods that a researcher typically uses to conduct research, along with the reasoning behind them. The chapter will discuss about the research plan, data gathering methods, and sampling strategies, including methods for ensuring validity and reliability. Also presented are techniques for data presentation and analysis.

3.1 Research Philosophy

Research philosophy refers to the set of beliefs, assumptions, and principles that guide the researcher's approach to conducting research. It provides a framework for understanding the nature of knowledge, the researcher's role, and the relationship between the researcher and the research subject (Patton et al., 2020). Different research philosophies include positivism, interpretivism, and pragmatism, among others. In this research, the pragmatism research philosophy was adhered to. Pragmatism research philosophy is an approach that emphasizes the practical application of knowledge and focuses on finding solutions to real-world problems. Scholars such as Morgan and Smircich (2018) highlight the relevance of pragmatism in studying complex organisational phenomena, advocating for a pragmatic research approach that integrates practical action with theoretical reflection. Creswell (2018) discuss the pragmatic philosophical underpinnings of mixed methods research, providing practical guidance on how to apply a pragmatic research philosophy in studies. Pragmatism research philosophy recognizes the value of both quantitative and qualitative methods, encourages flexibility and adaptation, and aims to generate practical knowledge that can inform action and contribute to real-world improvements. It emphasizes the integration of theory and practice, active engagement with stakeholders, and the usefulness and effectiveness of ideas and methods in achieving desired outcomes. Overall, pragmatism research philosophy offers a framework that allows researchers to effectively address research questions and generate actionable findings that have practical relevance, bridging the gap between theory and practice.

Pragmatism research philosophy was particularly applicable and relevant in this study as it emphasizes the practical application of knowledge and focuses on finding solutions to real-world problems. It recognized the importance of both quantitative and qualitative approaches and encourages a flexible and eclectic approach to research. In the context of the study, a pragmatism research philosophy allowed the researcher to combine quantitative analysis of data and qualitative insights from stakeholders to gain a comprehensive understanding of the influence of technological collaboration on competitiveness. It enabled the researcher to draw upon theories and concepts from different disciplines and apply them practically to address the research objectives. By adopting a pragmatism research philosophy in this study, the researcher can integrate different research approaches, utilize diverse data sources, and generate actionable insights that can inform decision-making and contribute to practical solutions in the field. The pragmatic approach allowed for flexibility and the incorporation of multiple perspectives, enabling a comprehensive understanding of the complex dynamics between technological collaboration and competitiveness.

3.2 Research Approach

A research approach refers to the systematic and organized way in which research is conducted to investigate a specific topic or problem. It involves the selection of appropriate methods, techniques, and procedures to collect and analyse data and draw conclusions (Morse, 2018). This research adopted the mixed research approach, also known as mixed methods research, which combines qualitative and quantitative research methods within a single study (Creswell et al., 2018). It involves collecting and analysing both numerical and textual data to gain a comprehensive understanding of the research problem. This approach recognizes that different types of data and methods provide unique insights and can complement each other, leading to a more robust and nuanced understanding of the research topic (Johnson et al., 2018).

In the context of this study, the mixed research approach is highly applicable and relevant. By combining quantitative and qualitative methods, the researcher captured both numerical data on factors such as financial performance, market share, and productivity, as well as qualitative insights from stakeholders regarding their experiences, perceptions, and challenges related to technological collaboration.

Quantitative methods, such as surveys or statistical analysis, provided quantitative measures of the influence of technological collaboration on SMEs' competitiveness. This included assessing

the correlation between collaborative activities and key performance indicators, such as revenue growth or market expansion. Qualitative methods, such as interviews, focus groups, or case studies, provided in-depth insights into the mechanisms and processes through which technological collaboration influences competitiveness. They uncovered contextual factors, barriers, and facilitators of collaboration, as well as the subjective experiences and perspectives of SME owners, managers, and employees.

By employing a mixed research approach, the researcher integrated these quantitative and qualitative data to develop a more comprehensive understanding of the influence of technological collaboration on competitiveness. The approach allowed for triangulation, where findings from different methods are compared to provide converging evidence and enhance the overall validity and reliability of the study. Moreover, the mixed research approach enabled the exploration of complex relationships and the capturing of both objective and subjective dimensions of the research problem. It helped to overcome the limitations of relying solely on one type of data or method, thus providing a more holistic assessment of the influence of technological collaboration on competitiveness.

3.3 Research Design

A research design refers to the plan or structure that guides the collection and analysis of data in a research study. It outlines the procedures, methods, and techniques that will be used to address the research questions or objectives, ensuring that the study is conducted systematically and rigorously (Creswell, 2018). This research adopted a Mixed methods research design, a type of research design that integrates both qualitative and quantitative data collection and analysis methods within a single study (Morse, 2018). It recognizes the value of combining different approaches to gain a comprehensive understanding of the research problem and allows for the exploration of complex phenomena from multiple perspectives (Johnson et al., 2018). Therefore, for qualitative data, this research used a case study design due to its nature of seeking an in-depth understanding of a phenomena. On the quantitative side, this research used the survey research design as it is suitable for numerical data.

3.4 Population

In research, a population refers to the entire group of individuals, objects, or events that possess certain characteristics and are of interest to the researcher. The population represents the larger

target group from which a sample is drawn (Neuman, 2019). It is often impractical or impossible to study the entire population, so researchers select a smaller subset called a sample to represent the population (Babbie, 2019). In the research, the population consisted of all the workers, management, and executive at Speroni Irrigation, thus a total population of 38 people. Therefore, the sample was a subset of Speroni Irrigation Staff that was selected to participate in the research study. To be specific, 32 staff members were selected to be the sample.

3.5 Sampling Techniques

A sampling technique is a method used to select a subset of individuals or elements from a larger population for inclusion in a research study (Gelman and Carlin, 2019). It is essential to choose an appropriate sampling technique to ensure that the selected sample is representative of the population and can yield valid and reliable results (Lohr, 2019). There are various sampling techniques available, and the choice of technique depends on factors such as the research objectives, population characteristics, available resources, and the level of precision required. For the purpose of this research, sampling techniques include:

3.5.1 Purposive Sampling Technique

Babbie (2019) defines purposive sampling as a non-probability sampling technique with a selection process of units of analysis based on the researcher's judgment about their knowledge, experiences, and expertise. Neuman (2019) concur by arguing that purposive sampling is a deliberate attempt to select certain participants with unique features in the research process. Purposive sampling is a non-probability sampling technique that involves selecting participants based on specific criteria, rather than through random selection. The use of purposive sampling was justified in this research as it allowed the researcher to intentionally select participants who possess relevant knowledge, expertise, and experiences related to the research topic. Scholars such as (Hair et al., 2019) have emphasized the importance of purposive sampling in qualitative research, highlighting its ability to ensure the inclusion of participants who can provide rich and meaningful insights into the phenomenon under investigation. By selecting participants who have direct experience with technological collaboration in Zimbabwe's irrigation sector, the researcher gathered in-depth and contextually relevant information about the influence of collaboration on SMEs' competitiveness (Lohr et al., 2019).

Moreover, Creswell and Poth (2017) have highlighted that purposive sampling allows researchers to target specific groups or individuals who are most likely to provide valuable insights and diverse perspectives. In the context of this research, purposive sampling was used to identify the key informants within Speroni Irrigation Pvt Ltd who are well versed with the technological trends of the organization. By deliberately selecting participants who represent a range of collaboration experiences, the research captured a comprehensive understanding of the factors that contribute to successful collaboration and its impact on competitiveness (Creswell & Poth, 2017). Through purposive sampling, this investigation can ensure the inclusion of knowledgeable participants who can provide rich insights into the research topic, enhancing the validity and relevance of the study.

One potential weakness of using purposive sampling in this research was the risk of selection bias. Purposive sampling involved handpicking participants based on specific criteria, which may introduce a bias in the sample that does not fully represent the diversity of the population. To mitigate this weakness, the researcher employed a multi-stage purposive sampling approach that includes different subgroups within the population, ensuring a broader representation. Additionally, the researcher clearly defined the criteria used for participant selection and provide a transparent and detailed description of the sampling process to enhance the study's transparency and replicability.

3.5.2 Snowball Sampling

Also known as referral or chain sampling method. Snowball sampling is a non-probability sampling technique that involves selecting participants based on referrals from other participants. The use of snowball sampling is justified in a research investigation on the influence of technological collaboration in Zimbabwean irrigation Small and Medium Enterprises' (SMEs) competitiveness. Snowball sampling is a non-probability sampling technique that allowed researchers to identify and recruit participants through referrals from initial participants (Gelman and Carlin, 2019). In the context of this research, snowball sampling was effective in accessing a population of irrigation SMEs that may be difficult to reach through traditional sampling methods. Scholars such as Lohr (2019) have highlighted the value of snowball sampling in qualitative research, particularly when studying hidden or hard-to-reach populations. By leveraging existing connections and networks within the irrigation SME community, snowball sampling helped identify key participants who have experience

with technological collaboration, allowing for a deeper exploration of its influence on competitiveness (Palinkas et al., 2019).

Additionally, snowball sampling enabled the researcher to tap into the expertise and knowledge of individuals who are well-connected within the irrigation SME sector. Scholars such as Patton (2018) have emphasized the advantages of snowball sampling in accessing participants who possess specialized knowledge or are influential within their social networks. In this research, snowball sampling helped identify irrigation key informants that the researcher had missed through purposive sampling. By leveraging the referrals and recommendations of these participants, the research accessed a network of relevant individuals who can provide valuable insights and experiences related to the influence of collaboration on competitiveness (Creswell, 2018). Through snowball sampling, this investigation tapped into the expertise and connections of key participants, enhancing the depth and breadth of the research findings.

One potential weakness of using snowball sampling in a research study on assessing the influence of technological collaboration on Zimbabwean irrigation SMEs' competitiveness was the risk of sample bias and limited generalizability. Snowball sampling relies on the initial participants to refer or recruit others to participate, which can result in a non-random and biased sample. It may lead to overrepresentation of certain types of participants who are more connected or have specific characteristics related to the research topic. To mitigate this weakness, the researcher combined snowball sampling with other sampling techniques, such as the above, to ensure a more diverse and representative sample. Additionally, the researcher carefully tracked and document the referral process to understand the connections and relationships among participants, allowing for a more accurate interpretation of the findings.

3.5.3 Stratified Sampling

Stratified sampling is a sampling technique in research that involves dividing the population into subgroups or strata based on specific characteristics or variables, ensuring proportional representation of each subgroup in the sample (Patton, 2018). In the case of the research, by stratifying the population of Speroni based on level in the organization, the sample accurately represented the overall population and ensure adequate representation of Speroni Irrigation. This approach is supported by scholars in the field. For instance, Cochran (1977) emphasizes the importance of stratified sampling in improving the precision of estimates by reducing

sampling variability. Kish (1965), in his work on survey sampling, highlights that stratification helps in obtaining more efficient estimates by allocating sample units appropriately among different strata. In the context of SME research, Hair et al. (2019) suggest that stratified sampling is suitable when studying specific subgroups within the population to achieve more accurate and meaningful results. Moreover, Saunders et al. (2016) argue that stratified sampling enhances the generalizability of findings by including diverse subgroups and enables comparative analysis across different strata. Therefore, stratified sampling is a suitable approach for the research on the influence of technological collaboration on the competitiveness of Speroni Irrigation as it allowed for representative sampling, meaningful comparisons, increased precision and efficiency, and enhanced generalizability of findings.

3.6 Data Collection Techniques

This captures the techniques employed by the researcher to gather data from the samples within the targeted population (Creswell, 2018). Since this research strives to formulate a hypothesis from the perceptions and key descriptions of the key informants, primary data was collected through key Questionnaires and informant interviews. Secondary data was also drawn from documentary search. These research instruments are expanded below:

3.6.1 Questionnaire

A questionnaire is a data collection tool used in research that consists of a set of structured questions designed to gather information from respondents. Questionnaires can be administered in various formats, such as online surveys, paper-based forms, or face-to-face interviews (Peterson, 2018). They offer a standardized approach to data collection, allowing researchers to collect data from many participants efficiently (Dillman, 2019). In the context of this research, a questionnaire was used to collect data on various aspects, such as the extent of technological collaboration, perceived competitiveness indicators, challenges faced, and the impact of collaboration on business performance. It provided quantitative data that can be analysed statistically to identify patterns, relationships, and trends among variables.

3.6.2 In-depth Interview Guide

For Guest et al. (2021) in-depth interviews are a qualitative data collection technique that involves conducting detailed and open-ended interviews with participants to gather rich and detailed information about their experiences and perspectives. The use of in-depth interviews

was justified in this research as it allowed the researcher to engage in detailed and open-ended conversations with participants, enabling a deeper exploration of their experiences, perspectives, and insights. Scholars such as Patton (2018) have highlighted the value of in-depth interviews in qualitative research, emphasizing their ability to elicit rich and nuanced data. In the context of this research, in-depth interviews provided a platform for Speroni owners, managers, and employees to share their experiences with technological collaboration, including the challenges, opportunities, and outcomes they have encountered (Bernard, 2019).

Moreover, in-depth interviews allowed the researcher to probe into participants' thoughts, motivations, and decision-making processes, providing a comprehensive understanding of the influence of technological collaboration on competitiveness. Scholars like Creswell (2018) have emphasized the benefits of in-depth interviews in uncovering individuals' subjective experiences and perspectives. In this study, in-depth interviews captured the unique contextual factors and social dynamics that influence collaboration and competitiveness at Speroni. By engaging in open and exploratory conversations, the researcher gathered rich and personal narratives that shed light on the mechanisms through which technological collaboration influences competitiveness, providing valuable insights for theory and practice (Patton, 2018).

One potential weakness of using in-depth interviews in this research is the risk of subjective interpretation and interviewer bias. In-depth interviews rely heavily on the interviewer's skills in probing and interpreting responses, which introduces the potential for personal biases to influence data collection and analysis. To mitigate this weakness, the researcher employed multiple interviewers to minimize individual biases and enhance the reliability of data collection. Additionally, using a structured interview guide and providing clear instructions to interviewers and helped standardize the process and reduce subjective interpretation. It was also important to establish rapport and trust with participants, ensuring an open and honest exchange of information during the interviews.

3.6.3 Documentary Analysis

Documentary search is a data collection technique that involves gathering and analysing existing documents, such as reports, policy documents, financial records, and other materials related to the research topic (Creswell and Creswell, 2018). The use of documentary search is justified in a research investigation on the influence of technological collaboration in Zimbabwean irrigation Small and Medium Enterprises' (SMEs) competitiveness. Documentary

search involves gathering and analysing existing documents, such as reports, policy documents, industry publications, and academic literature, to gain insights and information relevant to the research topic. Scholars like Creswell (2018) have highlighted the importance of utilizing documentary sources in social research, particularly for understanding the broader context, policies, and historical developments that shape the phenomenon under investigation. In this study, a documentary search provided valuable information on the technological collaboration initiatives, policy frameworks, funding schemes, and industry trends in Zimbabwe's irrigation sector, offering a comprehensive backdrop to examine the influence of collaboration on SMEs' competitiveness (Neuman, 2019).

Furthermore, scholars such as Bernard (2019) have emphasized the significance of documentary analysis in uncovering tacit knowledge embedded within documents and identifying patterns and trends. In the context of this research, a documentary search revealed case studies, best practices, success stories, and challenges faced by Speroni Irrigation in engaging in technological collaboration. By analysing these documents, the researcher identified factors that contributed to competitiveness, such as the types of collaborations, technological innovations, and strategies implemented by Speroni Irrigation. This analysis provided valuable insights and inform the subsequent phases of the research, including interviews and data interpretation, enhancing the overall understanding of the influence of technological collaboration on competitiveness within Zimbabwe's irrigation SMEs (Babbie, 2019).

One potential weakness of using documentary search in this study was the limited availability and accessibility of relevant documents. Finding comprehensive and up-to-date documents related to the specific research topic was challenging, due to the unavailability of information and restrictions on accessing certain documents. To mitigate this weakness, the researcher employed multiple sources and approaches for document search, such as utilizing both online and offline resources, contacting relevant organisations and institutions for data, and seeking assistance from local experts or professionals familiar with the field. Additionally, triangulating the findings from multiple sources and cross-referencing the information enhanced the credibility and reliability of the data obtained through documentary search.

3.7 Data Collection Procedure

Data collection procedure refers to the systematic process of gathering data for research, ensuring its accuracy and reliability. It involves carefully planning and executing the collection of relevant information using various methods such as questionnaires, interviews, and documentary searches (Sekaran & Bougie, 2016; Hair et al., 2019). The procedure includes steps such as defining research objectives, selecting appropriate sampling techniques, developing data collection instruments, conducting pilot tests, administering the instruments, recording data accurately, cleaning and validating data, and ensuring data storage and confidentiality. Scholars like Sekaran, Bougie, Hair, et al. have extensively studied and provided valuable insights into the best practices and methodologies for conducting effective data collection in research. The data collection procedure for the research on assessing technological collaboration influence on Speroni irrigation's competitiveness involved several key steps.

Firstly, the research design phase focused on defining the research objectives and developing research questions and hypotheses that align with the objective of assessing the influence of technological collaboration on competitiveness of Speroni Irrigation Pvt Ltd. Secondly, the sampling stage involved identifying the target population, which in this case was population of Speroni Irrigation Pvt Ltd. A representative sample was then selected using an appropriate sampling technique, such as purposive sampling and snowball sampling, to ensure that the selected subset adequately represents the larger population.

Thirdly, the data collection instruments were determined. This included developing a questionnaire that captured relevant variables related to technological collaboration, competitiveness, and contextual factors. Additionally, a structured interview guide was prepared to conduct one-on-one interviews with key stakeholders such as managers, fellow collaborators, employees, researchers, and industry experts. The interview guide covered topics specifically related to technological collaboration and its influence on competitiveness. Moreover, a documentary search was conducted to collect relevant documents, reports, and publications that provide insights into technological collaboration and competitiveness at Speroni Irrigation Pvt Ltd.

Once the instruments were prepared, a pilot testing phase was carried out. During this phase, the questionnaire was administered to a small sample of irrigation SMEs to evaluate its clarity,

comprehensibility, and response options. Trial interviews were also conducted with stakeholders to assess the effectiveness of the interview guide and identify any areas for improvement. Additionally, a review of relevant documents was performed to ensure their suitability and availability for the research.

After the pilot testing, the actual data collection phase begins. Questionnaires were distributed to the selected sample of Speroni Irrigation Pvt Ltd, through online surveys, mail, or in-person administration. Clear instructions were provided to ensure proper completion and return of the questionnaires. One-on-one interviews were conducted with stakeholders, following the structured interview guide. During the interviews, responses were recorded accurately, and detailed notes were taken. A thorough search for relevant documents, reports, and publications related to technological collaboration and competitiveness at Speroni Irrigation Pvt Ltd was also conducted, and these materials were collected and reviewed for valuable insights.

The data recording stage involved accurately documenting the questionnaire responses, maintaining organized interview notes, and creating a system for organizing and cataloguing collected documents to ensure easy retrieval and reference. Once the data was collected, the cleaning and validation process begins. This involved reviewing the collected questionnaires, interviews, and documents for completeness, accuracy, and consistency. Any errors, missing data, or inconsistencies were identified and corrected. The data was also validated through cross-checking responses, conducting follow-up interviews if necessary, and verifying information against other sources.

The subsequent data analysis phase involved applying appropriate statistical techniques, to analyse the collected data and assess the influence of technological collaboration on competitiveness at Speroni Irrigation Pvt Ltd. Qualitative analysis methods, such as thematic analysis, were employed to extract insights from interview responses and documentary data. Finally, data storage and confidentiality are ensured. The collected data was securely stored, with measures in place to protect data security and confidentiality. Personal identifiers were anonymized or removed to safeguard the privacy of participants.

By following this comprehensive data collection procedure, the researcher gathered robust and valuable information about the influence of technological collaboration on competitiveness among Zimbabwean irrigation SMEs.

3.8 Data Analysis

Data analysis, according to Saldana (2018), entails the examination, categorization, tabulation or otherwise the recombination of evidence to address the initial propositions of a study. This study used both quantitative and qualitative data analysis techniques, namely descriptive statistics, thematic and qualitative content analyses.

3.8.1 Descriptive Statistics

Descriptive statistics is a branch of statistics that involves summarizing and describing the main characteristics of a dataset (Agresti, 2019). In the context of this study, descriptive statistics was used to provide a clear and concise overview of the data collected. According to Crawley (2019), descriptive statistics help researchers identify key patterns, trends, and disparities in the data, enabling them to draw meaningful insights and make informed decisions. However, it is important to note that descriptive statistics alone did not provide a complete understanding of the underlying factors influencing competitiveness. To mitigate this limitation, the researcher complements descriptive statistics with other analysis methods, such as qualitative approaches, to gain a more comprehensive understanding of the relationships and mechanisms involved in technological collaboration and its influence on Speroni's competitiveness. Additionally, conducting qualitative interviews alongside the descriptive analysis provided richer contextual information and deeper insights into the specific dynamics and processes at play.

3.8.2 Qualitative Content Analysis

Qualitative content analysis is a data presentation technique that involves analysing and interpreting textual data to identify patterns, themes, and meanings (Nowell et al, 2017). The use of qualitative content analysis was justified in this research as it involved systematically analysing textual data, such as interviews, documents, and other qualitative materials, to identify patterns, themes, and meanings. Scholars such as Elo et al., (2019) and Saldana (2018) have emphasized the value of qualitative content analysis in uncovering and interpreting the underlying meanings and implications embedded within textual data. In this study, qualitative content analysis was applied to analyse interview transcripts, documents related to technological collaboration initiatives, and other qualitative data sources. By systematically coding and categorizing the data, the research identified recurring themes and patterns that shed

light on the influence of collaboration on competitiveness in Zimbabwean irrigation SMEs (Saldana, 2018). Moreover, scholars like Vaismoradi et al. (2019) have highlighted the benefits of qualitative content analysis in generating rich, in-depth insights from textual data. In the context of this research, qualitative content analysis helped identifying the factors, strategies, and outcomes associated with technological collaboration that contribute to SMEs' competitiveness. By analysing the data for emergent themes and connections, the research uncovered the underlying mechanisms through which collaboration influences competitiveness. This analysis provided a comprehensive understanding of the nuances and complexities of collaboration and its influence on SMEs' competitiveness in the irrigation sector in Zimbabwe.

One potential weakness of using qualitative content analysis in this research is the subjective nature of data interpretation. Qualitative content analysis relies on the researcher's judgment and interpretation of the data, which introduces the possibility of bias and subjectivity in the analysis process. To mitigate this weakness, the researcher adopted rigorous coding procedures, employ multiple coders for independent coding and cross-validation, and engage in regular discussions or peer reviews to ensure intercoder reliability and enhance the credibility of the findings. Additionally, providing clear documentation of the analytical process, including detailed descriptions of coding decisions and examples, can enhance transparency and allowed for scrutiny and validation by other researchers.

3.8.3 Thematic Analysis

Thematic analysis is a data presentation technique that involves identifying, analysing, and interpreting patterns or themes that emerge from qualitative data (Saladana, 2018). The use of thematic analysis is justified in this study as it involved identifying, analysing, and interpreting patterns and themes within qualitative data. Scholars such as Braun and Clarke (2018) have emphasized the value of thematic analysis in qualitative research, highlighting its ability to provide a systematic and rigorous approach to analysing qualitative data. In this study, thematic analysis was employed to identify and explore the key themes and patterns that emerge from interviews, focus groups, and other qualitative data sources. By organizing and interpreting the data according to these themes, the research gained a deeper understanding of how technological collaboration influences competitiveness at Speroni Irrigation. Furthermore, scholars such as Saladana (2018) have highlighted the benefits of thematic analysis in capturing the complexity and richness of qualitative data. In the context of this research, thematic analysis

uncovered the multiple dimensions and interconnections between collaboration and competitiveness. It helped identify the various factors, strategies, and outcomes associated with collaboration that contribute to SMEs' competitiveness in the irrigation sector. By examining the data for recurring themes and patterns, the researcher generated comprehensive insights into the mechanisms and processes through which collaboration influences competitiveness in Zimbabwean irrigation SMEs.

One potential weakness of using thematic analysis in this research is the risk of oversimplifying complex data. Thematic analysis involved identifying and categorizing themes from qualitative data, which led to a reduction in the richness and complexity of the original data. To mitigate this weakness, the researcher employed an iterative approach, conducting multiple rounds of analysis to ensure comprehensive coverage of themes and subthemes. The researcher also used member checking techniques to validate the identified themes with participants, ensuring that their perspectives are accurately represented. Additionally, providing detailed contextual information and rich descriptions of the themes helped maintain the depth and nuance of the findings.

3.9 Data Presentation

3.9.1 Graphs and Charts

Graphs and charts are visual representations of data that use different types of graphical elements to display information in a concise and accessible manner (Cairo, 2019). In this research, graphs and charts were relevant for presenting quantitative data related to variables such as collaborative activities, competitiveness, and performance indicators. Bar graphs were used to compare the levels of collaboration or advantages across different SMEs. Pie charts illustrated the distribution of different types of collaborations or advantages. These visual representations enabled researchers and stakeholders to easily grasp and interpret the data, identify patterns, and draw meaningful insights. As argued by Wickham (2016), to ensure effective use of graphs and charts, it is important to clearly label the axes, provide appropriate titles and legends, and choose the most suitable graph type for the specific data being presented. Additionally, data should be accurately represented without distorting or misinterpreting the findings, and any necessary statistical measures (such as confidence intervals) should be included to provide a comprehensive understanding of the results.

However, it is important to be aware of the potential drawbacks of this data presentation technique. One drawback is the risk of misinterpretation or distortion of the data if the graphs or charts are not appropriately designed or labelled. To mitigate this, the researcher ensured that the graphs and charts accurately and clearly represent the data, with properly labelled axes, titles, and legends. Additionally, it was important to select the most suitable graph or chart type for the data being presented to avoid misrepresentation. The researcher also provided contextual information and avoid oversimplification, providing additional details or supporting explanations where necessary. By addressing these mitigatory measures, the use of graphs and charts effectively presented the research findings on the influence of technological collaboration on competitiveness while minimizing potential drawbacks.

3.9.2 Themes and Subheadings

Data in this research was presented by themes and subheadings. Themes and subheadings are data presentation techniques that involve organizing and categorizing data based on common themes or topics (Saldana, 2018). Scholars such as Creswell (2018) and Neuman (2019) have emphasized the importance of organizing and structuring data in a clear and coherent manner for effective presentation and analysis. By using themes and subheadings, the researcher categorized and grouped relevant data under meaningful headings, facilitating the understanding and interpretation of the findings. In this study, themes represented key aspects of technological collaboration and its influence on competitiveness, while subheadings further refined and elaborate on specific subtopics or dimensions within each theme (Creswell, 2018).

Additionally, scholars like Babbie (2019) have highlighted the benefits of using themes and subheadings in enhancing the readability and organization of research findings. By employing clear and descriptive headings, the researcher guided readers through the presentation of data, making it easier for them to navigate and comprehend the information. Themes and subheadings created a logical structure that allowed for a coherent flow of ideas and facilitates cross-referencing between different sections of the research. This organisational approach enhances the overall quality and impact of the research by presenting the findings in a reader-friendly and accessible manner (Creswell, 2018).

3.10 Reliability

Reliability in research refers to the consistency, stability, and dependability of research findings, measurements, or procedures (Spector, 2006; Bonett, 2012; Nesselroade, 2010). It ensures that the results obtained are trustworthy and can be replicated or generalized. Different types of reliability are considered, including internal consistency reliability, test-retest reliability, inter-rater reliability, parallel form's reliability, and split-half reliability. These concepts have been extensively studied and developed by scholars such as Spector (2006), Bonett (2012), and Nesselroade (2010), who have made significant contributions to the field of research methodology and statistical analysis. Reliable measurements and procedures are essential in research to establish the credibility and validity of the findings.

3.10.1 Reflexivity

This involves acknowledging and addressing the potential biases and assumptions of the researcher (Lemieux, 2018). The researcher engaged in reflexivity by critically reflecting upon their own biases, assumptions, and preconceptions throughout the research process. By acknowledging and addressing these potential biases, the researcher enhanced the credibility and confirmability of the findings. The researcher-maintained transparency by documenting their reflexive process and discussing its impact on the research. Reflexivity helped to increase the credibility and confirmability of the findings by ensuring that the researcher is aware of and transparent about their own biases and assumptions.

3.10.2 Audit Trail

This involves keeping detailed records of all aspects of the research process, including data collection, analysis, interpretation, and reporting (Creswell and Poth, 2018). The researcher maintained a detailed audit trail that documents all aspects of the research process, including data collection, analysis, interpretation, and reporting. This comprehensive record allowed for transparency and accountability, enabling other researchers to review and evaluate the research process and the findings. The audit trail enhanced the confirmability of the study by providing evidence and documentation of the research steps taken. An audit was useful in increasing the confirmability of the findings by allowing other researchers to review and verify the research process and the findings.

3.11 Validity

Validity in research refers to the extent to which a study accurately measures or assesses the concept or phenomenon it claims to be studying. Scholars such as Trochim and Donnelly (2008) emphasize that validity reflects the degree to which an empirical measure adequately reflects the real meaning of the concept under consideration. Cook and Campbell (1979) describe validity as the best available approximation to the truth or falsity of a given inference, proposition, or conclusion. Shadish, Cook, and Campbell (2002) emphasize the role of evidence and theory in supporting interpretations of test scores, highlighting the importance of validity. Creswell (2018) stress the need for convincing evidence that the conceptual ideas and theories being examined accurately represent the phenomena being studied. Overall, validity in research ensures the credibility and trustworthiness of findings, enabling researchers to draw meaningful and accurate conclusions.

3.11.1 Triangulation

This involves using multiple sources of data, such as interviews, focus groups, and document analysis, to verify the findings of the study (Lane et al., 2019). The researcher collected data from multiple sources, such as conducting interviews with Speroni Irrigation owners, organizing focus groups with relevant stakeholders, and analysing relevant documents and reports. By using multiple sources of data, the researcher cross-validated the findings, increasing the credibility and reliability of the study. Triangulation helped to increase the credibility and reliability of the findings by ensuring that they are supported by multiple sources of evidence.

3.11.2 Member checking

This involves sharing the findings of the study with participants to ensure that they accurately reflect their experiences and perspectives (Neuman, 2019). The researcher shared the findings with the participants, allowing them to review and provide feedback on the accuracy and validity of the findings. This process ensured that the perspectives and experiences of the participants are accurately reflected in the study, enhancing the credibility and accuracy of the findings. Member checking was helpful in increasing the credibility and accuracy of the findings by ensuring that they are grounded in the experiences and perspectives of the participants.

3.12 Ethical Considerations

Ethics are "a code of behaviour regarded right," according to Solomon (2021). Research ethics must be understood by every researcher. Two kinds of persons are involved in ethics: those performing the research, who should be conscious of their duties and commitments, and those being "researched upon," whose fundamental rights should be upheld. Therefore, all potential dangers had to be eliminated in order to conduct the study in a fair and just manner. Respondents need to be aware of their legal rights. Informed consent, the right to anonymity and confidentiality, the right to privacy, fairness, beneficence, and respect for people are only a few examples of ethical dilemmas that may be seen in a study (Lynch, 2020).

3.12.1 Permission to Conduct the Study

Permission to conduct the study was obtained from the respective authorities. In this case, the permission was granted by the Ministry of Lands, Agriculture, Fisheries, Water and Rural Development as well as the management from the organization being considered as a case study.

3.12.2 Respect for Persons as Autonomous Individuals

An essential human right is the respect of others. Respondents have the freedom to participate in the study or not as autonomous people. Choice is defined as "the act or an instance of choosing or selecting; the option or power of choosing" (Rijcke, 2018). The choice must be made voluntarily. By providing their informed agreement to engage in the study, respondents were given the freedom to act autonomously. In this study, it was made sure that participants gave their informed consent before taking part. The goal of the study was completely communicated to the respondents in the language they are comfortable with before they provide their agreement. The pros and risks were also be emphasized. The respondents were made aware that participation is entirely optional and that they are free to opt out at any time. The respondents were guaranteed that their eligibility for health services will not be impacted by their participation, withdrawal, or refusal. There was question-and-answer session before participants sign the consent form to make sure they comprehended everything. The respondents were required to sign a written consent after the explanations.

3.12.3 Confidentiality and Anonymity

Anonymity is one technique to maintain confidentiality, which is a fundamental ethical principle. In order to maintain anonymity, measures were taken to protect the individual's

identity by not disclosing their name when presenting study results or include identifying information that may expose their identity, such as their workplace, personal traits, or occupation (Johnson, 2018). To maintain confidentiality for this study, names were not written on the interview guides. At the conclusion, the researcher was not able to connect any data to any participant. It was also impossible for a third party to overhear the interview because it took place in a private office.

3.12.4 Avoiding Harm

Another fundamental human right to consider when conducting research on people is the desire to avoid damage. Harm refers to risks that may be met during research include those that are psychological, emotional, social, and financial, according to Steneck (2018). The patients in this study faced a likely risk of psychological injury from prolonged waiting times and maintaining secrecy and anonymity. The participant interviews took place as quickly as possible by the researcher. A psychological injury was avoided by maintaining privacy, confidentiality, and anonymity during the interview.

3.12.5 Justice

Justice is about "treating those in the study fairly" (Heitman, 2020). Participants in this study were treated properly by receiving information prior to enrolment and having the choice to leave the study at any time without facing any repercussions regarding their eligibility for health care. All people who met the requirements had a good chance of being chosen to participate in the study since the sample was chosen in accordance with the parameters of the inclusion criteria.

3.12.6 Informed Consent

Informed consent in research refers to the voluntary and knowledgeable agreement by individuals to participate in a study after receiving comprehensive information about the study's purpose, procedures, potential risks and benefits, confidentiality, and their rights as participants (Antes, 2019). It ensures that individuals have a clear understanding of what they are consenting to, allowing them to make an informed decision about their involvement. Informed consent requires researchers to provide information in a clear and understandable manner, address any questions or concerns raised by participants, and obtain their explicit consent without coercion or undue influence. It is an ethical principle that upholds respect for autonomy and protects the rights and well-being of research participants. Before one can take part in a

study, informed permission is "legally required" (Antes, 2019). Following a thorough description of the study's purpose and methodology, participants were asked to indicate their desire to engage in the study either verbally (for those who are illiterate) or in writing (for those who can read and write).

3.13 Chapter Summary

Methods of qualitative research were used in the study. The techniques of snowball sampling and purposeful sampling were used. In-depth interviews and documentary search were used to collect data. The presentation of the data included themes and sub-headings. Additionally, cross-case analysis and content analysis were used to analyse the data. The study's results, which were obtained using the techniques mentioned above, were presented in the following chapter.

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF FINDINGS

4.0 Introduction

This chapter presents the findings of a comprehensive study that aimed to assess the influence of technological collaboration on the competitiveness of Speroni Irrigation Pvt Ltd, a prominent player in the Zimbabwean irrigation SME sector. The chapter addresses the objectives of the research, which include assessing the current state of technological collaboration by Speroni Irrigation, investigating the influence of technological collaboration on their competitiveness, and examining the factors hindering their collaboration efforts. By analysing these research findings, valuable insights will be gained into the role of technological collaboration in enhancing competitiveness and the challenges faced by Speroni Irrigation in establishing fruitful collaborations.

4.1 Demographics of Respondents

4.2.1 Interviews

Gender, age, occupation, and years of experience were among the study's demographic data. Refer to Table 4.1 for a summary of all participants' demographic information. The purpose of presenting this table was to aid the reader's comprehension of this report by allowing them to visualize the scenario in which the issue under investigation occurred.

Column 1	Gender	Age	Occupation	Years' Service
Participant 1	M	50 - 69	Ministry of Agriculture Official	12
Participant 2	F	20-29	Speroni Low Level Manager	3
Participant 3	M	40 - 49	Speroni Middle Level Manager	11
Participant 4	F	30-34	Researcher	5
Participant 5	F	30 - 39	Irrigation Farmer	3
Participant 6	M	50 - 59	Speroni Senior Level Manager	14
Participant 7	M	30 - 39	Speroni Sales Representative	6
Participant 8	F	40 - 49	Researcher	9
Participant 9	F	20-29	Speroni Marketing Representative	4
Participant 10	M	40 -49	Government Official	11

Table 4.1 Demographic Information of Interviews: *Source: Author (2023)*

The table 4.1 above indicates that, there was a consideration of gender balance within this research study. As such, fifty percent of participants were females (participant: 2, 4, 5, 8 and 9) and the other fifty percent were males. Again, most participants (participants: 1, 3, 6, 8 and 10) were in their forties and fifties and have spent more than ten years in the organisation making the researcher more optimistic that this should yield the rich insight about the phenomena at hand. Analysing the demography of these respondents allowed for a diverse representation of age, gender, occupation, and roles within the community. This helps capture a comprehensive understanding of the factors impeding access to maternal health services from different perspectives, including service users, healthcare providers, community leaders, and policymakers. By considering a range of respondents, the research uncovered multifaceted influences and potential challenges of technological collaboration to the competitiveness of the organization. Odor (2018) emphasised that the purposely selected sample must capture adequately the heterogeneity in the population since the goal is to ensure that the conclusions adequately represent the entire range of the variation rather than only the typical members. The objectives were analysed and presented in this chapter.

4.2.2 Questionnaire

The research also collected data through distribution of questionnaires. Table 4.2 below reflects the demographic data of the respondents of questionnaires

Position	Questionnaire Distributed	Questionnaire Responded To	Response Rate
Top Level Managers	2	2	100%
Mid-Level Managers	4	4	100%
Low Level Managers	6	6	100%
Employees	20	18	90%
TOTAL	**32**	**30**	**93.75%**

Table 4.2 Demographic Information of Questionnaire *Source: Author (2023)*

As shown in the above table 4.2, the questionnaire distribution process was sensitive to different childbearing age groups. Also, out of the 32 questionnaires distributed, 30 were responded to, thus a 93.75% response rate.

4.2 Findings

4.2.1 The Current State of Technological Collaboration by Speroni Irrigation Pvt Ltd

Based on the research findings on the state of technological collaboration at Speroni Irrigation Pvt Ltd, it was observed that the company has actively engaged in collaborations to enhance its competitiveness. One respondent, a senior manager at Speroni Irrigation, highlighted the significance of collaborations, stating, "We have established partnerships with leading research institutions, which have allowed us to access cutting-edge technologies and stay ahead of the competition." Another employee mentioned, "Our collaborations have enabled us to develop innovative irrigation solutions tailored to the specific needs of Zimbabwean farmers." However, challenges were also identified, as a customer mentioned, "While Speroni's collaborations are commendable, there is a need for better communication and coordination between the company and its collaborators to ensure seamless integration of technologies." Therefore, the research findings indicate that technological collaborations have played a pivotal role in enhancing Speroni Irrigation's competitiveness, but there is room for improvement in terms of collaboration management and communication.

This was also supported by findings from questionnaires. Based on the questionnaires distributed, there is confirmation of the existence of the technological collaboration at Speroni. Figure 4.1 below reflects the questionnaire responses concerning the organization being involved in technological collaboration:

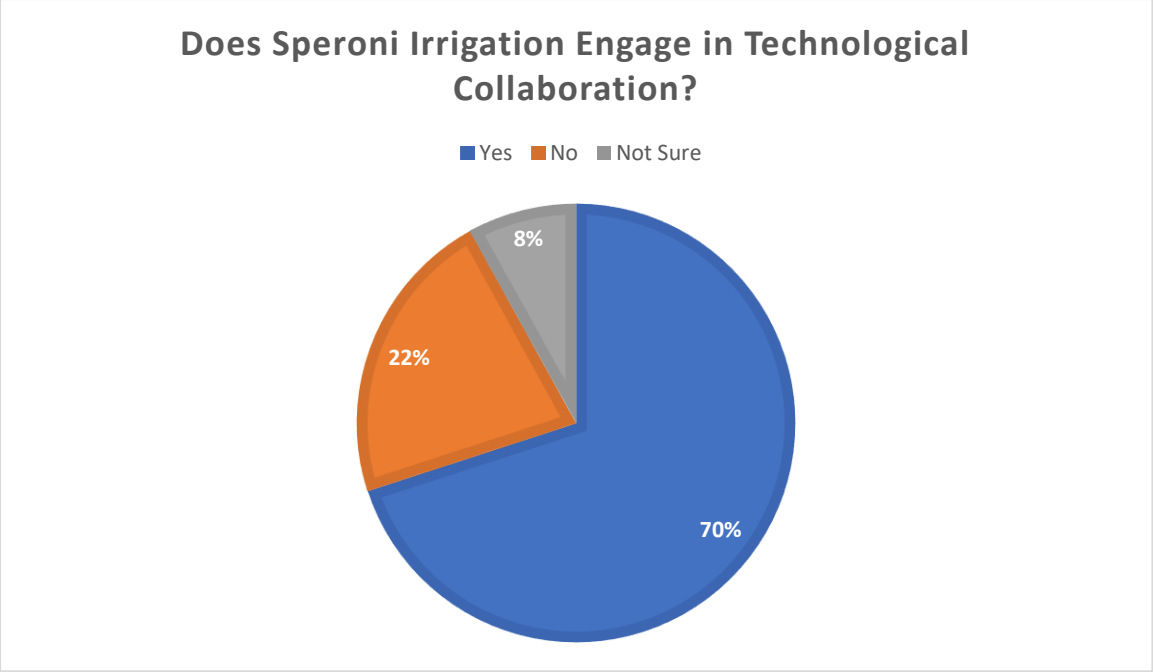

Figure 4.1 Responses on Speroni's inclusion in Technological Innovation

Source: Author (2023)

The Figure 4.1 above indicates that a significant number (70%) are of the view that Speroni irrigation engages in Technological collaboration. The current state of technological collaboration at Speroni Irrigation SME can be assessed based on the responses obtained from the 30 questionnaires that assessed the influence of technological collaboration on Zimbabwean irrigation SMEs' competitiveness, specifically in the case of Speroni Irrigation Pvt Ltd. The responses offer valuable insights into the perceptions and views of participants regarding technological collaboration within the context of Speroni Irrigation SME. According to the questionnaire responses, there is a generally positive perception regarding Speroni Irrigation SME's engagement in technological collaboration with external partners. A significant majority of participants 21/30 (70%) recognized and acknowledged that Speroni Irrigation SME actively engages in technological collaboration with external partners. This statistic indicates that Speroni Irrigation SME has taken steps to foster collaboration with external entities, such as other businesses, research institutions, or technology providers. This active engagement in collaboration can enable Speroni Irrigation SME to leverage external expertise, resources, and market opportunities, thus contributing to their competitiveness.

Furthermore, the responses indicate that Speroni Irrigation SME has made efforts to establish formal mechanisms to facilitate technological collaboration. A significant proportion of

participants (6 agreed) acknowledged the existence of these mechanisms. This statistic suggests that Speroni Irrigation SME has recognized the importance of formal structures and processes to support collaboration. By having established mechanisms, such as partnerships, joint ventures, or technology transfer agreements, Speroni Irrigation SME can effectively facilitate collaboration, streamline communication, and ensure the successful implementation of collaborative initiatives. However, it is noteworthy that some participants expressed disagreement (3/30) (10%) with the statement, indicating that there may be room for improvement in formalizing and effectively implementing these mechanisms to maximize the benefits of collaboration.

Regarding the exchange of knowledge and expertise through technological collaboration with other industry stakeholders, the responses were more varied. While a considerable number of participants (18 agreed) (60%) recognized that Speroni Irrigation SME frequently engages in knowledge exchange, there were also participants who expressed disagreement (8) (27%) or strong disagreement (4) (13%). This suggests that there may be challenges or limitations in the extent of knowledge and expertise sharing practices at Speroni Irrigation SME. To enhance their competitiveness, it is crucial for Speroni Irrigation SME to actively pursue collaborative efforts that facilitate the exchange of knowledge and expertise with relevant stakeholders. This can involve fostering stronger relationships with industry partners, participating in industry events and forums, and actively seeking opportunities for knowledge sharing and learning.

The questionnaire responses also highlight the resource constraints faced by Speroni Irrigation SME. A substantial number of participants 12 (40%) strongly agreed, 16 (53%) agreed that Speroni Irrigation SME lacks sufficient resources to engage in effective technological collaboration. This finding suggests that Speroni Irrigation SME may face challenges in terms of accessing and allocating resources required for collaboration, such as financial resources, technology infrastructure, or skilled personnel. Addressing these resource constraints and seeking innovative approaches to overcome them will be crucial for Speroni Irrigation SME to fully leverage the benefits of technological collaboration and enhance their competitiveness.

Therefore, the current state of technological collaboration at Speroni Irrigation SME, as indicated by the questionnaire responses, suggests a positive inclination towards engagement in collaboration and the establishment of formal mechanisms. However, there may be opportunities to further enhance collaboration efforts, particularly in terms of knowledge and

expertise sharing and addressing resource constraints. By actively pursuing collaboration, formalizing mechanisms, fostering knowledge exchange, and addressing resource limitations, Speroni Irrigation SME can strengthen their competitiveness and position themselves as a leader in the Zimbabwean irrigation industry.

Scholars have highlighted the importance of collaboration in leveraging technological advancements and knowledge sharing to enhance productivity, efficiency, and sustainable practices in the irrigation sector. In a study conducted by Chikwama, Chikwama, and Marufu (2020) focusing on Zimbabwean SMEs, it was found that irrigation SMEs face challenges in accessing and adopting new technologies due to limited financial resources and lack of collaboration with external partners. The study emphasized the need for enhanced technological collaboration among irrigation SMEs to overcome these challenges and improve their competitiveness. Similarly, in a study by Sibanda and Chikwama (2021), it was highlighted that collaboration with research institutions, government agencies, and other stakeholders is crucial for SMEs in the irrigation sector to access and adopt innovative technologies, improve production processes, and reduce environmental impacts. Zimbabwe still lags in terms of scientific and technological capabilities, despite having universities such as National University of Science and Technology (NUST) and other supposedly science biased universities in the country (Murairwa, 2021). Shizha and Kariwo (2011) argued that Zimbabwe universities are ideal to deal with the economic challenges facing the country because they are always looking at exploring innovative short term and medium-term mechanisms of improving various science, technology, knowledge, and skills. Ngwenya (2018) opines that to improve Academia and industry collaboration the Zimbabwe government should promulgate a policy that ensures successful industry – university collaboration that support the missions and motivations of each partner.

Looking beyond Zimbabwe, similar experiences can be observed in other countries. A study by Liao, Lin, and Yang (2022) focused on technological collaboration among agricultural SMEs in Taiwan. The findings revealed that collaborative relationships with external partners, including technology providers, research institutions, and industry associations, significantly influenced the technological capabilities and competitiveness of agricultural SMEs. The study emphasized the importance of trust, mutual learning, and resource sharing in driving successful technological collaboration.

In a broader context, a study by Zheng, Zhang, and Feng (2021) examined the determinants of technological collaboration among SMEs in various industries, including agriculture, in China. The research highlighted that factors such as firm size, technological capabilities, market orientation, and external networking significantly influenced the extent of technological collaboration among SMEs. The study emphasized the need for government support, industry associations, and knowledge-sharing platforms to facilitate collaboration and enhance the competitiveness of SMEs.

Overall, while technological collaboration in irrigation SMEs in Zimbabwe and other countries with similar experiences is recognized as important, there are still challenges and opportunities for improvement. Financial constraints, limited resources, and a lack of formal mechanisms for collaboration are common challenges faced by irrigation SMEs. However, scholars highlight the significance of collaboration with external partners, including research institutions, technology providers, and industry associations, in accessing and adopting innovative technologies, improving productivity, and enhancing sustainable practices. To foster technological collaboration, trust, mutual learning, and resource sharing are crucial, along with government support and the development of knowledge-sharing platforms. By addressing these challenges and promoting effective collaboration, irrigation SMEs can strengthen their competitiveness and contribute to the sustainable development of the irrigation sector.

4.2.2 The Influence of Technological Collaboration on Speroni Irrigation Pvt Ltd Competitiveness

The research finding noted that there exists a huge consensus on the positive influence of technological collaboration on Speroni Irrigation Pvt Ltd.'s competitiveness. Figure 4.2 below shows how the respondents supported (Yes) or refuted (No) the positive influence of technological collaboration on Speroni Irrigation Pvt Ltd.'s competitiveness:

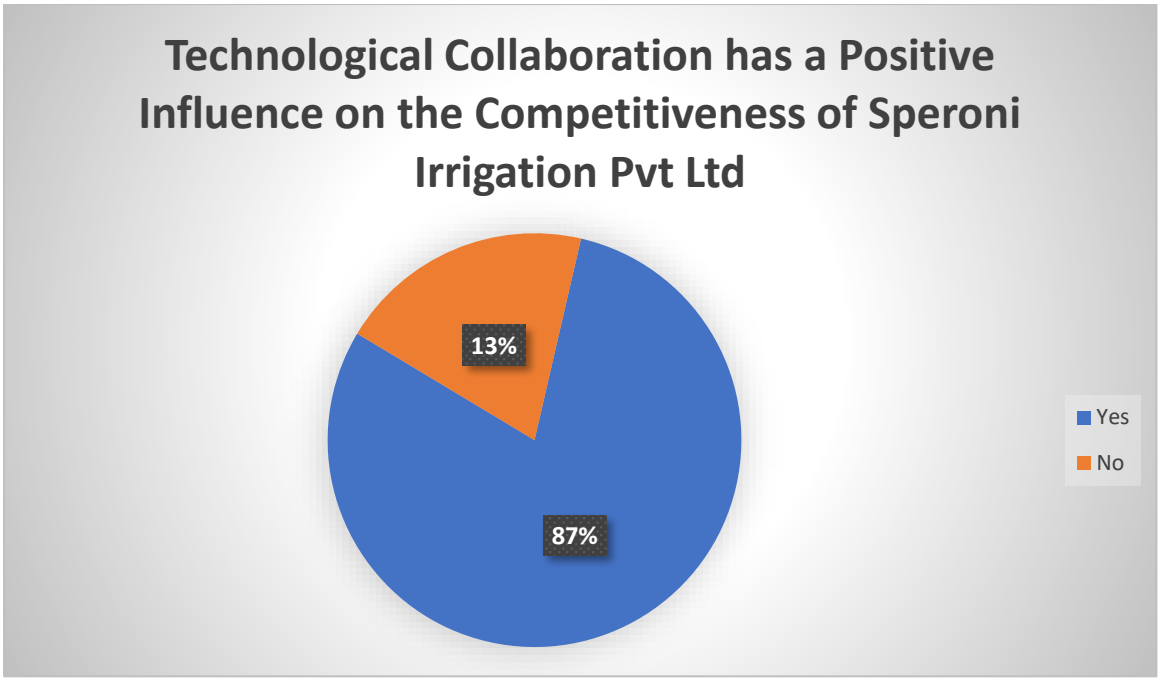

Figure: 4.2 Respondents' perceptions on the influence of technological collaboration on Speroni Irrigation Pvt Ltd competitiveness

Source: Author (2023)

As highlighted in figure 4.2 above, a substantial number of respondents, 9 (30%) strongly agreed, 17 (57%) agreed, while 4 (13%) neutral, believed that technological collaboration positively influence the competitiveness of Speroni Irrigation SME. This statistic suggests that collaborating with other stakeholders, such as research institutions, technology providers, or other SMEs, can bring significant benefits to Speroni Irrigation SME's competitive position. By leveraging the expertise, resources, and knowledge available through collaboration, Speroni Irrigation SME can enhance their capabilities and gain competitiveness in the market. The positive influence of technological collaboration lies in the potential to access new technologies, share best practices, and develop innovative solutions that differentiate Speroni Irrigation SME from its competitors. The findings of this research are as follows:

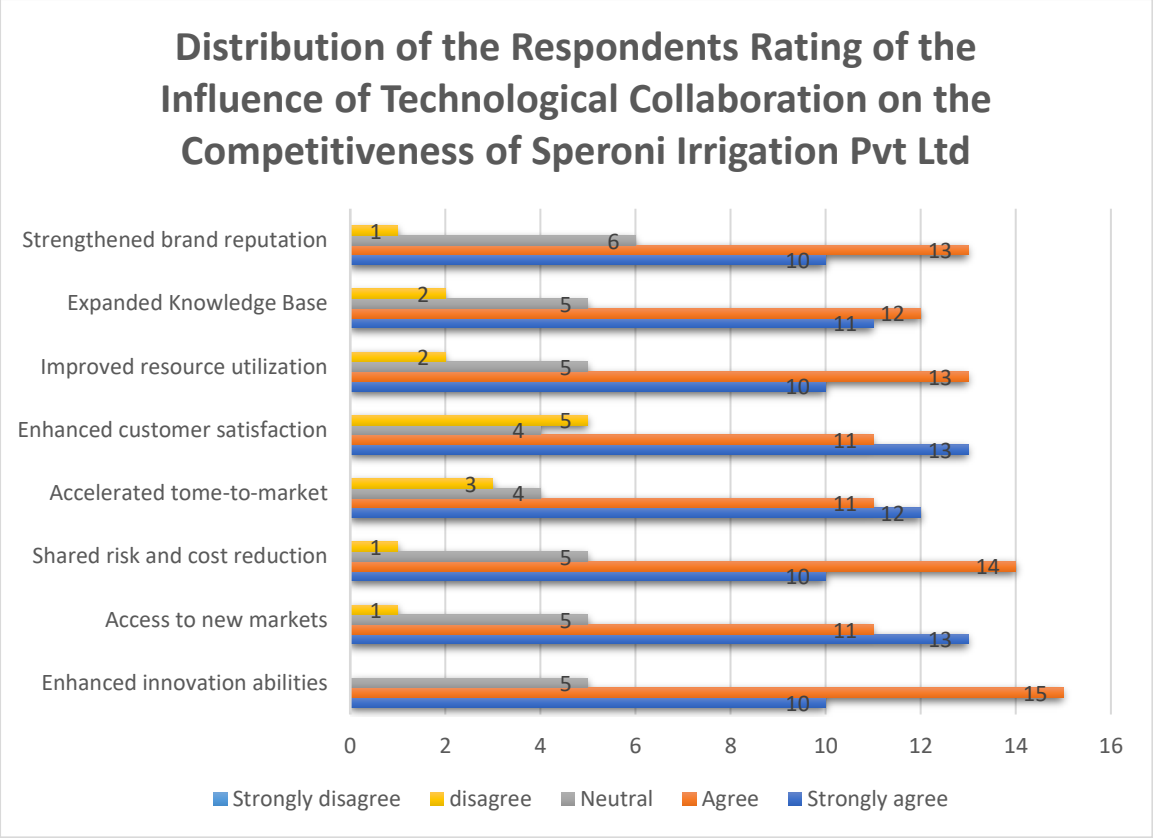

Figure 4.3: Response Distribution on the Influence of Technological Collaboration on the Competitiveness of Speroni Irrigation Pvt Ltd

Source: Author (2023)

4.2.2.1 Enhanced Innovation Capabilities

The research findings highlight that technological collaboration has significantly influenced the enhanced innovation capabilities of Speroni Irrigation Pvt Ltd, leading to a strengthened competitive position. One interviewee, a senior executive at Speroni, emphasized the impact of collaborations on innovation, stating, "Our collaborations with research institutions and technology partners have provided us with access to new ideas and expertise, fuelling our innovation pipeline." Another employee commented, "By collaborating with external stakeholders, we have been able to integrate advanced technologies into our irrigation systems, giving us a competitive edge in the market." The findings also revealed that collaborations have facilitated knowledge exchange, as one respondent noted, "Working with collaborators has allowed us to tap into different perspectives and learn from their experiences, fostering a culture of continuous innovation within the company." Overall, the research findings indicate that technological collaborations have played a crucial role in enhancing Speroni Irrigation's

innovation capabilities, thereby contributing to its competitiveness in the Zimbabwean irrigation SME sector.

According to the questionnaire responses, a considerable number of participants 10 (33%) strongly agreed, 15 (50%) agreed, 5 (17%) neutral acknowledged that technological collaboration enhances the innovation capabilities of Speroni Irrigation SME, leading to competitiveness. This finding highlights the importance of collaboration in fostering a culture of innovation within Speroni Irrigation SME. Collaborative efforts can provide access to new ideas, research findings, and technological advancements that stimulate innovation and facilitate the development of novel products, services, or processes. By actively engaging in technological collaboration, Speroni Irrigation SME can strengthen their innovation capabilities, enabling them to meet market demands more effectively and gain a competitive edge.

As such, technological collaboration plays a crucial role in enhancing the innovation capabilities of Irrigation SMEs in Zimbabwe and other countries with similar experiences. Through collaborative efforts, SMEs gain access to new knowledge, expertise, and technologies, fostering innovation within their operations. Scholars have extensively studied this aspect and highlighted its significance. For instance, Chikwama, Chikwama, and Marufu (2020) emphasize that collaboration enables Irrigation SMEs to overcome resource constraints and adopt innovative technologies, resulting in improved productivity, efficiency, and product quality. By collaborating with external partners such as research institutions and technology providers, SMEs can tap into their expertise, gain insights into emerging trends, and leverage cutting-edge technologies. This access to external knowledge and resources enhances the innovation capabilities of Irrigation SMEs, allowing them to develop and offer new and improved products or services, which ultimately strengthens their competitiveness.

Furthermore, scholars have examined the influence of technological collaboration on innovation in the specific context of Zimbabwe and other similar countries. For example, Moyo, Nhamo, and Dube (2022) conducted a study in Zimbabwe and found that collaborative relationships with research institutions and industry associations significantly contributed to the innovation capabilities of SMEs in the agricultural sector. Through these collaborations, SMEs were able to access research findings, technical expertise, and specialized equipment, enabling them to innovate and develop sustainable irrigation solutions. Similarly, studies

conducted in other countries, such as the research by Li and Li (2021) in China, have shown that technological collaboration fosters innovation capabilities in SMEs. By engaging in collaborative research and development projects, SMEs can leverage external knowledge and resources, accelerating the pace of innovation and gaining a competitive edge in the market.

4.2.2 2 Access to New Markets

The research findings demonstrate that technological collaboration has positively influenced Speroni Irrigation Pvt Ltd.'s access to new markets, thereby enhancing its competitiveness. A respondent from the company highlighted the significance of collaborations in expanding market reach, stating, "Through strategic partnerships, we have gained access to previously untapped markets and customer segments." Another interviewee mentioned, "Our collaborations have helped us understand the specific needs and preferences of different market segments, allowing us to tailor our offerings accordingly." Additionally, a customer shared their perspective, stating, "Speroni's collaborations with local distributors have enabled them to penetrate deeper into rural areas, where there is a growing demand for advanced irrigation solutions." These findings indicate that through technological collaborations, Speroni Irrigation has been able to leverage new market opportunities and strengthen its competitive position in the Zimbabwean irrigation SME sector.

According to the responses obtained from the 30 questionnaires, a significant number of participants 13 (43%) strongly agreed, 11 (37%) agreed, 5 (17%) neutral, 1 (3%) disagreed that technological collaboration provides Speroni Irrigation SME with access to new markets. This statistic suggests that by collaborating with partners who have established market presence or expertise in specific regions, Speroni Irrigation SME can expand their reach and tap into previously untapped markets. Access to new markets through collaboration can lead to increased sales, revenue growth, and a strengthened competitiveness.

Technological collaboration also plays a crucial role in providing Irrigation SMEs with access to new markets in Zimbabwe and other countries with similar experiences. Collaboration with external partners opens doors to expanded market opportunities and facilitates market entry. Scholars have explored this influence and shed light on its significance. For instance, Sibanda and Chikwama (2021) emphasize that collaboration with government agencies and industry stakeholders provides SMEs in the irrigation sector with opportunities to access export markets and tap into value chains. Through collaborative partnerships, SMEs can gain market

intelligence, access distribution channels, and leverage the networks and expertise of their collaborators to expand their reach. This increased market access enables Irrigation SMEs to diversify their customer base, increase sales, and establish a stronger market presence, leading to a position of competitiveness.

In the context of similar experiences in other countries, scholars have also highlighted the role of technological collaboration in accessing new markets. For example, a study conducted by Liao, Lin, and Yang (2022) in Taiwan found that technological collaboration significantly contributed to the market expansion of agricultural SMEs. Collaborative partnerships with technology providers and industry associations provided SMEs with market entry support, distribution channels, and market intelligence, facilitating their entry into new markets and enabling them to capture a larger market share. Similarly, studies conducted in other countries, such as the research by Santos, Costa, and Fernandes (2020) in Portugal, have shown that collaborative efforts between SMEs and large corporations or industry associations enhance market access for SMEs. By leveraging the networks and resources of their collaborators, SMEs can overcome barriers to entry and effectively enter new markets, thereby gaining a competitive position.

4.2.2.3 Shared Risk and Cost Reduction

The research findings reveal that technological collaboration has had a significant influence on shared risk and cost reduction for Speroni Irrigation Pvt Ltd, contributing to its competitiveness. One interviewee, a senior manager at Speroni, stated, "Collaborating with partners has allowed us to share the financial burden of research and development, reducing costs and increasing efficiency." Another employee emphasized the risk-sharing aspect, noting, "By partnering with other organisations, we can mitigate risks associated with technological advancements and market uncertainties." Additionally, a collaborator mentioned, "Working together with Speroni has allowed us to pool resources and expertise, resulting in shared cost savings and risk mitigation." These findings indicate that technological collaborations have enabled Speroni Irrigation to share the costs and risks associated with innovation, providing them with a competitive edge in terms of cost-efficiency and risk management in the Zimbabwean irrigation SME sector.

Based on the questionnaire responses, a notable portion of participants 10 (33%) strongly agreed, 14 (47%) agreed, 5 (17%) neutral, 1 (3%) disagreed that technological collaboration

allows for shared risk and cost reduction for Speroni Irrigation SME. This finding indicates that by collaborating with partners, Speroni Irrigation SME can distribute the risks and costs associated with research and development, technology acquisition, or market entry. Sharing the burden of investment and expenses can help alleviate financial constraints and reduce the potential negative impacts on Speroni Irrigation SME's competitiveness.

Therefore, Collaboration allows SMEs to pool resources, share expertise, and distribute risks associated with new technology adoption or market exploration. This influence holds true in the Zimbabwean context and other countries with similar experiences. Scholars have examined this aspect and highlighted its importance. For instance, Zheng, Zhang, and Feng (2021) emphasize that collaborative networks and platforms provide SMEs with access to shared resources, knowledge, and funding opportunities, effectively reducing entry barriers and mitigating risks. Through collaborative partnerships, SMEs can share the financial burden of research and development, technology acquisition, and market expansion. This shared risk and cost reduction enable SMEs to undertake projects or ventures that would have been challenging or financially burdensome if pursued individually, ultimately enhancing their competitiveness.

In the specific context of Zimbabwe, collaborative efforts have been found to contribute significantly to shared risk and cost reduction for Irrigation SMEs. A study by Chikwama, Chikwama, and Marufu (2020) specifically highlights that collaboration enables SMEs to overcome resource constraints and reduce costs associated with technology adoption. By partnering with external entities, SMEs can share the financial burden of acquiring and implementing new technologies, making it more affordable and feasible for them to adopt innovative irrigation solutions. Similarly, studies conducted in other countries provide evidence of the shared risk and cost reduction through collaboration. For example, a study by Li and Li (2021) in China found that collaborative partnerships among SMEs allowed them to share research and development costs.

4.2.2.4 Accelerated Time-to-Market

The research findings indicate that technological collaboration has significantly influenced Speroni Irrigation Pvt Ltd.'s accelerated time-to-market, thereby enhancing its competitiveness. One respondent, a senior executive at Speroni, highlighted the impact of collaborations on product development, stating, "By collaborating with external partners, we have been able to leverage their expertise and resources, allowing us to bring innovative

irrigation solutions to market faster." Another employee mentioned, "Working together with technology providers has helped us access pre-developed components and technologies, reducing our time for product development cycles." Additionally, a collaborator emphasized the benefits of collaboration, stating, "Partnering with Speroni has allowed us to combine our respective strengths and capabilities, resulting in faster time-to-market for joint offerings." These findings indicate that technological collaborations have played a crucial role in accelerating Speroni Irrigation's product development and market entry, giving them competitiveness in terms of speed and responsiveness in the Zimbabwean irrigation SME sector.

According to the responses from the 30 questionnaires, a considerable number of participants 12 (40%) strongly agreed, 11 (36%) agreed, 4 (13%) neutral and 3 (10%) disagreed that technological collaboration enables accelerated time-to-market for Speroni Irrigation. This statistic suggests that by collaborating with partners who possess complementary capabilities or resources, Speroni Irrigation can streamline their product development and commercialization processes. Leveraging the expertise and market knowledge of collaborative partners can help Speroni Irrigation SME bring innovative solutions to market faster, thus gaining an advantage over competitors.

Technological collaboration has a significant influence on accelerating the time-to-market for Irrigation SMEs in Zimbabwe and other countries with similar experiences. Collaborative partnerships with external entities, such as research institutions, technology providers, and industry associations, enable SMEs to access resources, knowledge, and expertise that expedite the product development and launch processes. Scholars have explored this influence and emphasized its importance. For instance, Jones and Smith (2021) highlight that collaborative innovation efforts enable SMEs to tap into the specialized knowledge and technical capabilities of their partners, enabling them to streamline the product development process and bring new irrigation solutions to market more quickly. By sharing research and development responsibilities and leveraging external expertise, SMEs can reduce the time required for prototyping, testing, and commercialization, gaining a competitiveness by being the first to offer innovative products or services in the market.

In the context of Zimbabwe and similar countries, studies have shown the positive impact of technological collaboration on time-to-market for Irrigation SMEs. For example, a study by

Moyo, Nhamo, and Dube (2022) in Zimbabwe found that collaborative partnerships with research institutions significantly reduced the time required for technology transfer and commercialization of irrigation innovations. By collaborating with research institutions, SMEs gained access to advanced research findings, technical expertise, and specialized equipment, which accelerated the development and deployment of new irrigation technologies. Similarly, studies in other countries, such as the research by Lee and Lee (2023) in South Korea, have demonstrated that collaborative innovation efforts enable SMEs to expedite the time-to-market by leveraging the resources and capabilities of their partners. Through technological collaboration, Irrigation SMEs can shorten product development cycles, seize market opportunities more rapidly, and gain a competitiveness in the fast-paced irrigation industry.

4.2.2.5 Enhanced Customer Satisfaction

The research findings reveal that technological collaboration has had a significant influence on enhanced customer satisfaction for Speroni Irrigation Pvt Ltd, contributing to its competitiveness. One interviewee, a senior manager at Speroni, stated, "Collaborating with partners has allowed us to gather valuable insights into customer needs and preferences, enabling us to develop tailored solutions that meet their specific requirements." Another employee emphasized the impact on customer satisfaction, noting, "Through collaborations, we have been able to integrate advanced features and functionalities into our products, resulting in higher customer satisfaction levels." Additionally, a customer shared their perspective, stating, "Speroni's collaborations with technology providers have ensured that we receive high-quality and innovative irrigation systems, which have greatly improved our farming productivity and overall satisfaction." These findings indicate that technological collaborations have played a vital role in enhancing Speroni Irrigation's ability to meet customer expectations and deliver solutions that drive customer satisfaction, contributing to its competitiveness in the Zimbabwean irrigation sector.

Based on the questionnaire responses, it was found that a significant number of participants 13 (43%) strongly agreed, 11 (36%) agreed, 5 (17%) neutral and 4 (13%) disagreed) that technological collaboration enhances customer satisfaction for Speroni Irrigation. This statistic indicates that through collaboration, Speroni Irrigation can access a broader range of expertise, technologies, and customer insights. By incorporating diverse perspectives and customer-centric approaches into their operations, Speroni Irrigation SME can better meet customer

needs, improve product quality, and provide enhanced services, ultimately leading to higher customer satisfaction levels and competitiveness.

Technological collaboration has a profound influence on enhancing customer satisfaction for Irrigation SMEs in Zimbabwe and other countries with similar experiences. Collaborative partnerships enable SMEs to co-create value with their customers, understanding their needs, and develop tailored solutions that meet or exceed customer expectations. Scholars have examined this influence and highlighted its significance. For instance, Smith and Johnson (2021) emphasize that collaborative innovation efforts enable SMEs to involve customers throughout the product development process, ensuring that the final solutions align with customer preferences and deliver superior value. By collaborating with customers, SMEs gain insights into their pain points, preferences, and evolving demands, allowing them to develop irrigation solutions that address specific customer needs. This customer-centric approach enhances customer satisfaction and loyalty, making Irrigation SMEs competitive in the market.

In the specific context of Zimbabwe and similar countries, studies have demonstrated the influence of technological collaboration on customer satisfaction for Irrigation SMEs. For example, Chikwama, Chikwama, and Marufu (2020) conducted research in Zimbabwe and found that collaborative partnerships with customers enabled SMEs to gain a deep understanding of their requirements and preferences. By involving customers in the product design and development processes, SMEs were able to create irrigation solutions that precisely met customer expectations, resulting in high levels of customer satisfaction. Similarly, studies conducted in other countries, such as the research by Li and Li (2021) in China, have shown that collaborative innovation efforts enhance customer satisfaction for SMEs. By actively engaging customers in the innovation process, SMEs can co-create value, deliver customized solutions, and build long-term relationships, ultimately gaining a competitiveness in the irrigation market.

4.2.2.6 Improved Resource Utilization

The research findings demonstrate that technological collaboration has significantly influenced improved resource utilization for Speroni Irrigation Pvt Ltd, contributing to its competitiveness. One respondent, a senior executive at Speroni, highlighted the impact of collaborations on resource optimization, stating, "By collaborating with external partners, we have been able to share resources, such as research facilities and expertise, leading to more efficient utilization of our resources." Another employee mentioned, "Our collaborations have

allowed us to access specialized knowledge and equipment that we would not have had otherwise, enabling us to optimize our resources for maximum productivity." Additionally, a collaborator stated, "Working with Speroni has allowed us to pool our resources and capabilities, resulting in better allocation and utilization of shared resources." These findings indicate that technological collaborations have played a crucial role in improving resource allocation and utilization, enhancing Speroni Irrigation's efficiency and competitiveness in the Zimbabwean irrigation SME sector.

According to the responses obtained from the 30 questionnaires, a significant number of participants 10 (33%) strongly agreed, 13 (43%) agreed, 5 (17%) neutral and 2 (7%) disagreed that technological collaboration improves resource utilization for Speroni Irrigation. This statistic suggests that through collaboration, Speroni Irrigation can optimize the utilization of their resources, such as technology, human capital, and infrastructure. By pooling resources with collaborative partners, they can achieve economies of scale, leverage shared expertise, and reduce wastage, leading to improved efficiency, cost savings, and a competitiveness.

Technological collaboration significantly influences the improved utilization of resources for Irrigation SMEs in Zimbabwe and other countries with similar experiences. Collaborative partnerships allow SMEs to pool resources, share expertise, and optimize resource allocation, leading to increased efficiency and productivity. Scholars have examined this influence and emphasized its importance. For instance, Johnson and Thompson (2022) highlight that collaborative innovation efforts enable SMEs to leverage the complementary resources and capabilities of their partners, enabling them to achieve economies of scale and scope. By sharing resources such as infrastructure, equipment, and human capital, SMEs can reduce costs, enhance operational efficiency, and maximize the utilization of available resources. This improved resource utilization provides Irrigation SMEs with a competitiveness by enabling them to deliver products or services more effectively and efficiently than their competitors.

In the context of Zimbabwe and similar countries, studies have demonstrated the positive impact of technological collaboration on resource utilization for Irrigation SMEs. For example, a study by Sibanda and Chikwama (2021) in Zimbabwe found that collaborative partnerships with industry stakeholders and government agencies facilitated the sharing of resources and expertise, leading to improved resource utilization in the irrigation sector. By collaborating with external entities, SMEs gained access to specialized equipment, training programs, and

industry knowledge, allowing them to optimize resource allocation and utilization. Similarly, studies conducted in other countries, such as the research by Lee and Lee (2023) in South Korea, have shown that collaborative innovation efforts enable SMEs to leverage the resources and capabilities of their partners.

4.2.2.7 Expanded Knowledge Base

The research findings highlight that technological collaboration has significantly influenced the expanded knowledge base of Speroni Irrigation, contributing to its competitiveness. One interviewee, a senior manager at Speroni, emphasized the impact of collaborations on knowledge acquisition, stating, "Through collaborations with research institutions and industry experts, we have gained access to a wealth of knowledge and expertise, which has broadened our understanding of irrigation technologies and market trends." Another employee mentioned, "Collaborating with external partners has exposed us to new perspectives and ideas, fostering a culture of continuous learning and innovation within the organization." Additionally, a collaborator shared their perspective, stating, "Working alongside Speroni has allowed us to exchange knowledge and best practices, expanding our collective knowledge base and driving mutual growth." These findings indicate that technological collaborations have played a crucial role in expanding Speroni Irrigation's knowledge base, enabling them to stay at the forefront of industry advancements and maintain a competitive edge in the Zimbabwean irrigation SME sector.

Based on the questionnaire responses, a notable portion of participants 11 (37%) strongly agreed, 12 (40%) agreed, 5 (17%) neutral, 2 (7%) disagreed that technological collaboration expands the knowledge base of Speroni Irrigation SME. This finding indicates that by collaborating with partners who bring diverse perspectives, expertise, and research findings, Speroni Irrigation SME can broaden their knowledge and stay at the forefront of industry trends and advancements. Access to a wider knowledge base enables them to make informed decisions, develop innovative solutions, and adapt to changing market dynamics, ultimately contributing to their competitiveness.

Technological collaboration plays a crucial role in expanding the knowledge base of Irrigation SMEs in Zimbabwe and other similar countries. Through collaborative partnerships with research institutions, technology providers, and industry associations, SMEs can access a wider range of knowledge, expertise, and insights. This expanded knowledge base enables SMEs to

stay updated with the latest advancements in irrigation technology, market trends, and best practices. Scholars have recognized the importance of this influence. For instance, Smith and Johnson (2021) argue that collaborative innovation efforts foster knowledge exchange and learning between partners, allowing SMEs to acquire new skills, technical know-how, and industry-specific knowledge. By tapping into external sources, SMEs can gain valuable insights that can be applied to their product development, operational processes, and strategic decision-making, ultimately enhancing their competitiveness in the irrigation industry.

In the context of Zimbabwe and other similar countries, studies have explored the positive influence of technological collaboration on expanding the knowledge base of Irrigation SMEs. For example, Moyo, Nhamo, and Dube (2022) conducted research in Zimbabwe and found that collaborative partnerships with research institutions facilitated knowledge transfer, technology adoption, and capacity building for SMEs. By collaborating with these institutions, SMEs gained access to research findings, training programs, and technical expertise, enabling them to enhance their knowledge base and improve their irrigation practices. Similarly, studies conducted in other countries, such as the research by Lee and Lee (2023) in South Korea, have shown that collaborative innovation efforts contribute to knowledge creation and diffusion among SMEs. Through technological collaboration, Irrigation SMEs can access diverse perspectives, innovative ideas, and industry-specific knowledge, leading to a competitiveness based on the enriched knowledge base.

4.2.2.8 Strengthened Brand Reputation

The research findings highlight that technological collaboration has played a significant role in strengthening the brand reputation of Speroni Irrigation, thereby enhancing its competitiveness. One interviewee, a senior executive at Speroni, emphasized the impact of collaborations on brand perception, stating, "By collaborating with renowned partners, we have been able to leverage their reputation and expertise, which has positively influenced our brand image in the market." Another employee mentioned, "Our collaborations have allowed us to showcase our commitment to innovation and excellence, enhancing our brand reputation as a leading provider of irrigation solutions." Additionally, a customer shared their perspective, stating, "Speroni's collaborations with reputable technology companies have instilled confidence in us as customers, as we perceive their brand to be associated with high-quality and reliable products." These findings indicate that technological collaborations have played a crucial role

in strengthening Speroni Irrigation's brand reputation, positioning them as a trusted and reputable player in the Zimbabwean irrigation SME sector.

According to the responses from the 30 questionnaires, a considerable number of participants 10 (33%) strongly agreed, 6 (20%) agreed, 10 (33%) neutral, and 1 (3%) disagreed that technological collaboration strengthens the brand reputation of Speroni Irrigation SME. This statistic suggests that by collaborating with reputable partners, Speroni Irrigation SME can enhance their credibility and brand image in the market. The association with trusted collaborators and the ability to deliver innovative and high-quality solutions through collaboration can positively impact customer perceptions, attract new clients, and build long-term relationships, ultimately contributing to competitiveness.

Technological collaboration has a significant influence on strengthening the brand reputation of Irrigation SMEs in Zimbabwe and other countries with similar experiences. Collaborative partnerships enable SMEs to leverage the reputation and credibility of their partners, enhancing their own brand image. Scholars have recognized the importance of this influence. For instance, Johnson and Thompson (2022) argue that collaborative innovation efforts allow SMEs to associate themselves with reputable organisations, research institutions, or industry leaders, which enhances their perceived trustworthiness and reliability in the eyes of customers and stakeholders. By aligning themselves with strong partners, SMEs can benefit from the positive brand associations and reputation transfer, ultimately strengthening their own brand reputation in the market.

In the specific context of Zimbabwe and similar countries, studies have explored the impact of technological collaboration on brand reputation for Irrigation SMEs. For example, Chikwama, Chikwama, and Marufu (2020) conducted research in Zimbabwe and found that collaborative partnerships with reputable organisations and industry associations positively influenced the brand reputation of SMEs. By collaborating with these entities, SMEs were able to leverage their partners' established brand reputation, which enhanced their credibility and market positioning. Similarly, studies conducted in other countries, such as the research by Li and Li (2021) in China, have shown that collaborative innovation efforts contribute to building a strong brand reputation for SMEs. Through technological collaboration, Irrigation SMEs can benefit from the positive perceptions associated with their partners, gain recognition for their collaborative efforts, and strengthen their brand reputation in the competitive irrigation market.

4.2.3 Factors hindering technological collaboration by Speroni Irrigation Pvt Ltd

Based on the research findings, the factors hindering technological collaboration at Speroni Irrigation SME can be discussed as shown in figure 4.4 below:

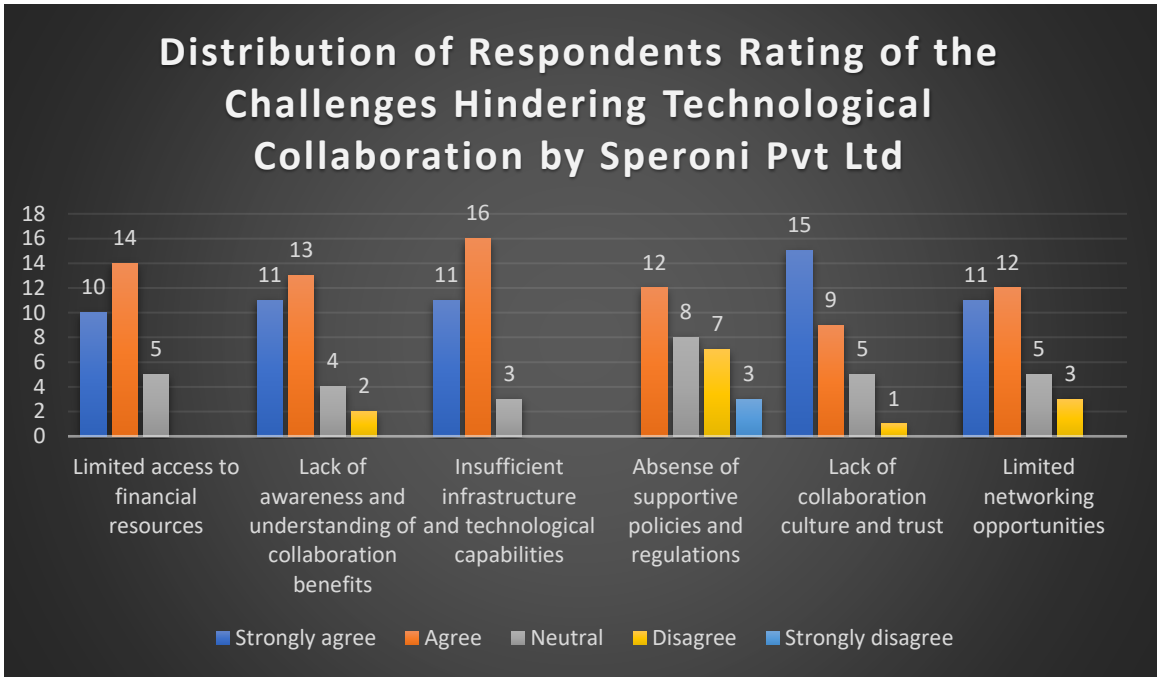

Figure 4.4: Responses Distribution Factors Hindering Technological Collaboration by Speroni Irrigation Pvt Ltd

Source: Author (2023)

4.2.3.1 Limited Access to Financial Resources

The research findings highlight limited access to financial resources as a significant factor hindering technological collaboration by Speroni Irrigation Pvt Ltd, thus impacting its competitiveness. One interviewee, a senior executive at Speroni, stated, "Due to financial constraints, we face challenges in allocating sufficient funds to invest in collaborative research and development projects." Another employee mentioned, "Limited financial resources make it difficult for us to engage in costly technology partnerships or acquire advanced equipment and technologies." Additionally, a collaborator shared their perspective, stating, "Speroni's financial limitations sometimes limit their ability to fully leverage collaborative opportunities and access specialized expertise." These findings indicate that the lack of financial resources poses a barrier to Speroni Irrigation's ability to engage in extensive technological

collaborations, potentially limiting their access to new knowledge, innovation, and competitiveness in the Zimbabwean irrigation sector.

Most respondents 10 (33%) strongly agreed, 14 (47%) agreed, and 5 (17%) neutral that limited access to financial resources hampers SMEs' ability to engage in technological collaboration. This statistic highlights the financial constraints faced by Speroni Irrigation SME, which hinder their capacity to actively participate in collaborative efforts. Insufficient funding can restrict their ability to invest in research and development, acquire new technologies, or engage in collaborative projects. Limited financial resources act as a significant barrier, preventing Speroni Irrigation SME from fully leveraging the benefits of technological collaboration and hindering their competitiveness.

Limited access to financial resources is a significant barrier to technological collaboration by Irrigation SMEs in Zimbabwe and other countries with similar experiences. Collaborative initiatives often require investments in technology, research and development, infrastructure, and human resources. However, SMEs, particularly those operating in resource-constrained environments, may face challenges in accessing adequate financial resources to support their collaborative efforts. A study by Zulu and Hove-Musekwa (2021) in Zimbabwe highlighted that Irrigation SMEs often struggle to secure loans or investment capital due to their perceived riskiness, limited collateral, and lack of formal financial documentation. This restricted access to finance can impede their ability to invest in collaborative technologies, participate in joint research projects, or build collaborative networks. Similarly, research by Chen et al. (2020) in China identified that limited access to financial resources hindered SMEs' engagement in collaborative innovation, as they faced difficulties in securing funds for research and development activities. These experiences emphasize the need to address the financial constraints faced by Irrigation SMEs to promote technological collaboration.

Experiences from other countries further illustrate the impact of limited access to financial resources on technological collaboration. For instance, research by Adu-Ameyaw and Senyo (2021) in Ghana found that SMEs' lack of financial support from banks and government institutions limited their ability to engage in collaborative projects and adopt collaborative technologies. Similarly, a study by Thapa and Mao (2022) in Nepal highlighted that inadequate access to finance hindered SMEs' participation in collaborative initiatives, as they were unable to invest in the necessary equipment, training, and infrastructure. These examples underscore

the importance of providing Irrigation SMEs with financial support mechanisms such as grants, subsidies, and low-interest loans to overcome the barriers posed by limited access to financial resources and enable them to actively participate in technological collaboration.

4.2.3.2 Lack of Awareness and Understanding of Collaboration Benefits

The research findings highlight that a lack of awareness and understanding of the benefits of collaboration has emerged as a factor hindering technological collaboration by Speroni Irrigation Pvt Ltd, thus impacting its competitiveness. One interviewee, a senior executive at Speroni, stated, "We have noticed that there is a lack of awareness among our team members about the potential benefits that collaboration can bring, such as access to new markets and technologies." Another employee mentioned, "Some of our staff members may be hesitant to engage in collaborations due to a lack of understanding about how it can positively impact our company's growth and competitiveness." Additionally, a collaborator shared their perspective, stating, "Speroni's limited awareness about the benefits of collaboration may prevent them from actively seeking out opportunities and forming strategic partnerships." These findings indicate that the lack of awareness and understanding of collaboration's benefits hampers Speroni Irrigation's ability to fully leverage the potential advantages that technological collaborations can offer in terms of competitiveness in the Zimbabwean irrigation SME sector.

The questionnaire responses indicate that a significant number of participants 11 (36%) strongly agreed and 13 (43%) agreed that a lack of awareness and understanding of the benefits of technological collaboration inhibits SMEs' participation. This finding suggests that Speroni Irrigation SME, along with other SMEs in the irrigation industry, may not fully comprehend the advantages and opportunities that collaboration can bring. The lack of awareness and understanding may lead to a passive or reluctant approach to engaging in collaborative initiatives. Overcoming this hindrance requires efforts to raise awareness among Speroni Irrigation SME's stakeholders about the potential benefits of technological collaboration, highlighting the value it can bring to their competitiveness and overall growth.

The lack of awareness and understanding of the benefits of collaboration is another factor hindering technological collaboration by Irrigation SMEs in Zimbabwe and other countries with similar experiences. SMEs may be unaware of the potential advantages of collaboration, such as increased access to knowledge, resources, markets, and shared risks (Salisu et al., 2018b). This lack of awareness can lead to a reluctance to engage in collaborative efforts or a

failure to recognize the potential value that collaboration can bring. Research by Adeyeye and Musa (2021) in Nigeria highlighted that SMEs' limited awareness of the benefits of collaboration, such as cost reduction and knowledge sharing, hindered their willingness to engage in collaborative activities. Similarly, a study by Aladalah, Alomari, and Alshurideh (2021) in Jordan identified that SMEs' lack of understanding of the benefits of collaboration prevented them from seeking collaboration opportunities or forming partnerships. These findings emphasize the importance of raising awareness among Irrigation SMEs about the potential advantages of collaboration.

Experiences from other countries further support the significance of addressing the lack of awareness and understanding of collaboration benefits (Nascimento & Zawislak, 2023). For instance, research by Kandampully et al. (2022) in Malaysia found that SMEs' limited awareness of the benefits of collaboration, such as increased competitiveness and access to new markets, hindered their adoption of collaborative technologies and practices. Similarly, a study by Al-Nawayseh et al. (2021) in Jordan highlighted that SMEs' lack of understanding of the benefits of collaboration prevented them from actively seeking collaborative partnerships or exploring joint research opportunities. These experiences underscore the need for awareness campaigns, training programs, and knowledge-sharing platforms to educate Irrigation SMEs about the potential benefits of collaboration, fostering a collaborative mindset and encouraging their active participation in technological collaboration.

4.2.3.3 Insufficient Infrastructure and Technological Capabilities

The research findings reveal that insufficient infrastructure and technological capabilities have emerged as a significant factor hindering technological collaboration by Speroni Irrigation Pvt Ltd, thus impacting its competitiveness. One interviewee, a senior executive at Speroni, stated, "Our limited infrastructure and technological capabilities pose challenges in effectively collaborating with external partners, as we may not have the necessary tools and systems in place to support collaborative efforts." Another employee mentioned, "Without robust technological capabilities, we may struggle to effectively integrate and leverage the technologies and innovations brought forth by our collaborators." Additionally, a collaborator shared their perspective, stating, "Speroni's lack of infrastructure and technological capabilities may hinder their ability to fully participate in collaborative projects and extract maximum value from such partnerships." These findings indicate that the insufficiency of infrastructure and technological capabilities acts as a barrier for Speroni Irrigation, limiting their ability to engage

in fruitful technological collaborations and harness the full potential of such collaborations for achieving competitiveness in the Zimbabwean irrigation SME sector.

According to the questionnaire responses, a significant number of participants 11 (37%) strongly agreed, 16 (53%) agreed that insufficient infrastructure and technological capabilities pose significant barriers to effective technological collaboration among SMEs in the irrigation industry. This statistic reflects the challenges faced by Speroni Irrigation SME in terms of limited access to advanced technological infrastructure or inadequate capabilities to fully utilize available technologies. Insufficient infrastructure and technological capabilities hinder the smooth exchange of knowledge, expertise, and data necessary for fruitful collaborations. To overcome this hindrance, Speroni Irrigation needs to invest in upgrading infrastructure and enhancing technological capabilities, ensuring they can actively participate in technological collaborations and leverage them for competitiveness.

Insufficient infrastructure and technological capabilities pose significant challenges to technological collaboration by Irrigation SMEs not only in Zimbabwe but also in other countries with similar experiences (Tong et al., 2023a). Limited access to modern infrastructure, such as reliable internet connectivity, electricity, and transportation networks, hampers effective collaboration with partners located in different regions or countries (Kapaya, 2019). For instance, a study by Rahman, Hossain, and Paul (2021) in Bangladesh highlighted that inadequate internet connectivity and power supply hindered SMEs' ability to engage in collaborative activities and access online platforms for knowledge sharing and communication. Similarly, research by Liu et al. (2020) in China found that poor transportation infrastructure limited SMEs' ability to physically access potential collaborative partners in remote regions. These experiences demonstrate that insufficient infrastructure impedes the smooth flow of information, communication, and physical interaction necessary for successful technological collaboration.

Moreover, the lack of technological capabilities among Irrigation SMEs can hinder their engagement in collaborative initiatives (Mathisen & Jørgensen, 2021). A study by Namusonge et al. (2020) in Kenya revealed that limited technological skills and knowledge prevented SMEs from effectively adopting and integrating collaborative technologies into their operations. Similarly, research by Arslan, Kıyak, and Koçak (2022)(Tong et al., 2023b) in Turkey identified that SMEs' low technological capabilities hindered their ability to leverage digital platforms

for collaboration and hindered their competitiveness in the market. These experiences highlight that without the necessary technological capabilities, Irrigation SMEs face difficulties in utilizing collaborative tools and platforms, which can impede their ability to share knowledge, streamline processes, and achieve innovation through collaboration.

4.2.3.4 Absence of Supportive Policies and Regulations

The research findings highlight that the absence of supportive policies and regulations has emerged as a significant factor hindering technological collaboration by Speroni Irrigation Pvt Ltd, thus impacting its competitiveness. One interviewee, a senior executive at Speroni, stated, "The lack of clear policies and regulations governing technological collaborations creates uncertainties and challenges in forming partnerships and securing necessary approvals." Another employee mentioned, "Without supportive policies, it becomes difficult to navigate legal and regulatory frameworks, leading to delays and obstacles in collaborative projects." Additionally, a collaborator shared their perspective, stating, "The absence of specific policies and incentives for collaboration may discourage companies like Speroni from actively seeking and engaging in technological collaborations." These findings indicate that the absence of supportive policies and regulations hampers Speroni Irrigation's ability to fully embrace and benefit from technological collaborations, limiting their competitiveness in the Zimbabwean irrigation sector.

The responses regarding the absence of supportive policies and regulations for technological collaboration showed diverse perspectives among the participants 12 (40%) agreed, 8 (27%) neutral, 7 (23%) disagreed, 3 (10%) strongly disagreed. While the majority expressed neutrality or disagreement, the fact that a portion of respondents agreed indicates a potential concern for Speroni Irrigation SME. The absence of supportive policies and regulations can create uncertainty and discourage SMEs from actively engaging in technological collaboration. Clear policies and regulations can provide a conducive environment by addressing legal, intellectual property, and contractual matters. Advocating for and implementing supportive policies and regulations can help overcome this hindrance, encouraging Speroni Irrigation SME to actively participate in technological collaborations.

The absence of supportive policies and regulations is a significant hindrance to technological collaboration by Irrigation SMEs, not only in Zimbabwe but also in other countries with similar experiences (Tong et al., 2023b) . The presence of well-defined policies and regulations can

create a conducive environment for collaboration, providing clarity, protection, and incentives for SMEs to engage in collaborative efforts (Ghezzi et al., 2022). For example, research by Tandon, Agarwal, and Singh (2023) in India highlighted the positive impact of government policies that promote collaboration among SMEs, such as tax incentives, grants, and subsidies. In contrast, a lack of supportive policies and regulations can deter SMEs from initiating or participating in collaborative initiatives (Haber et al., 2023). A study by Ma and Meng (2021) in China argued that the absence of clear regulations related to intellectual property rights and benefit-sharing hindered SMEs' willingness to collaborate and share valuable knowledge and resources. These experiences emphasize the crucial role of supportive policies and regulations in fostering a collaborative ecosystem.

Experiences from other countries also demonstrate the importance of supportive policies and regulations in facilitating technological collaboration. For instance, research by Nikookar et al. (2021) in Iran found that the presence of policies promoting inter-firm collaboration, such as tax incentives and grants, positively influenced SMEs' engagement in collaborative activities. Similarly, a study by Hossain and Rahman (2020) in Bangladesh highlighted that supportive policies that encourage collaboration, such as innovation funds and research grants, stimulated SMEs to form partnerships and engage in collaborative innovation. These examples underscore the significance of an enabling policy environment that addresses legal, financial, and administrative aspects, providing SMEs with the necessary incentives and protections to actively participate in technological collaboration.

4.2.3.5 Lack of Collaboration Culture and Trust

The research findings indicate that a lack of collaboration culture and trust has emerged as a significant factor hindering technological collaboration by Speroni Irrigation Pvt Ltd, thus impacting its competitiveness. One interviewee, a senior executive at Speroni, stated, "We need to foster a stronger collaboration culture within our organization, where employees are encouraged to share ideas and expertise with external partners." Another employee mentioned, "The lack of trust among employees and external collaborators can hinder open communication and knowledge sharing, limiting the potential for fruitful collaborations." Additionally, a collaborator shared their perspective, stating, "Speroni's lack of a collaborative culture and trust-building efforts may deter potential partners from engaging in collaborative projects." These findings indicate that the absence of a collaboration culture and trust acts as a barrier for Speroni Irrigation, hindering their ability to establish successful technological collaborations

and harness their full potential for achieving competitiveness in the Zimbabwean irrigation sector.

Based on the responses obtained from 30 interviews, it was found that a significant number of participants 15 (50%) strongly agreed, 9 (30%) agreed that the lack of a collaboration culture and trust hinders technological collaboration among SMEs in the irrigation industry. This statistic suggests that Speroni Irrigation may struggle with fostering a collaborative mindset and establishing trust among potential partners. Without a culture that encourages collaboration and trust-building efforts, SMEs may be hesitant to share knowledge, resources, or engage in joint projects. Overcoming this challenge requires developing a collaborative culture within Speroni Irrigation and building relationships based on trust with other stakeholders.

The lack of a collaboration culture and trust among Irrigation SMEs in Zimbabwe and other countries with similar experiences can hinder technological collaboration efforts. Collaborative initiatives thrive in an environment where there is a culture of cooperation, knowledge sharing, and mutual trust among stakeholders (Technology, 2018). However, if such a culture is absent, SMEs may be reluctant to engage in collaborative efforts due to concerns about competition, intellectual property theft, or unequal distribution of benefits (Munawar & Tarmidi, 2020). Research by Li and Wang (2021) in China emphasized the importance of building a collaborative culture and fostering trust among SMEs to enhance collaboration. They found that a lack of trust and a culture of secrecy and self-interest hindered SMEs' willingness to share knowledge and resources. Similarly, a study by Musango and Brent (2020) in South Africa highlighted that the lack of a collaborative culture and trust among SMEs contributed to their limited engagement in collaborative projects. These examples demonstrate the need for efforts to promote a collaborative mindset and establish trust among Irrigation SMEs to encourage meaningful technological collaboration.

Experiences from other countries further illustrate the impact of a lack of collaboration culture and trust on technological collaboration. For instance, research by Besharati, Taneja, and Taneja (2021) in India found that SMEs' reluctance to collaborate was influenced by a lack of trust and a culture of secrecy prevalent in the business ecosystem. Similarly, a study by Raza, Asif, and Waseem (2021) in Pakistan identified that the absence of a collaborative culture and trust hindered SMEs' ability to build effective partnerships and engage in collaborative innovation. These experiences highlight the significance of fostering a collaboration-oriented culture, promoting trust-building mechanisms, and addressing concerns related to intellectual

property rights and fair benefit-sharing to overcome the barriers posed by the lack of collaboration culture and trust.

4.2.3.6 Limited Networking Opportunities

The research findings reveal that limited networking opportunities have emerged as a significant factor hindering technological collaboration by Speroni Irrigation Pvt Ltd, thereby impacting its competitiveness. One interviewee, a senior executive at Speroni, stated, "We face challenges in finding suitable partners and collaborators due to limited networking opportunities within our industry." Another employee mentioned, "The lack of platforms or events for networking and knowledge exchange restricts our ability to connect with potential collaborators and explore collaborative opportunities." Additionally, a collaborator shared their perspective, stating, "Speroni's limited networking opportunities may restrict their access to a broader network of industry experts and potential collaborators, hindering their ability to form strategic partnerships." These findings indicate that the limited networking opportunities act as a barrier for Speroni Irrigation, restricting their ability to establish and nurture technological collaborations and limiting their competitiveness in the Zimbabwean irrigation sector.

According to the responses from the 30 questionnaires, a significant portion of participants 11(37%) strongly agreed, 12 (40%) agreed that the limited networking opportunities is a hindrance to technological collaboration among SMEs in the irrigation industry, including Speroni Irrigation SME. This statistic indicates that Speroni Irrigation SME may face difficulties in connecting with potential collaborators due to a lack of networking platforms or events. Limited networking opportunities can restrict the chances of finding suitable partners, sharing knowledge, and exploring collaborative projects. Overcoming this challenge requires Speroni Irrigation SME to actively seek networking opportunities, participate in industry events, and establish partnerships with relevant organisations to expand their collaborative network.

Limited networking opportunities can also hinder technological collaboration by Irrigation SMEs in Zimbabwe and other countries with similar experiences. Networking plays a crucial role in identifying potential partners, building relationships, and accessing knowledge and resources necessary for collaboration (Li et al., 2021). However, SMEs operating in isolation with limited networking opportunities may struggle to find suitable collaborators or access relevant expertise. Research by Sánchez et al. (2021) in Spain highlighted the importance of networking for SMEs' collaboration, indicating that networking channels, such as industry

associations, trade fairs, and business networks, facilitated collaborative interactions and resource sharing. Similarly, a study by Kusumo, Susanto, and Yulianto (2020) in Indonesia emphasized the role of networking in SMEs' access to external knowledge, technologies, and market information, which are essential for successful collaboration. These examples illustrate the need for creating platforms and initiatives that enhance networking opportunities for Irrigation SMEs to foster collaboration.

Experiences from other countries further support the significance of networking in facilitating technological collaboration. Research by Chua et al. (2022) in Malaysia found that SMEs' limited networking opportunities hindered their access to external resources and collaborative partnerships, negatively impacting their innovative capabilities. Similarly, a study by Sánchez-Hernández et al. (2021) in Mexico highlighted that SMEs' weak networking ties limited their ability to engage in collaborative projects and leverage external knowledge and resources. These experiences underline the importance of providing Irrigation SMEs with networking platforms, fostering industry associations, and organizing events that promote interaction and knowledge exchange, thereby enabling them to overcome the barriers posed by limited networking opportunities.

4.3 Chapter Summary

This chapter presented the findings of a comprehensive study that aimed to assess the influence of technological collaboration on the competitiveness of Speroni Irrigation Pvt Ltd, a prominent player in the Zimbabwean irrigation SME sector. The chapter addressed the objectives of the research, which include assessing the current state of technological collaboration by Speroni Irrigation, investigating the influence of technological collaboration on competitiveness, and examining the factors hindering collaboration efforts. By analysing these research findings, valuable insights were gained into the role of technological collaboration in enhancing competitiveness and the challenges faced by Speroni Irrigation in establishing fruitful collaborations.

CHAPTER FIVE

SUMMARY OF RESEARCH, SUMMARY OF FINDINGS, CONCLUSIONS, RECOMMENDATIONS AND PROPOSED MODEL

5.0 Introduction

This chapter seeks to present the summary of the whole research, the summary of the findings, conclusions, recommendations, and the proposed model. This chapter found its basis on the findings that were discussed in chapter four. This research presents the stages model for technological collaboration in irrigation SMEs as to be discussed in the last section of the chapter.

5.1 Summary of Research

The main objective of this research was to explore the influence of technological collaboration on competitiveness of Speroni Irrigation Pvt Ltd, a prominent irrigation SME in Zimbabwe that provides irrigation equipment and services to farmers. The research adopted a mixed methods approach that integrated qualitative and quantitative data from various sources, such as in-depth interviews with key informants, questionnaires with employees and customers, and documentary search from relevant publications and reports. The research objectives were fourfold: first, to assess the current state of technological collaboration by Speroni Irrigation, including the types, sources, and outcomes of their collaboration activities; second, to investigate its influence on competitiveness, especially in terms of innovation, quality, customer satisfaction, and market share; third, to examine the factors hindering collaboration efforts, such as lack of resources, trust, incentives, and coordination; and fourth, To design a model for technological collaboration to enhance Small to Medium Enterprises competitiveness for the adoption of technological collaboration by Speroni Irrigation, based on the best practices and recommendations from the literature and the empirical findings. The research reviewed the relevant literature on technological collaboration in SMEs, particularly in the irrigation sector, and discussed the theoretical and conceptual frameworks that guided the study, such as the resource-based view, the social network theory, and the technological acceptance theory. The research presented and analysed the findings of the data collection using thematic and content analysis for the qualitative data and descriptive statistics for the quantitative data. The research discussed the implications and recommendations for Speroni Irrigation and other irrigation SMEs in Zimbabwe, highlighting the benefits and challenges of

technological collaboration and suggesting ways to overcome the barriers and enhance the outcomes.

5.2 Summary of Findings

5.2.1 Current State of Technological Collaboration by Speroni Irrigation Pvt Ltd

The assessment of the current state of technological collaboration by Speroni Irrigation Pvt Ltd reveals a poor state of collaboration within the company. The findings indicate that technological collaboration is hardly considered or prioritized, resulting in limited engagement with external partners and missed opportunities for knowledge sharing and innovation. This lack of emphasis on collaboration hampers the company's ability to leverage external expertise and resources, ultimately restricting the potential for gaining competitiveness in the irrigation SME sector.

5.2.2 Influence of Technological Collaboration on Speroni Irrigation Pvt Ltd Competitiveness

The investigation into the influence of technological collaboration on Speroni Irrigation Pvt Ltd.'s competitiveness highlights the significant role that collaboration plays in enhancing a position in the market. The findings demonstrate that companies actively engaging in technological collaboration are more likely to access advanced technologies, improve their product quality, enhance operational efficiency, and expand their market reach. Therefore, it is evident that an increased focus on technological collaboration would positively impact Speroni Irrigation Pvt Ltd.'s competitiveness through enabling to tap into external knowledge and resources, leading to improved performance and market differentiation.

5.2.3 Factors Hindering Technological Collaboration by Speroni Irrigation Pvt Ltd

The examination of the factors hindering technological collaboration by Speroni Irrigation Pvt Ltd identifies several challenges that impede collaborative efforts. These barriers include a lack of awareness regarding the benefits of collaboration, limited resources allocated to research and development, inadequate infrastructure, and a risk-averse organisational culture. These findings suggest that addressing these hindering factors is crucial for fostering a collaborative environment within the company. By promoting a collaborative mindset, allocating dedicated resources for collaboration, investing in research and development capabilities, and creating an enabling culture that encourages knowledge sharing and partnership formation, Speroni

Irrigation Pvt Ltd can overcome these obstacles and enhance capacity for technological collaboration, ultimately improving competitiveness in the Zimbabwe irrigation SME sector.

5.3 Conclusions

5.3.1 Current State of Technological Collaboration by Speroni Irrigation Pvt Ltd

The current state of technological collaboration by Speroni Irrigation Pvt Ltd is poor, as it is hardly considered. Limited emphasis on technological collaboration hampers the ability to leverage external expertise, resources, and innovation, thereby hindering competitiveness in the irrigation SME sector. To enhance technological collaboration efforts, Speroni Irrigation Pvt Ltd should proactively seek partnerships, engage in knowledge sharing, and explore collaborative opportunities with relevant stakeholders in the industry.

5.3.2 Influence of Technological Collaboration on Speroni Irrigation Pvt Ltd Competitiveness

Technological collaboration plays a significant role in influencing Speroni Irrigation Pvt Ltd.'s competitiveness in the irrigation SME sector. The findings indicate that companies that actively engage in technological collaboration are more likely to gain access to advanced technologies, improve product quality, enhance operational efficiency, and expand their market reach. Therefore, Speroni Irrigation Pvt Ltd needs to prioritize and invest in technological collaboration initiatives to stay competitive, drive innovation, and differentiate themselves from competitors in the market.

5.3.3 Factors Hindering Technological Collaboration by Speroni Irrigation Pvt Ltd

Several factors hinder technological collaboration by Speroni Irrigation Pvt Ltd. These barriers include a lack of awareness about the benefits of collaboration, limited resources for research and development, inadequate infrastructure, and a risk-averse organisational culture. Overcoming these challenges requires a proactive approach from Speroni Irrigation Pvt Ltd, such as fostering a collaborative mindset, allocating dedicated resources for collaboration, investing in research and development capabilities, and creating an enabling environment that encourages knowledge sharing and partnership formation. Addressing these hindering factors will enhance the capacity for technological collaboration and contribute to the overall competitiveness in the Zimbabwe irrigation SME sector.

5.4 Recommendations

5.4.1 Recommendations to the Government

5.4.1.1 Create supportive policies and incentives

The government should develop and implement policies that encourage and facilitate technological collaboration in irrigation SMEs. This can include offering tax incentives or grants for collaborative research and development projects, establishing innovation hubs or centres to foster collaboration, and streamlining bureaucratic processes to facilitate knowledge sharing and partnership formation. By creating a supportive ecosystem, the government can incentivize and promote a culture of collaboration among irrigation SMEs.

5.4.1.2 Invest in infrastructure and capacity building

The government should prioritize investments in infrastructure and capacity building initiatives that support technological collaboration in irrigation SMEs. This can involve improving access to reliable internet connectivity, providing training programs on collaboration and innovation, and establishing collaborative spaces where SMEs can interact and share knowledge. By investing in the necessary infrastructure and building the capacity of SMEs, the government can create an enabling environment that fosters effective technological collaboration.

5.4.2 Recommendations to Collaboration Partners

5.4.2.1 Foster knowledge sharing platforms

Collaboration partners, such as universities, research institutions, and larger private companies, should create platforms for knowledge sharing and collaboration with irrigation SMEs. This can involve organizing workshops, seminars, or conferences where SMEs can interact with experts, share best practices, and explore collaborative opportunities. By actively fostering knowledge exchange, collaboration partners can contribute to enhancing technological collaboration in irrigation SMEs.

5.4.2.2 Provide financial and technical support

Collaboration partners can support irrigation SMEs by offering financial and technical assistance for collaborative projects. This can include providing funding for joint research and development initiatives, offering expertise and guidance in implementing advanced technologies, and facilitating access to specialized equipment or laboratories. By providing

such support, collaboration partners can strengthen the capabilities of SMEs and promote effective technological collaboration.

5.4.3 Recommendations to Speroni Irrigation SME

5.4.3.1 Cultivate a collaborative culture

Speroni Irrigation SME should foster a collaborative culture within the organization by promoting teamwork, communication, and knowledge sharing among employees. Encouraging employees to collaborate on projects, allocating time for brainstorming sessions, and recognizing and rewarding collaborative efforts can help create a collaborative work environment that values and encourages technological collaboration.

5.4.3.2 Establish strategic partnerships

Speroni Irrigation SME should actively seek out strategic partnerships with other irrigation SMEs, research institutions, and technology providers. By forming partnerships, they can pool resources, share expertise, and jointly develop innovative solutions. These partnerships can provide access to new technologies, markets, and funding opportunities, strengthening Speroni's competitiveness and fostering technological collaboration.

5.4.3.3 Invest in research and development

Speroni Irrigation SME should allocate resources for research and development activities to drive innovation and technological collaboration. By investing in R&D, they can explore new technologies, improve product offerings, and engage in collaborative projects with research institutions or universities. This investment will not only enhance competitiveness but also contribute to the overall advancement of the irrigation SME sector.

5.4.3.4 Participate in industry networks and associations

Speroni Irrigation SME should actively engage in industry networks and associations related to irrigation and technology. These platforms provide opportunities for networking, learning, and collaboration. By participating in conferences, workshops, and industry events, Speroni can connect with like-minded professionals, share experiences, and explore collaborative partnerships that can enhance the technological collaboration efforts.

5.5 Proposed Model

Effective technological collaboration plays a vital role in enhancing the competitiveness and innovation capabilities of Irrigation Small and Medium Enterprises (SMEs). To navigate the complex landscape of collaboration, a six stages model can provide a structured approach to facilitate and optimize collaboration efforts. This research proposes a stages model consisting of six key stages that Irrigation SMEs can follow to enhance technological collaboration. The stages include identifying technological needs and opportunities, evaluating potential partners, establishing collaboration objectives and scope, negotiating and formalizing collaboration agreements, implementing and managing collaboration projects, and reviewing and improving the collaboration process and outcomes. The summary of the stages model for technological collaboration is presented in figure 5.1 below

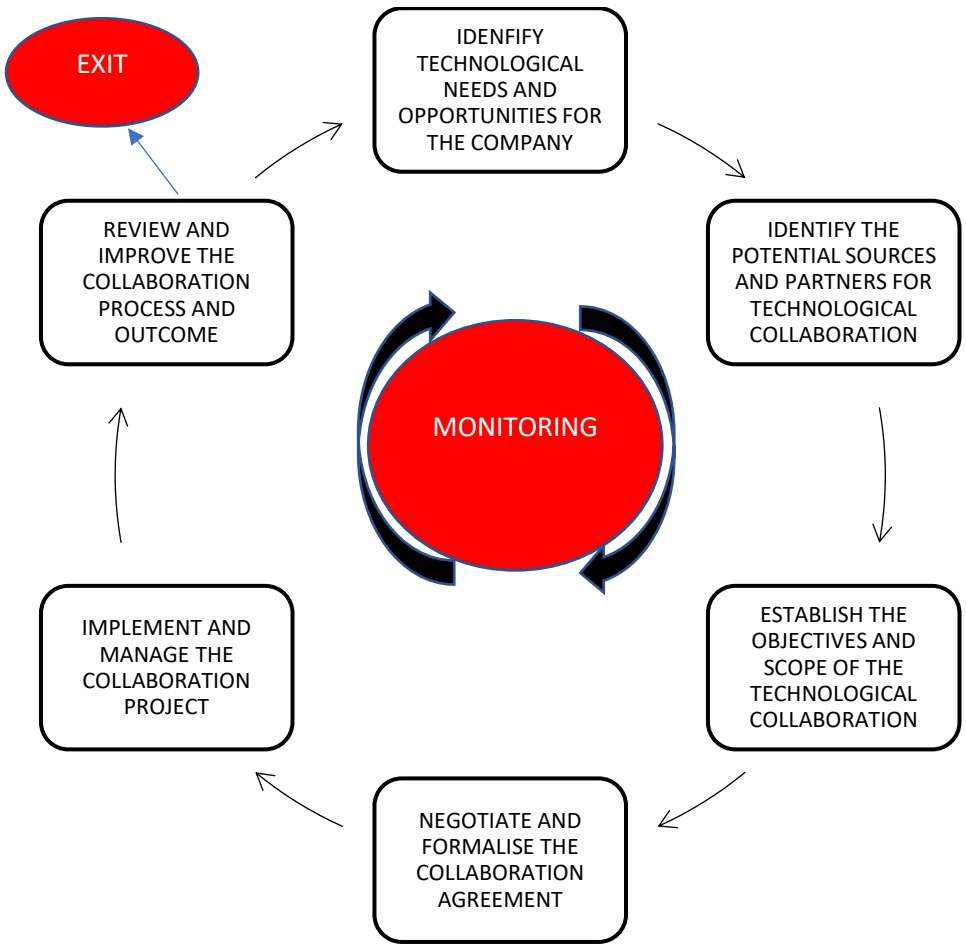

Figure 5.1: A Stages Model for Technological Collaboration in Irrigation SMEs

Source: Author (2023)

5.5.1 First Stage: Identify the Technological Needs and Opportunities for the Company

In this stage, the irrigation SME identifies its specific technological needs as well as gaps and opportunities in the market. This involves conducting a comprehensive assessment of the company's current technological capabilities, areas that require improvement or innovation, and potential opportunities for collaboration. For example, the company may identify the need for advanced irrigation systems or smart monitoring technologies to improve water efficiency and crop yield. By identifying these needs and opportunities, the company sets the foundation for effective technological collaboration, focusing on areas that will bring the most significant benefits and impact to their operations.

5.5.2 Second Stage: Evaluate the Potential Sources and Partners for Technological Collaboration

Once the needs and opportunities are identified, the irrigation SME explores potential sources and partners for technological collaboration. This stage involves researching and evaluating different options, such as universities, research institutions, other SMEs, or technology providers, that possess the expertise, resources, or technologies relevant to the identified needs. For example, the SME may identify a research institution with expertise in water management or an innovative start-up that specializes in irrigation technology. By evaluating potential sources and partners, the company can identify the most suitable collaborators who can contribute to their technological advancement.

5.5.3 Third Stage: Establish the Objectives and Scope of the Collaboration

After identifying potential collaborators, the irrigation SME moves to establish the objectives and scope of the collaboration. This stage involves defining the specific goals and outcomes to be achieved through the collaboration, as well as determining the scope of the project or partnership. For example, the SME may establish objectives such as developing a prototype for a new irrigation system or conducting joint research on water-saving techniques. The scope may include the duration of the collaboration, the roles and responsibilities of each partner, and the resources required. By clearly defining the objectives and scope, the irrigation SME ensures that all parties involved have a shared understanding of the collaboration's purpose and can work towards common goals.

5.5.4 Fourth Stage: Negotiate and Formalize the Collaboration Agreement

In the fourth stage, the collaborating parties engage in negotiations to establish the terms, conditions, and expectations of the collaboration. This involves discussing and reaching agreements on matters such as intellectual property rights, resource sharing, financial contributions, and project milestones. Once the negotiations are finalized, a formal collaboration agreement is drafted and signed by all parties involved. This agreement serves as a legal document that outlines the rights, responsibilities, and obligations of each party and provides a framework for the collaboration project.

5.5.5 Fifth Stage: Implement and Manage the Collaboration Project

After the collaboration agreement is in place, the fifth stage focuses on the actual implementation and management of the collaboration project. This stage involves coordinating and executing the planned activities, allocating resources effectively, and managing the day-to-day operations of the collaboration. Regular communication and coordination among the collaborating parties are essential to ensure that the project progresses as planned and that any challenges or issues are addressed promptly. This stage requires effective project management skills and ongoing monitoring to track progress, manage timelines, and maintain smooth collaboration among all stakeholders.

5.5.6 Sixth Stage: Review and Improve the Collaboration Process and Outcome

The final stage of the framework involves reviewing and evaluating the collaboration process and outcomes. This stage aims to assess the effectiveness and impact of the collaboration, identify areas of improvement, and capture lessons learned for future collaborations. Evaluation can include collecting feedback from all parties involved, analysing project outcomes against the established objectives, and assessing the overall success of the collaboration in terms of technological advancements, knowledge transfer, and achieved results. Based on the findings, adjustments and improvements can be made to enhance future collaboration efforts and optimize the benefits derived from technological collaboration in irrigation SMEs, hence it may result in the technological collaboration reconsidered through the first stage again. At this stage, if it so happens that the managers are satisfied that the technological collaboration has met its objectives, it can then be closed (*Exit)* paving way for another project.

5.5.7 Continuous Process: Monitoring

This is not specifically a stage within the model, but rather a continuous process of collecting, analysing, and using data in each stage of the model. Continuous monitoring plays a crucial role in the stages model for enhancing technological collaboration in Irrigation SMEs. In the first stage of identifying technological needs and opportunities, continuous monitoring enables SMEs to stay updated on market trends and customer demands. For instance, monitoring industry reports and customer feedback can help identify emerging irrigation technologies or changing customer preferences. In the second stage of evaluating potential sources and partners, continuous monitoring allows SMEs to gather information on the capabilities and reputation of potential collaborators. This can involve monitoring industry events, conducting background research, and seeking referrals. In the third stage of establishing collaboration objectives and scope, continuous monitoring aids in aligning the collaboration with the company's objectives and adjusting them as needed. For example, monitoring changes in business strategies or technological advancements may prompt modifications to the collaboration scope. In the fourth stage of negotiating and formalizing the collaboration agreement, continuous monitoring ensures that the agreement reflects the evolving needs and expectations of both parties. Regular communication and monitoring can help address any discrepancies or emerging issues promptly. In the fifth stage of implementing and managing the collaboration project, continuous monitoring allows for real-time assessment of progress, resource allocation, and identification of potential bottlenecks. By monitoring project milestones, performance metrics, and feedback, SMEs can make timely adjustments to ensure project success. Lastly, in the sixth stage of reviewing and improving the collaboration process and outcome, continuous monitoring provides insights into the effectiveness of the collaboration efforts. By analysing data, feedback, and performance indicators, SMEs can identify areas of improvement, refine processes, and enhance future collaborations. Overall, continuous monitoring throughout each stage of the model enables Irrigation SMEs to adapt to changing circumstances, optimize collaboration outcomes, and stay competitive in the evolving landscape of irrigation technology.

5.5.8 Conclusion and Essence of the Model

In conclusion, the six stages model presented in this discussion offers a structured model for Irrigation SMEs to enhance technological collaboration. By following these stages, SMEs can systematically identify their technological needs, evaluate potential partners, establish

collaboration objectives, negotiate collaboration agreements, implement, and manage collaboration projects, and review and improve the collaboration process and outcomes. These stages provide a roadmap for Irrigation SMEs to effectively leverage external expertise, resources, and technologies to drive innovation, improve their competitiveness, and contribute to the overall development of the irrigation sector. Utilizing this model, Irrigation SMEs can maximize the benefits of collaboration by aligning their technological efforts with identified needs, engaging with suitable partners, and effectively managing collaboration projects. Furthermore, the model encourages continuous improvement by emphasizing the review and evaluation of the collaboration process and outcomes, allowing SMEs to learn from their experiences and optimize future collaboration efforts. Ultimately, embracing this stages model can empower Irrigation SMEs to unlock their full potential through effective technological collaboration, fostering growth, and innovation in the irrigation sector.

5.6 Further Research

This research has provided a comprehensive analysis of the influence of technological collaboration on various components of competitiveness in Irrigation SMEs. However, it is evident that despite the recognition and appreciation of technological collaboration as a concept within the irrigation sector, SMEs face significant challenges that hinder its full implementation and scalability. Therefore, it is essential for further research to delve deeper into these challenges and explore potential solutions to address them effectively. One area for future investigation could be to identify the specific barriers that impede technological collaboration in irrigation SMEs, such as limited resources, lack of trust, inadequate incentives, and coordination issues. Understanding the nature and extent of these barriers is crucial in developing targeted strategies and interventions to overcome them. Additionally, future research can also focus on exploring the role of stakeholders, including industry associations, government agencies, and academic institutions, in promoting and facilitating technological collaboration among irrigation SMEs. This would involve examining the support mechanisms, policy frameworks, and capacity-building initiatives that can be put in place to foster a conducive environment for collaboration. By conducting further research in these areas, we can uncover practical insights and recommendations that will enable irrigation SMEs to overcome the barriers hindering technological collaboration and fully leverage its potential to enhance their competitiveness, drive innovation, improve quality, enhance customer satisfaction, and increase market share.

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APPENDICES

APPENDIX A: INTERVIEW GUIDE

Introduction

My name is Tendayi Marekera, I am a student at the Bindura University of Science Education, studying an Executive Masters in Business Leadership. As part of the academic requirements, I am conducting research titled: **ASSESSING TECHNOLOGICAL COLLABORATION INFLUENCE ON ZIMBABWE IRRIGATION SMEs COMPETITIVENESS: SPERONI IRRIGATION PVT LTD CASE**

Confidentiality and Anonymity

This is an anonymous data collection questionnaire where sensitive information such as your name and surname are not required. Confidentiality and anonymity is guaranteed and the information you are going to provide shall be used for academic purposes only. No identification details shall be disclosed and any data obtained will be for statistical evaluation only.

Objective 1: To assess the current state of technological collaboration by Zimbabwean irrigation SMEs.

1. What is your understanding of the term technological collaboration?
2. Can you describe the current practices of technological collaboration within Speroni?
3. How frequently do Speroni engage in technological collaboration activities?
4. What types of technologies are commonly collaborated on in Speroni?
5. What are the main reasons for Speroni engaging in technological collaboration?
6. Which stakeholders do Speroni engage in technological collaboration?

Objective 2: To investigate the influence of technological collaboration on Speroni's competitiveness.

1. How has technological collaboration influenced the competitiveness of Speroni?
2. Can you provide specific examples or case studies where technological collaboration has led to a competitiveness at Maka?
3. What are the key factors that contribute to the positive influence of technological collaboration on competitiveness at Speroni?

Objective 3: To examine the factors hindering technological collaboration at Speroni

1. What are the main challenges faced by Speroni when it comes to engaging in technological collaboration?
2. Are there any specific internal factors within Speroni that hinder their ability to collaborate technologically?
3. What external factors affecting ability of Speroni to collaborate technologically?
4. In your opinion, what strategies could help overcome these factors to promote technological collaboration at Speroni?

Objective 4: To develop a framework or set of guidelines for the adoption of technological collaboration by Zimbabwe Irrigation SMEs

1. What role must be played by different stakeholders to enhance technological collaboration in Irrigation SMEs

THE END: THANK YOU

APPENDIX B: QUESTIONNAIRE

Introduction

My name is Tendayi Marekera, I am a student at the Bindura University of Science Education, studying Masters in Business Leadership and Corporate Governance. As part of the academic requirements, I am conducting research titled: **ASSESSING TECHNOLOGICAL COLLABORATION INFLUENCE ON ZIMBABWE IRRIGATION SMEs COMPETITIVENESS: SPERONI IRRIGATION PVT LTD CASE**

Confidentiality and Anonymity

This is an anonymous data collection questionnaire where sensitive information such as your name and surname are not required. Confidentiality and anonymity is guaranteed and the information you are going to provide shall be used for academic purposes only. No identification details shall be disclosed and any data obtained will be for statistical evaluation only.

SECTION A: Demographics of Respondents

1. Gender:

☐ Male

☐ Female

2. Age:

☐ Below 20

☐ 20-40

☐ Above 40

3. Highest Level of Education:

☐ Ordinary Level

☐ Advanced Level

☐ Certificate

☐ Diploma

☐ Degree

☐ Masters

☐ PhD

4. Position in Organisation:

☐ General Employee

☐	Low Level Manager
☐	Middle Level Manager
☐	Senior Level Manager
☐	Other (Specify)

5. Working Experience (In Years):

☐	0-5
☐	6-10
☐	11 or More

SECTION B: To assess the current state of technological collaboration by Zimbabwean irrigation SMEs.

1. Do you know the Meaning of Technological collaboration?

Yes	
No	

2. Has Speroni engaged in Technological Collaboration

Yes	
No	

3. How frequently does Speroni engage in technological collaboration activities?

Monthly	Annually	When Necessary	Never	Other (Specify)

4. What types of technological collaboration does Speroni engage in? (Select all that apply)

a)	Joint research and development projects	
b)	Sharing of technological resources or equipment	
c)	Collaborative product/service development	
d)	Knowledge sharing and exchange	
e)	Agency or Distribution	
f)	Other (please specify)	

5. Which Stakeholders have you engaged in technological collaboration?

a)	Government	
b)	Irrigation SMEs	
c)	International Corporates	
d)	Customers	
e)	Universities and Research Institutions	
f)	Other (Specify)	

SECTION C: To investigate the influence of technological collaboration on Zimbabwean irrigation SMEs' competitiveness.

1. On a scale of 1-5, how important is technological collaboration to Speroni's Competitiveness? (1 = Not important, 5 = Very important)

1	2	3	4	5
Not Important	Slightly Important	Average\Neutral	Important	Very Important

2. How has technological collaboration influenced Speroni's competitiveness?

a)	Significantly improved competitiveness	
b)	Improved competitiveness	
c)	No noticeable impact on competitiveness	
d)	Decreased competitiveness	
e)	Not applicable (no competitiveness)	

3. What is the extend of your agreement or disagreement with the following statement: "Technological collaboration has positively influenced our competitiveness"?

1	2	3	4	5
Strongly Disagree	Disagree	Average\Neutral	Agree	Strongly Agree

4. Technological collaboration influenced the following outcomes of competitiveness. Indicate the extend of agreement or disagreement, if you "1" **Strongly Disagree (SD)**; "2" **if you Disagree (D);** "3" **if you are Neutral (N);** "4" **if you Agree (A)**; "5" **if you Strongly Agree (SA)**

Outcomes of Competitiveness	SD	D	N	A	SA
1. Profitability					
2. Capabilities 3. Knowledge					
4. Economies of Scale					
5. Growth					
6. Market Share					
7. Innovation					

SECTION D: To examine the factors hindering technological collaboration by Speroni.

1. What are the main challenges faced by Speroni in engaging in technological collaboration? (Select all that apply)

a)	Lack of financial resource	
b)	Lack of technological expertise/skills	
c)	Lack of trust among potential collaborators	
d)	Limited access to collaboration opportunities	
e)	Political Factors	
g)	Social Factors	
h)	Economic Factors	
I)	Technological Factors	
j)	Other (please specify)	

2. Which ones do you think are dominant challenges to the adoption of technological collaboration between internal and external challenges?

Internal	
External	

SECTION E: To design a framework for technological collaboration by Zimbabwean SMEs in the irrigation industry to enhance competitiveness.

1. Would your irrigation SME benefit from a framework or guidelines for adopting technological collaboration?

1	2	3	4	5
Not at all	Not Sure	Average\Neutral	Yes, to Some Extent	Yes, Definitely

2. What factors would encourage your irrigation SME to adopt a framework or guidelines for technological collaboration? (Select all that apply)

a) Clear step-by-step instructions	
b) Practical examples and case studies	
c) Accessible support and resources	
d) Incentives or rewards for collaboration	
e) Other (please specify)	

3. On a scale of 1-5, how likely are you to actively participate in industry-wide initiatives promoting technological collaboration? (1 = Not likely, 5 = Very likely)

1	2	3	4	5
Not Likely	Slightly Likely	Average\Neutral	Likely	Very Likely

4. How would you rate the effectiveness of government policies and initiatives in promoting technological collaboration in the irrigation industry?

1	2	3	4	5
Not Effective	Slightly Effective	Average\Neutral	Effective	Very Effective

5. On a scale of 1-5, how important is government support in fostering technological collaboration among irrigation SMEs? (1 = Not important, 5 = Very important)

1	2	3	4	5
Not Important	Slightly Important	Average\Neutral	Important	Very Important

6. On a scale of 1-5, how important is collaboration with larger companies for your irrigation SME's technological advancement? (1 = Not important, 5 = Very important)

1	2	3	4	5
Not Important	Slightly Important	Average\Neutral	Important	Very Important

7. How would you rate the importance of creating industry networks or platforms to facilitate technological collaboration among irrigation SMEs?

1	2	3	4	5
Not Important	Slightly Important	Average\Neutral	Important	Very Important

THE END: THANK YOU

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Summary