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DISSERTATION RESEARCH PROJECT

THE IMPACT OF DIGITAL TECHNOLOGIES ON FISH SUPPLY CHAIN MANAGEMENT. A STUDY OF ONLINE MARKETPLACES AND LOGISTICS OPTIMISATION. A CASE STUDY OF LAKE HARVEST.

BY

SHARAI MERCY MARAIDZA

B212647B

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SUPERVISOR: MS S NYENGERAI

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Name of Author Sharai Mercy Maraidza

Registration Number B212647B

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Signature of student Date

Permanent address 31704 Damofalls, Phase 6, Ruwa

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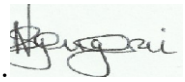

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DEDICATION

I am deeply grateful to the Almighty for his constant grace and guidance throughout this journey. This research is dedicated to my parents, whose unwavering support and encouragement have been instrumental in helping me persevere.

ABSTRACT

This research investigates the impact of digital technologies on fish supply chain management in Zimbabwe, using Lake Harvest as a case study. The study was guided by three objectives: to explore the impact of digital technology on fish supply chain management, to examine the effect of online marketplaces and logistics optimization on supply chain efficiency, and to identify the benefits and challenges of adopting digital technologies in the sector. A mixed-method research design was employed, combining questionnaires, interviews, and observations. The study used purposive and snowball sampling techniques to select 30 participants comprising fish farmers, transporters, and buyers. Findings reveal that digital technologies, particularly online marketplaces, Internet of Things (IoT) tools, and digital communication platforms, enhance operational efficiency, traceability, and coordination across the supply chain. Notable benefits include improved inventory visibility, faster payment processing, and increased customer reach via platforms like WhatsApp Business and social media. However, the study also identifies barriers such as high implementation costs, poor internet infrastructure, digital resistance among employees, and low consumer digital literacy. These challenges hinder full digital integration. The research concludes that while digitalisation presents clear strategic and operational advantages, its effectiveness depends on coordinated planning, stakeholder involvement, and supportive policy frameworks. The study provides practical recommendations for supply chain stakeholders and contributes to academic discourse on digital transformation in agro-industrial contexts.

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CHAPTER ONE

1.0 Introduction

Chapter One provides an overview of the study by outlining the background of the research, the statement of the problem, research objectives, hypotheses, justification, significance, assumptions, delimitations, and limitations. The chapter sets the foundation for the study by contextualizing the research problem and highlighting why investigating the impact of digital technologies on fish supply chain management is important in Zimbabwe, with Lake Harvest as the focal case study.

1.1 Background of the study

In a global economy, supply chains are now highly complicated systems with multiple parties that work across borders. Consequently, it is essential for organizations to start integrating digital technologies with these networks over the last decade. With the evolution of these digital tools, supply chain management has witnessed substantial changes and enhancements (Wang, 2022). Some consider technology to be the heart, while others argue that any successful implementation is dependent on well-coordinated and collaborative support configurations of technical elements. However, implementing digital supply chain systems remains a convoluted process. With the proliferation of digital footprints, continuing quick changes in information flows, and the upshot evolution of cyber infrastructure maturity, the challenges surrounding the issues on enhancing coordination and collaboration among these stakeholders seem to have worsened (Infosys, 2018). Using a systematic literature review, this study looks at how digital innovations, principally IoT, can foster supply chain improvements through coordination and interaction among stakeholders in the fish industry in Zimbabwe.

Fish farming, a fractured and multilayered supply chain, can truly carry afar the benefits of IoT integration and logistics optimizations. In Zimbabwe, agricultural supply chains suffer systemic challenges such as dominated by smallholder producers, poorly coordinated supply structures, low economies of scale, low value addition, and poor market infrastructure. Hence, any move by the fish farming sector to capitalize on digital technologies to optimize their operations has continued to attract attention. There exists an urgent need for an understanding of both opportunities and constraints in adopting these new technologies. The study will help stakeholders appreciate the potential of digital tools with the associated process of their implementation in supply chain enhancement. Specifically, the study emphasizes how IoT offers improvements in information accessibility, quality, and functionality.

A supply chain, by definition, is a set of interlinked stages that go about fulfilling end-user needs, each stage representing, among others, processes such as production and consumption (Felea & Albastroiu, 2013). Manufacturer and supplier chains also cover transport services, warehouses, distributors, retailers, and finally their consumers

(Opara, 2003). Beyond this, supply chain operations could constitute product innovation, marketing, logistics, financial flows, or internal customer engagement. The measure of how effective a supply chain is may lean on its ability to integrate these functions to deliver consumer value while producing profits at each stage.

The term supply chain management has been familiar to academics and practitioners for many years. However, the realization of supply chain importance began to enter the international arena soon after 2020, that is, when the outbreak of the pandemic started. With the virus primarily transmitted through droplets resulting from sneezing and coughing, worldwide governments, including the Zimbabwean one, imposed restrictions in the SADC region on people's movements to minimize the rates of virus transmission (Gandhi et al., 2020). In Zimbabwe, farmers were classified as essential and were permitted to continue operations, albeit under strict regulations.

The disappearance of many basic commodities from store shelves during efforts to maintain the supply of food caused media personnel to call in certain supply chain experts who suggested how to abate those disruptions (Baycik, 2023). The industries were prompted to increasingly incorporate agile systems employing digital technologies to maintain their operations. The businesses in Zimbabwe, specifically Lake Harvest, will now have to seriously consider implementing digitalized supply chain solutions to remain competitive.

The pandemic furthermore fast-tracked the advancement of e-commerce, causing the consumer base to expand as more consumers went online for shopping (Al Mashalah et al., 2022). Consumer awareness, in this respect, is instrumental in helping producers develop suitable marketing strategies and in assisting policymakers to develop a framework that supports an evolving fishery sector. Nonetheless, getting consumers to go online for shopping remains a hard endeavour, especially in Zimbabwe, where there still appears to be a greater appreciation for physical retail (Raharjani, 2005). Factors relating to consumer behaviour include ease of facilities, product choice, and location. Further socioeconomic characterizations, including income and place of residence, make market segmentation possible and hence the optimization of logistics dimension, which this study aims to investigate. Lastly, fish consumption is regarded as the last link in the fishery supply chain and is crucial for online marketplace activities. This research, therefore, appraises these notions in great detail in the Zimbabwean Fishery industry context.

1.2 Statement of the problem

Disruptions to Lake Harvest operations were caused mostly by travel restrictions and logistical issues arising from the geographic dislocation of production sites from markets amid the COVID-19 crisis. With the headquarters in Kariba, northern Zimbabwe along the shores of Lake Kariba, Lake Harvest suffered operational bottlenecks in its activities. Nevertheless, these disturbances occurred alongside structural inefficiencies and a poorly developed technological framework, as well as poor consumer engagement in

online marketplaces in Zimbabwean fish industries. Therefore, this study intends to look at the possible prospects of IoT technologies in transforming the fish farming supply chain in Zimbabwe. More explicitly, the study envisages exploring the capacity of IoT for supply chain visibility and its implications for the use of digital marketplaces in the industry.

1.3 Research objectives

i. To explore the impact of digital technology on fish supply chain management at Lake Harvest Zimbabwe.

ii. To examine the impact of online marketplaces and logistics optimization on fish supply chain efficiency at Lake Harvest.

iii. To identify the benefits and challenges of adopting digital technology in fish supply chain management.

1.4 Statement of Hypotheses

Objective 1: To explore the impact of digital technology on fish supply chain management at Lake Harvest.

- $H0_1$: Digital technology adoption has no significant impact on fish supply chain management at Lake Harvest.
- $H1_1$: Digital technology adoption has a significant positive impact on fish supply chain management at Lake Harvest.

Objective 2: To examine the impact of online marketplaces and logistics optimization on fish supply chain efficiency at Lake Harvest.

- $H0_2$: Online marketplaces and logistics optimization have no significant effect on supply chain efficiency at Lake Harvest.
- $H1_2$: Online marketplaces and logistics optimization significantly improve supply chain efficiency at Lake Harvest.

Objective 3: To identify the benefits and challenges of adopting digital technology in fish supply chain management.

- $H0_3$: Adoption of digital technology offers no significant benefits and presents no major challenges in fish supply chain management.

- $H1_3$: Adoption of digital technology provides significant benefits but also presents notable challenges in fish supply chain management.

1.4 Justification of the Research

Although several studies have been conducted in the last 20 years on this topic, findings concerning technology adoption for supply chains and operational performance remain inconclusive. This perpetuates an ongoing academic debate about whether technology actually works in improving supply chain performance. In Zimbabwe, the advent of COVID-19 worsened economic and logistical constraints, especially in the agricultural sector. With the restrictions on movement, farmers found it challenging to access markets for inputs and the distribution of their products, leading to some supply chain disruptions. These constraints made businesses more adaptive toward digital solutions like e-marketplaces and improved logistics coordination aimed at accessing the market.

The study thus focuses on investigating how digitalization is being onboarded in Zimbabwe's fish supply chains, paying particular attention to the transition from traditional physical means to digital methodologies, primarily at the distribution/sales end of the value chain. Though previous studies have been conducted on the fisheries industry in Zimbabwe (e.g., Rukasha et al., 2021; Mabika, 2024), this study sets itself apart by focusing on the integration of digital tools and the potential for IoT technologies in the restructuring supply chain environment of the industry.

1.5 Significance of the study

To the Student

This study is significant to the student as it enhances research and analytical skills while contributing to overall academic growth. By engaging in an in-depth investigation of digital technologies and their application in supply chain management, the student gains practical knowledge that bridges theory and practice. It also strengthens problem-solving abilities and prepares the student for future research or professional roles in marketing, logistics, and digital transformation.

To the Industry

For the fisheries and aquaculture industry, the study provides valuable insights into how digital technologies can improve efficiency, competitiveness, and market reach. By adopting digital platforms and optimizing logistics, industry players can minimize costs, streamline operations, and expand their customer base. The findings also offer a roadmap for innovation, enabling companies to adapt to changing market conditions and enhance their overall sustainability.

To the University

The study is important to the university as it enriches the body of academic knowledge on supply chain management and digitalisation. It serves as a resource for future researchers, lecturers, and students who may wish to build on the findings. Furthermore, it positions the university as a hub for generating relevant research that addresses contemporary challenges faced by industries, thereby strengthening its academic reputation.

To Society

At a societal level, the study demonstrates how technology adoption in fisheries can improve food security, reduce post-harvest losses, and create employment opportunities. Efficient supply chain management ensures that fish products reach consumers in better quality and at affordable prices. Moreover, by promoting innovation and digital inclusion, the study contributes to sustainable livelihoods and supports broader economic development within the community.

1.6 Research assumptions

The study is predicated on the assumption that the supply chain observed at Lake Harvest is representative of the wider supply chain operations that exist in Zimbabwe and the surrounding region, thus allowing for the generalization of the research findings. It is also assumed that participants in this research- fish farmers, transporters, and buyers- will truthfully and accurately report on the various issues to maintain the reliability and validity of the results. It is further assumed that ethical considerations will be duly respected during data collection, such as during interviews and observational procedures, and that the researcher will maintain neutrality so that personal biases do not affect the interpretation of the findings.

1.7 Delimitations of the study

The study aims at assessing the level of impact of digital technologies on supply chain management, with particular emphasis on the online marketplaces and Lake Harvest optimization of logistics. The study shall majorly pivot on the operations within the Harare city metropolitan area as well as those of Lake Harvest. Angling into fish farming as a topic, there may be references made to other fish farmers and centres, such as Kariba fish farming centres. The study shall employ purposive and snowball sampling methods to sample thirty participants, an assemblage of fish farmers, transport operators, and buyers. The study will borrow a mixed research design involving surveys, interviews, and direct observations as the main data collection techniques. Both regression analysis and thematic analysis will be conducted on the data for quantitative inference and qualitative interpretation, respectively.

1.8 Limitations of the study

Outcomes of this study might be influenced by certain limitations. One prospective constraint pertains to social desirability bias: the respondents might have given responses they felt were acceptable or favourable rather than what their true experiences or opinions really were. Then again, as the research is to be carried out by a student, limitations in financial and logistical resources restrict the scope. Hence, the sample size remains relatively small. Time limits imposed on the student by the institutional academic calendar are also a limitation that might have been set on how deeply and broadly data could be collected and analysed.

1.9 Definition of terms

COVID-19 - According to the WHO, it is an infectious disease caused by the SARS-CoV-2 virus, with a status of a pandemic across the globe.

Digital technology- These are the tools and technologies used in the digitization of an organization; some examples include blockchain, data science and analytics, IoT, and automation.

Supply chain - It is a series of flows that aim at fulfilling the final customer requirements, happening along the continuum within and at various stages of production to final consumption.

Supply chain management- The management of the flow of materials and finished goods for sale to actual customers and finished manufacturers through warehouses and potential intermediaries is known as supply chain management.

1.10 Conclusion

This chapter first discussed the background of the study, the statement of the problem, and some of the basic elements. The following is the literature review chapter, which looks at how digital technologies influence fish supply chain management and analyses online marketplace adoption within the Zimbabwean setting, especially concerning fish products. Further, the chapter shall have the theoretical frameworks on which the research is based and guided.

CHAPTER TWO

LITERATURE REVIEW

2.0. Introduction

This chapter reviews literature relevant to the study on the impact of digital technologies on fish supply chain management, with Lake Harvest as the focal case. It discusses supply chain management concepts, explores digital technologies and their role in improving operational efficiency, and highlights global and local evidence. The chapter also outlines the theoretical framework underpinning the study (UTAUT), reviews empirical evidence, and concludes with a gap analysis.

2.1 Conceptual Framework

2.1.1 Supply chain management (SCM)

A supply chain refers to an interconnected system of facilities and distribution agents, such as suppliers, manufacturers, distributors, and retailers, that manage the sourcing, conversion of raw materials into intermediate or final goods, and the delivery of goods to the consumer. In this regard, supply chain management consists of strategically coordinating the flow of materials and products from production onward through to retail, frequently using manufacturers' plants and warehouses as intermediate links in fulfilling customer demand (Sengupta & Turnbull, 1996), as depicted in Figure 1.

Figure 1: Basic supply chain of goods

The supply chain is formed by all those entities, directly or indirectly, contributing to meeting a customer's demand. These are producers, suppliers, transporters, storage facilities, retailers, and finally, the consumers. The central goal of the supply chain is to maximize the total value it delivers. Supply chain management (SCM) covers the direction

and coordination of the flow of goods, services, and information through the coupled stages in such a way that decreases total cost and increases speed (Habib, 2010).

In agriculture, supply chains consist of organizations leading to the production and distribution of a plethora of products, such as vegetables, fruits, cereals, pulses, and animal-based commodities, until they reach the end consumer (Denis et al., 2020). Generally, agricultural supply chains are classified into two main categories: those involved with fresh produce and those engaged in processing raw materials to value-added products. Fresh produce supply chains-for example, vegetables, fruits, and flowers-generally involve growers, auction houses, wholesalers, exporters and importers, retailers, specialist shops, and service providers. These supply chains are characterized by handling the products in their natural state only through packaging, storage, transportation, and trading throughout the supply chain (Arora, 2017). In contrast, processed agricultural products' supply chains, such as meat cuts, snacks, canned foods, juices, and desserts, turn raw agricultural inputs into products with long shelf life and high market price (Arora, 2017).

According to Habib and Sanjida (2013), conventions in food industry supply chains include producers, processors, wholesalers, exporters, importers, retailers, and end consumers. The ultimate aim of all production chains remains the same: producing at optimal value for consumers (Lambert & Cooper, 2000; Stock, Boyer, & Harmon, 2010). On the other hand, advancing supply chains become complex due to globalization, meaning companies often manage relations with many suppliers and customers in different locations around the world. This complexity makes decision-making very challenging (Mentzer et al., 2001), causing disruptions (Wu, Blackhurst, & O'Grady, 2007) with their consequences on late deliveries and customer dissatisfaction.

Managing supply chains has always posed a great challenge for managers in the current global economy. Never before had so much information flooded the channels and simultaneously provided an opportunity and contained great risk--thus forcing the firms to make very fast, but very informed decisions (Kumar et al., 2022). SCM visibility, in particular, rose amidst the pandemic, while basic consumer goods started disappearing from store shelves. During the pandemic, news channels hired supply chain experts to explain to the general public the kind of disruptions the world faces today and possible ways of mitigating them.

In addition, the pandemic fast-tracked the growth of e-commerce, forcing consumers to shift to online buying (Kannan & Li, 2017; Al Mashalah et al., 2022). The modern customer now wants much faster delivery services, usually same-day delivery. This pressure builds on the pressure on supply chain responsiveness. As a result, conventional supply chain management systems are no longer good enough. Modern supply chains must be quick, flexible, accurate, and efficient to adapt to the changing needs of consumers (Lyall, Mercier, & Stefan, 2018). Digital transformation has been the big enabler for this transition. With the help of digital tools and platforms—solutions whose primary goal is the creation, sharing, and storage of information—they are redefining the concept of

supply chain management (Turban et al., 2017). Nevertheless, the building and running of digital supply chains are still very complex and warrant further investigation. The intention here is to examine how digital technologies can contribute to promoting supply chain effectiveness, especially in the fish industry.

2.1.2 Digital technology

Digital technologies are crucial for allowing an efficient, fair, and environmentally sustainable food system and can enhance the potential for small farmers to compete. According to Mangan and Lalwani (2016), successful supply chain management in the fish sector is vital to ensure products reach consumers in the right quantities, in the desired quality, condition, and timing. However, rapid changes in market dynamics accompanied by diversified consumer preferences have augmented challenges for fish supply chains, most especially because these systems heavily utilize data that needs to be accurate and timely within a complex operational set-up (Speranza, 2018).

The unpredictable nature of global competition, coupled with social and environmental alterations, has made supply chains increasingly intricate-i.e., more cost-intensive to operate. Takeaways of that being the COVID-19 pandemic disrupted the global fish supply chain on several levels of their operations: labour shortages, scarcity of materials, delays in logistics, bottlenecks culminating in a wide blockage of distribution channels. Subsequently, several economies saw the silver lining of this realization and sped up the uptake of digital technologies to build resilience through digital supply chains. DSC is a smart system centred around data that enables real-time information processing, efficient collaboration, and top-notch communication technologies. This allows for higher levels of transparency, better demand forecasting, proactive planning, and optimal use of resources.

Digitization will largely enhance the performance of the supply chain, especially at the source of production or the initial points of data capture in food distribution networks. Since the present study revolves around Lake Harvest in Zimbabwe, it becomes necessary to surface the structure and scale of the local fish industry. A complete grasp of the supply chain configuration, particularly concerning the distribution of fishery products, is vital to assessing its functional dynamics and overall operational effectiveness (Collins, 2001; Stadtler, 2015).

2.2 Theoretical Framework

2.2.1 The Unified Theory of Acceptance and Use of Technology

The e-commerce sector has been a principal driver in the adoption of innovative technology across companies, with the simultaneous evolution of big data, artificial intelligence, cloud computing, and robotics (Verhoef et al., 2021). ICT developments

would be the major force behind changes in how businesses operate both internally and externally. ICTs streamline processes, making organizations more productive, contributing to employee well-being, and increasing customer satisfaction (Papagiannidis & Marikyan, 2020). Yet, ICT implementation does not always yield successful outcomes, as such investments can have few returns if implemented incorrectly (Davis, 1989; Venkatesh et al., 2003).

Due to the importance of technology acceptance and implementation evaluation, the Unified Theory of Acceptance and Use of Technology (UTAUT) has crystallized into a model of maximum application. The present study employed the UTAUT model in analysing how digitalization of supply chain processes, in particular with logistics optimizations in the fish industry, can improve operational performance. According to the UTAUT model, actual use of technology is a function of an individual's behavioural intention (BI) to use the technology, which, in turn, is influenced by four main variables: performance expectancy, effort expectancy, social influence, and facilitating conditions (Venkatesh et al., 2003). The theoretical framework of this study is highly relevant to this study as it provides the foundation to analyse the impact of digital technology on fish supply chain management.

2.3 Empirical evidence

For this research, attention is given to virtual food supply chains about the IoT. Within such a setting, supply chains could manifest as self-regulating systems in which intelligent devices interact autonomously, making decisions, adapting, and learning from their environment. Integrating digital solutions into such systems is a huge project that requires big infrastructure, technological expertise, and synergistic collaboration. As Olsen and Tomlin (2019) and Min, Zacharia, and Smith (2019) indicate, digitalization typically involves tools such as blockchain, data analytics, automation, and IoT. These innovations could make food systems more efficient, fair, and environmentally sustainable while also giving smaller producers a competitive edge.

According to Lyall et al. (2018), digital transformation is now a matter of life and death for any competitive organization. It requires granting real-time visibility to operations, automating processes, and generating continuous monitoring; Chase (2019) agrees that DSC models are ahead or a matter of strategy for an organization that wants to increase forecast accuracy, timely response to change, and service-level improvements. DSCs use intelligent systems to support planning, minimize exposure to risk, and improve customer satisfaction.

However, research evidence reveals that there have been some cases where the use of digital supply chains has not correlated with good performance. This is to say that Zhang and Wang (2011) argue that IT is often considered one of the key forms of modern supply chain success, but it cannot assure performance enhancement without direct application. Aral and Weill (2007) argue that IT capacities influence organizational performance if

they modify the technical assets of an organization and extend its scope of functionalities. Bharadwaj (2014) further highlighted that IT capabilities may be sources of competitive advantage but depend on the way in which an organization effectively uses them. Banerjee and Mishra (2017) argue that digital technologies can encourage collaboration across supply chains by increasing the internal and external integration of stakeholders such as suppliers, manufacturers, distributors, and consumers. Additionally, they enable these digital technologies to collect data to store it, analyse it, and disseminate it, thereby lowering transaction costs; secondly, furnishing analyses and market information; and thirdly, supporting real-time decision-making (Jagun et al., 2008; World Bank Group, 2019). Within the small-scale fisheries sector, the practical implementation of digital solutions is often stifled by structural inequalities, whether social or economic, that constrain innovation and uptake.

Robust value chain data in fisheries contributes to better resource management and food security (Hilborn et al., 2020). Digital technologies in industrial fisheries are already deployed in an array of applications, from blockchain to virtual reality to enhance operational transparency, detect food fraud, limit contamination, and cut down on food wastage (Cusack et al., 2023; Rowan, 2023). Moreover, digital interventions have also been seen to promote social cohesion, galvanize collective action (Nthane et al., 2020), and support biodiversity conservation (Fulton et al., 2018). The implementation of digital supply chains is, however, an incredibly complex undertaking, requiring multi-sectoral cooperation and the alignment of actors across industries and disciplines. One prominent challenge stems from the limited availability of evaluative data on digital interventions; most projects do not integrate impact assessments in their design or are stopped without any formal reporting afterward (FAO & WorldFish, 2020). Whereas digital systems should theoretically allow a much greater degree of adaptation and flexibility, on-the-ground realities are the very things undermining this potential and, as such, are subjects of investigation within the context of Zimbabwe's fish sector (Tilley et al., 2024).

A major barrier to inclusive digital transformation is the so-called "digital divide," encompassing inequalities concerning access to digital tools, services, and infrastructure. According to the FAO and WorldFish (2020), digital inclusion stretches beyond data creation to tackle social and economic inequalities shaping who can benefit from digital resources. In many low-income settings, access is curtailed by factors such as high technology costs; low internet coverage; poor digital literacy; and scarce electricity, especially in rural areas. Unless conscious efforts are made by everybody to redress these issues and uphold digital rights, the course of technological advancement will lock deep inequalities tighter and further isolate vulnerable populations (Blythe et al., 2018).

2.4 Fish supply globally

Fish and other seafood products are globally recognized as key sources of dietary protein and other essential nutrients. Besides protein, these foods are rich in long-chain polyunsaturated fatty acids (PUFAs) that are beneficial in reducing the risk of

cardiovascular diseases. Fish only account for an estimated 6% of protein supplied at the global level, but for over 3 billion people, it is a major source of protein, and anywhere between 10 and 20% of animal-based protein is contributed by fish (FAO, 2014). The consumption of fish increased consistently during the previous 40 years, moving from 9.9 kg per person in the 1960s to 16.4 by 2005 (FAO, 2009).

The fishing potential is determined by a variety of factors, such as geographical conditions, marine resources, fishing infrastructure, and levels of economic development; hence, the ranking of fish-producing nations in Africa and worldwide would differ. Due to its special location between the Mediterranean and the Red Sea and a well-developed aquaculture industry complemented by traditional fisheries methods, Egypt is the highest producer of fish in Africa. With a large coastline on the Atlantic Ocean and with good inland water systems, Nigeria too ranks high in production. Morocco, Ghana, Tunisia, and Algeria are other fish-producing countries of importance to Africa. The global fish production reached approximately 184.6 million metric tonnes in 2022, up from 178.1 million metric tonnes in 2021 (Statista, 2022). As the demand for fish grows, with increasing environmental constraints limiting traditional fishing, aquaculture as a modern industry has seen a boost in the number of fish farmers, overtaking the slow increase in marine fishers.

The gradual increase in aquaculture activities reflects the transformation in the global fishing industry. Wild stocks are dwindling while farm-based stocks are increasing. Aquaculture is growing in many parts of Africa, especially within the Southern African Development Community (SADC) region, owing to the inland nature of these countries. Even though fish farming started with ancient civilizations in China, Egypt, and Rome, the trade has been largely transformed by developments in technology. Currently, aquaculture is heavily investing in global food security, needing to increase the supply of nutritious and affordable sources of proteins, especially in developing economies.

Also, promotion of socio-economic development takes place from aquaculture through employment in rural communities where traditional fishing opportunities may be limited; the industry further aids local economies via trade in the domestic market and export markets. Worldwide, fish pose a big challenge in food and nutrition since it is regarded as one of the most commonly consumed protein sources. According to Short et al. (2021), nutrient contents from the existing fish harvest may represent a simple but untapped solution to many micronutrient deficiencies. In the same manner, Hicks et al. (2019) vowed that fish-based food systems present substantially untapped opportunities to alleviate nutritional deficiencies.

However, the growth of this fish-farming sector is inseparable from these challenges. Sustainability concerns are now brought to the forefront by consumers, environmental groups, and regulators. The industry is currently under-going a rapid change brought about by its fast growth rate, agitated demographic shifts, rising markets, and growing environmental concerns (Sterling & Chiasson, 2014). In relation to these, the present

study focuses on theorizing the influence of digital technologies on the performance and management of fish supply chains.

2.5 Fish supply in Zimbabwe

Zimbabwe fish supply is predominantly supplied through inland water sources due to its landlocked nature. Lake Kariba remains the major fish producer in the country, while smaller reservoirs and rivers in communal areas provide about 2,000 tonnes annually, assuming yields of 100 kg per hectare. In privately managed reservoirs, however, very little utilization occurs, and with average yields at perhaps below 50 kg per hectare, the aggregate output is somewhere near 3,000 tonnes. Aquaculture plays a very minor role in the total fish supply in Zimbabwe, estimated to produce just 750 tonnes a year. Likewise, fish from rivers only once in a while become a significant component of the national supply.

In the recent past, an upsurge of fish and fish-related product imports has been witnessed in Zimbabwe. This scenario is partly related to regional trade liberalization and the consequent elimination of customs duties on many fisheries imports. These imports were being imported chiefly from Canada under the country's drought relief aids, especially canned fish products like mackerels. Zimbabwe, on the other hand, exports comparatively little fish into bordering countries, mostly dried kapenta, with South Africa having proved to be the key market.

In recognition of aquaculture as a means of sustaining livelihoods, improving food security, and contributing to economic development through export earnings diversification, the government of Zimbabwe has put the development of fish farming high on its agenda. The introduction of aquaculture dates back to the colonial period hyu(1950s), mainly to promote trout farming in areas like Vumba, but not much happened for the next few decades (Marshall, 2011). Several hindrances, which will be explained later, have been attributed to the stagnation of growth of this sector right up to 1998.

(i) The sector was initiated by foreign donors and (is still) dependent upon international finance, and

(ii) The government did not support fish farming because they did not consider it as a major economic activity.

Farming fish in Zimbabwe began gaining momentum after Lake Harvest Aquaculture (Pvt) Ltd was granted permission in 1997 by the Zimbabwe Parks and Wildlife Management Authority (ZPWMA) to farm Nile tilapia in cages situated in Lake Kariba's eastern basin (FAO, 2007; Nyikahadzoi & Songore, 2016). Following such developments, a series of aquaculture projects came up around Lake Kariba, Lake Chivero, and various other smaller dams. Production data indicates that fish production in Zimbabwe witnessed a boom in the early 2000s, with production ranging from about 2,000 metric tonnes to surpassing

11,000 metric tonnes per year. In a bid to promote a proper aquaculture sub-sector within the country, the Zimbabwean government has over time instituted several policies to harness the vast fish farming potential of the country (Chiduku, 2023).

The Second Republic nurse primed the fisheries and aquaculture development strategy, taking advantage of rehabilitated irrigation schemes and community gardens to develop areas for fish farming country-wide. This policy thrust culminated in an increase in the fishponds operating—up from 5,634 in 2023 to 7,247 in 2024. Zimbabwe is projected to continue sustaining fish production at about 5,140 metric tonnes per annum up to 2028, similar to production in 2023. Meanwhile, production has been in downward spiral on a longer run, having undergone a reduction rate of 22.8 percent per annum since 1977. On the other hand, local fish consumption has been gradually increasing and is expected to reach 21,000 metric tonnes by 2028, from approximately 20,000 metric tonnes in 2023, reflecting a 1 percent annual growth rate.

Currently ranked among the top 10 fish producers in Sub-Saharan Africa, Zimbabwe's growth in aquaculture is enabled by government- and donor-supported fishery projects, including all types of aquaculture systems from extensive to intensive. The growth has been driven by strong consumer demand and the natural endowment of inland water bodies suitable for cage culture. Operational bottlenecks and structural problems punctuate the industry, however, among them weak institutional frameworks within NGOs, limited access to finance, lack of adoption of technology, poor disease surveillance, demarcation gaps between legislations, and shortage of skilled personnel (Mabika & Utete, 2024).

Since 2019, fish demand in Zimbabwe has increased by about 1.4% per year, largely stimulated by increasing awareness of the health and nutritional value of fish (Mabika, 2024). The implication of this has been that fish has become a preferred source of protein. Yet, in Zimbabwe, per capita fish consumption levels continue to be the lowest at 0.5 kilograms per annum, way below the average for the Southern African Development Community (SADC) region. Much of the fish consumed locally is farmed, as well as imported to meet growing demand. Zimbabwe stood at position 92 in the global list of fish consumption in 2023, with Kenya, a neighbour, ranking slightly higher.

Despite the legitimate prospects of the sector, rural fish farmers are hampered by credit and technology barriers. As FAO(2021) noted, global technology trends call for adaptation to enhance profit margin and competitiveness. Most producers down here lack access to pertinent technologies, namely cold storage, modern hatcheries, efficient medicines for fish, and high-quality feed

(Shava and Gunhidzirai, 2017), which in turn limit commercialization of the sector.

Because of the perishable nature of fish and the existing physical distances between production areas and consumer markets, therefore, a supply chain well-structured and highly responsive is a pre-condition. Frozen fish distribution currently only reaches places where refrigeration facilities are available. Most of the fish caught in small reservoirs is consumed almost at the point of harvest, while farmed bream and Lake Kariba catches are mostly transported and sold to urban or peri-urban markets. The "digital divide" (Norris, 2001) caused by limited access to digital services is another stark contradiction.

Fluctuating numbers of small-scale aquaculture practitioners and their inconsistent transactions in digital marketplaces have also brought about improvements in fish consumption. According to Nomura, in the 2009 FAO annual report, such changes highlight the need for empirical studies that analyse the effects of digital technology on marketing in aquaculture; such studies would be instrumental to rendering the sector competitive.

2.6 Gap Analysis

Amidst the increasing body of supply chain digitalisation scholarship, especially in retailing and manufacturing, few studies have specifically targeted the fish farm industry in Zimbabwe. Other works instead provide information on agricultural supply chains in general or are devoid of empirical data that relates to digital technology like IoT, marketplaces online, or fish distribution logistics systems. Though there are writers who point out the advantages of digitisation, fewer efforts have been made to research barriers to digital uptake in resource-constrained environments or organisational culture on the local scale as one factor driving digital transformation. To our knowledge, no research has thoroughly evaluated the advantages and limitations of digital tools under a fish-based supply chain scenario, integrating approaches from producers, buyers, and logistics service providers. This research completes these knowledge gaps by proposing an extensive case study of Lake Harvest, using a mixed-methods approach for collecting primary data from various stakeholder groups. It not only analyses existing digital use but also identifies adoption constraints and strategic potential, offering a fresh understanding to the specialist nexus of digital technology and fish supply chain management.

2.7 Conclusion

This chapter has examined the relationship between supply chain management and digitization to improve the efficiency of distributing fish-related products. Fish production trends were also presented, both at the international and local (Zimbabwean) levels, to provide contextual understanding. Chapter four will outline the research methodology, thus describing the data collection procedures, research design, and techniques for data analysis used in the research.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

Within this chapter, the methodological framework used in performing the study is presented, describing how data were gathered and how the empirical component was performed. The research procedure, design, the context of the study, sampling strategies, and ethics issues are discussed. Higher emphasis is placed upon the rationale for the methods chosen, their execution, and the techniques used in the analysis of data.

Generally, research is thought of as a process that is experiential, has a logical sequence, and is capable of revealing factual information. Rajasekar et al. (2006) consider research to be the systematic and logical search for new and meaningful information about a specific area. It involves the objective search-to-testing of possible solutions to a problem using systematic procedures. In this perspective, research is the purposive activity aimed at producing creative knowledge of a given phenomenon. According to Collis and Hussey (2003), methodology sets out the reasons for collecting data of a particular type, where the data is collected from, when and how the data is collected, and how the data is analysed.

Research methodology refers to the systematic steps that direct how researchers seek explanation, descriptions, and predictions of phenomena. In any respect, this chapter looks into the particular methods and instruments used to collect data and how these instruments assisted with achieving the study's objectives: assessing the impact of digital technology on supply chain management.

3.2 Research Design

Research design refers to the framework for acting toward an objective or, in other words, the plan for conducting research, and it includes the methodological orientation, strategies for gathering data, and instruments to analyse the data (Bryman & Bell, 2015). A mixed-methods design has been implemented in this study in an attempt to make use of both qualitative and quantitative orientations. Given its exploratory nature, the study followed an exploratory case study design that allows investigating emerging phenomena in real-life settings (Holosko, 2006). Respondents were asked to express their views on digital technological interventions to improve supply chain operations and logistics performance.

Exploratory designs are best suited to study nascent or ambiguous matters, just like in the case of digitalization in the fish farming sector of Zimbabwe, where literature remains scant and its adoption is low (Paneerselvam 2007). Thus, the chosen design allows for a flexible investigation of supply chain visibility and the transformative effects of digital technology in this regard.

Paneerselvam (2007) defines exploratory research as preliminary investigations to determine new relationships between variables. This approach resonates well with the present study's aim of investigating relations between technological adoption and improvement of operational efficiency in the fish supply chain. The choice for a single-case study-Lake Harvest-was due to time limitations and the cumbature of multi-case studies, thus affording the researcher an opportunity to gain deep insight into one targeted scenario.

An exploratory case study affords the researcher the opportunity to embrace multiple perspectives from varied industry stakeholders and, thus, build richer insights concerning the extant conditions and the possibilities for digital solutions. Hence, qualitative research was deemed a perfect fit to capture the latent characteristics of digital technology use, considering that such adoption is still in its infancy within Zimbabwe's fish industry and is hard to quantify.

The current study required an in-depth exploration of supply chain visibility within fish farming. According to Bryman and Bell (2015), a case study differs from other designs due to its being concerned with a so-called bounded system, which has definable functions and components, thereby making Lanke Harvest an ideal choice to understand the logistics and technological implementation-related study. Although Lake Harvest is the focal point, the associated analysis is not confined to the exact supply chain actors within it, owing to the difficulties of mapping and surveying all stakeholders within a single supply chain.

3.3 Subjects

3.3.1 Population

According to Harper (2018), a population will represent the broader unit of individuals or entities about which information is desired. The target population is thus the entire class of individuals to which the results of a study may be generalized. The population of interest in this study is those who are basically engaged in fish farming, logistics, and distribution in the fish supply chain.

The research will focus on both permanent and casual workers of Lake Harvest as well as on selected retailers of fish products. These participants have been chosen because of their involvement at different stages of the supply chain-from production and

transportation to retail distribution. More specifically, the target population consists of about 20 employees stationed at the Lake Harvest aquaculture site in Kariba and 10 employees working within Lake Harvest retail outlets in Harare.

This sampling frame represents the operational elements of Lake Harvest's supply chain from which the research will draw in studying forthcoming digital technology in improving visibility and efficiency in the supply chain..

3.3.2 Sampling

Sampling is a methodological approach used to select a subset of individuals from a larger population with the goal of drawing conclusions that mirror the overall trends and characteristics of that population. According again to Royse (1999), useful information about a larger group can sometimes be determined from a smaller sample, as the general patterns and tendencies can frequently be seen in the responses of a limited number of participants.Due to limitations in time, cost, and accessibility, it was not feasible to survey every stakeholder involved in Zimbabwe's fish industry, especially the large and widely dispersed population of fish farmers. Hence, a targeted sample was drawn to glean information from persons in positions of significance, including both managerial and operational staff.In order to balance and enhance the representativeness, a non-probability sampling method was applied. Hence, as Patton (2002) states, qualitative research uses a flexible sampling procedure that is neither rigidly defined nor requires a fixed sample size. Following this line of thinking, purposive sampling provided researchers with a method to identify and select participants who have either direct knowledge or experience in the use of digital technology in fish supply chain operations. Strydom and Delport (2005) reiterate that in qualitative research, the once-for-all determination of the sample size is made in terms of the research aims, the nature of what is to be studied, the depth of inquiry required, available resources, and the degree to which the data collected will be meaningful and defensible. This means that sampling in this study was aimed at identifying those people best able to provide meaningful insight on behalf of the study's objectives.

3.3.2.1 Sampling Method

Generally, sampling techniques in research are grouped into two broad camps: probability sampling and non-probability sampling (Saunders et al., 2009). Probability sampling can set an equal chance for every individual within a population to be selected, and so it enables one to generalize the results to the broader population through statistical approximation. On the contrary, a non-probability sampling method depends on the researcher’s subjective judgment for selecting a given group of participants whom he deems accessible or relevant to his research topic. Common types of this sampling, as

explained by Wegner (2007), include convenience sampling, judgmental sampling (purposive sampling), quota sampling, and snowball sampling.

For the purpose of this study, a non-probability sampling approach was warranted because the study intends to explore in-depth perspectives rather than to make wide generalizations about those perspectives. More specifically, purposive sampling was adopted, a methodology well supported for qualitative research by Bryman and Bell (2015). This will give the researcher the opportunity to select participants consciously from among those who possess certain characteristics or have knowledge pertinent to the research questions.

Participants were therefore selected based on their awareness and direct experience with supply chain and logistics operations within the fish farming industry. Sampling also targeted individuals who had knowledge of digital technologies in order to gain insight into the feasibility and suitability of such technologies within fish supply chain management. This selected approach guaranteed that the data collected would be rich and relevant, with direct bearing on the study objectives.

3.4 Research Instruments

One Research Instrument/Tool was described by Kumar (2016) as a functionally designed tool employed to elicit data relevant to a given variable or research objective from respondents selected. In resonance with this, Antwi et al. (2015) warn that "a research effort built upon poorly constructed instruments is as unsound as a building with a weak foundation," thus stressing that a reliable measurement tool is needed to get valid and deserving results into research.

Questionnaires and interviews were the main instruments for primary data collection. Questionnaires were institutionalized firstly because they were inexpensive and really appropriate to the academic study given the limited resources. Secondly, they guarantee the anonymity of the respondents, thus allowing respondents to be freer and less biased in their responses.

Semi-constructed interviews and questionnaires worked hand-in-hand for an effective and focused data collection procedure. The questionnaires were largely close-ended questions, which allowed for standardized responses useful in quantitative data analysis. The interviews complemented the questionnaire to provide qualitative in-depth views about the study topic, especially from key informants who knew about digital supply chain technologies.

This method uses a survey-based research strategy that systematically gathers answers using a question-based instrument, aimed at probing perceptions, experiences, and knowledge relevant to a given topic. It is chosen for its flexibility in accommodating a wide range of variables suitable to the research objectives.

In addition, the research adopted inductive reasoning, drawing conclusions which generated insights and theories from observed patterns and responses, especially given the exploratory nature of digital technology adoption in Zimbabwean fish supply chains.

3.5 Data Collection Procedures

The data collection happens to be a backdrop-important activity of any research (Bryman & Bell, 2015). In literature, data are often subdivided into primary and secondary. Hence, to promote the status and increase the credibility of the findings, this study used both means of data.

Primary data consists of original data collected directly by the researcher for the purpose of his or her study. Cameron (1999) states that it is collected through observation, measurement, interviews, and questionnaires. These tools can be modified to suit the researcher's particular investigation, so that only data relevant to his research questions is gathered.

Secondary data, on the other hand, refers to the use of existing information, obtained previously for different purposes. According to Saunders et al. (2009), secondary data is usually reinterpreted or reanalysed to gain new understanding within the context of the current research.

Being that in this study, the approach adopted is mixed, with higher priorities given to qualitative inquiry, data were gathered through both structured and semi-structured interviews. These instruments were opened for inquiries into participants' experiences and enabled the researcher to drill down into pertinent responses within the impact of digital technologies in supply chain management into fish farming.

3.5.1 Primary Data

According to Bryman and Bell (2015), primary data stands for original data collected and directly analysed by a researcher. The primary data formed the research process base. Expert interviews took a paramount position in unearthing detailed insights into fish farming and technology adoption.

As stated by Shuttleworth (2008), primary data are based on direct experiences or observations of those who have been closely involved in the phenomenon under consideration. This type of data is unique in purpose and developed to serve certain goals, sometimes providing timely and focused original insight that cannot be found through secondary sources. Primary data are employed where it is felt that the data must be precisely aligned to the scope of the inquiry and resolve a research gap not only inadequately but also impossible to address fully using existing literature.

Semi-structured interviews in relation to collecting primary qualitative data were conducted with key actors within the fish farming supply chain. Such interviews offer a measure of structure and flexibility-the researcher goes into the interview with a prepared set of questions, while the respondent can give open-ended answers and discuss relevant issues in more depth. This technique enabled a deeper penetration into the view, with new themes or clarifications arising naturally during the discussions (Bryman & Bell, 2015).

Questionnaires were given as well to a more extensive group of participants, thus complementing the qualitative insights with quantifiable feedback. The interviews were audio-recorded, which secured the integrity of the data and revealed help for post-interview transcription and thematic analysis, thus adding to the reliability and traceability of the data.

The interview guide was a structured outline of the discussion points and open-ended questions pertinent to the study, focusing on actual technological practices within the fish farming industry, communication, and flow of information along the supply chain, as well as perceived barriers to digital adoption. It was intentionally designed not to lead the interviewees in any particular direction but rather to enable direct and sincere responses and maintain conversational liquidity for the ends of the research.

3.5.2 Secondary data

Secondary data for the study, taken from existing literature, were gathered from prior findings and established theoretical frameworks relevant to the research objectives. Such a data collection strategy is employed to complement primary data by offering wider contextual meaning and support from documented sources.

The researcher would look at a variety of existing documents, including internal documents from Lake Harvest- documents received specifically from unit heads of departments. Others included dissertations, textbooks, peer-reviewed journals, reputable online databases, and newspaper articles contributing geared toward widening the analytical spectrum for the study.

Publications and data from various recognized institutions were analysed to develop clarity on the current situation within the Zimbabwe fish farming sector and its concomitant supply chain dynamics: the Ministry of Lands, Agriculture, Fisheries, Water

and Rural Development, and international institutions such as the FAO. Secondary data, therefore, provides a good platform also to place its backdrops on academia and policy, useful benchmarks for triangulation, if necessary, to validate the primary findings..

3.6 Measurement tools and scales

To consolidate reliability, construct validity, and comparability of the study's findings, three measurement scales originally procured from the Handbook of Marketing Scales were utilized. These instruments blend a pragmatic theoretical orientation with consistency in previous research and indelible pertinence to the chosen digital technology and supply chain management context in this study.

Technology Readiness Index (TRI)

The study made use of the Technology Readiness Index (Parasuraman, 2000) to measure participants' propensity to adopt and use new technologies. The scale assesses four major psychological dimensions, namely optimism, innovativeness, discomfort, and insecurity, which together determine an individual's readiness to interact with digital applications such as online marketplaces and logistics systems. The use of the scale in the present research is indeed apropos because of its orientation towards understanding user acceptance of digital tools in supply chain activities.

Electronic Service Quality (E-S-QUAL) scale

The E-S-QUAL scale (Parasuraman, Zeithaml, & Malhotra, 2005) was used to measure perceptions of digital service delivery. The instrument measures critical service quality dimensions of efficiency, fulfilment, system availability, and privacy. Since the emphasis here is on the performance of the digital platform in the fish supply chain, applying the E-S-QUAL scale would be an excellent means of getting at the service experience in online transaction environments.

Electronic Retailing Quality Scale

Further, the test of eTailQ from Wolfinbarger and Gilly (2003) measured the users' evaluation of e-retailer services. Important areas include website functionality, reliability, security, and customer support. The scale acted as an adjunct to E-S-QUAL by focusing more on the consumer-side digital retailing issues, which were imperative for understanding satisfaction and trust in the online purchase of fish products.

All three measurement tools had been extensively validated in empirical research with strong evidence supporting their reliability; a slight tweak to some items was such that they would reflect specific characteristics of the Zimbabwean fish industry whilst still maintaining the original conceptual and scale structure.

3.7 Research Tool and Justification

Statistical Package for the Social Sciences (SPSS) was used in analysing the quantitative data obtained. SPSS was considered robust and appropriate when undertaking various statistical procedures central to the present research, such as descriptive analyses, tests for reliability, and regression modelling. The techniques were required to test relationships among variables relevant to the adoption of digital technology, the performance of online marketplaces, and logistics optimization in the fish supply chain sector. SPSS is well-known for its accuracy and precise outputs, easy-to-use interface, and universal application in academia, thus making it ideal for case-study data analysis.

3.8 Data presentation and analysis procedures

Data analysis involves the process of categorizing and interpreting data in such a way as to draw meaningful conclusions (Saunders et al., 2007). The manual methods of data analysis are being overtaken by the introduction of digital technologies with powerful tools like spreadsheets and qualitative analysis packages for precision and speed. The qualitative data for this study will hence include interview transcripts from interviews held with important persons in the fish farming industry, underpinned by the theoretical framework.

Immediately after an interview, it will be analysed individually while initial interpretations are being forged. The interviews will be transcribed so as to enable deeper engagement with the data. These transcripts will facilitate an iterative process of examining the data so that the researcher can continually revisit and reflect on participants' answers. Themes, patterns, and key quotations will be extracted to contrast and highlight the prevailing conditions and perspectives regarding the use of digital technology along Zimbabwe's fish supply chain. This conforms to Bryman and Bell's (2015) guidelines for qualitative analysis and allows for a rigorous reflective interpretation of the qualitative data collected.

3.9 Summary

With the methodological approach presented in detail in this chapter, the design of the study will be discussed along with the target population, the sampling methods, and the relevant instruments and procedures for data collection. The next chapter will focus on presenting and analysing the data, thus giving insight into patterns, trends, and interpretations relating to the research design.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, AND DISCUSSION

4.0 Introduction

This chapter presents and interprets data collected to investigate the impact of digital technology on fish supply chain management, with particular reference to online marketplaces and logistics optimization. It was to ascertain the level of digital innovation adoption Lake Harvest has achieved in fish product marketing and the streamlining of logistics.

Primary data collection included semi-structured questionnaires, in-depth interviews, and field notes. The thematic analysis proposed by Lichtman (2010) was adopted to guide the analysis process so that answers may be categorized and interpreted in a consistent manner. Content analysis was applied to analyse qualitative data coming from open-ended questions; coding was carried out manually in Excel, based on transcripts translated from the original interviews.

Thus, the results obtained from the supply chain management and logistics systems active within the industry were distinguished into two categories. Anonymity is also preserved through those quotations, with the prefix "F" used for fish industry informants.

4.1 Data Presentation

4.1.1 Response rate

Of the 31 questionnaires distributed for this study, only 24 were completed and returned, giving a response rate of 77.4%. The remaining seven questionnaires that constitute 22.6% were returned incomplete or not returned at all. Mugenda and Mugenda (2003) claim that if a response rate is 50% and above, then it is sufficient to proceed to data analysis and drawing conclusions in social research. This implies that a 77.4% response rate attained in this study is satisfactory for the purposes of data analysis and interpretation of findings.

4.1.2 Demographic characteristics

Information concerning respondents' demographics was obtained in order to grasp the setting of the sample population rigorously engaged in the study. Some major

demographic variables discussed here are gender, age range, and education level. Table 4.1 presents a discussion on the matter below:

Table 1Demographic characteristics summary

Demographics (*n*=30)	Category	Respondent *N*	*%*
Gender	Male	17	54.8
	Female	14	45.2
Age	20-29 years	6	19.3
	30-39 years	12	38.7
	40-49years	5	16
	50 and above	8	26
Education	Secondary level	7	22.6
	Certificate/diploma	5	16.1
	Bachelors	12	38.7
	Postgraduate	7	22.6
Job Tenure (Experience)	1–4 years	6	19.4
	4-6 years	5	16.1
	6 years or above	20	64.5
		7	8.1

Source: *Field data (2025)*

Demographic analysis reveals that the fishing industry of Zimbabwe has no gender dominance and this can be attributed to government policies on equal employment opportunities. The majority of employees belonged to 30-39 years age group which accounted for 38.7%. It was also noted that most of the respondents have received education mostly to Bachelor's degree, thus made it possible for the respondents to understand the questionnaire and respond accordingly. The level of education of workers at Lake Harvest reflects a well-educated and skilled workforce that has got the expertise in the fish farming field. The findings revealed a preference to hire well educated and young workforce due to inclusion of technology in the fish industry as well agility to adapt to changes. Also of importance was the work experience of the respondents which showed that majority of the respondents (64.5%) have been working at Lake Harvest for 6 years and above, this can be attributed to job security offered by the company.

4.2 Results for research questions

4.2.1 Digital technology in supply chain management

The participants were asked to provide their opinions on the topic of digital technology in relation to supply chain management. To answer the questions posed in Section B, descriptive analysis was performed on the ratings provided by the respondents. These ratings used a five-point Likert scale.

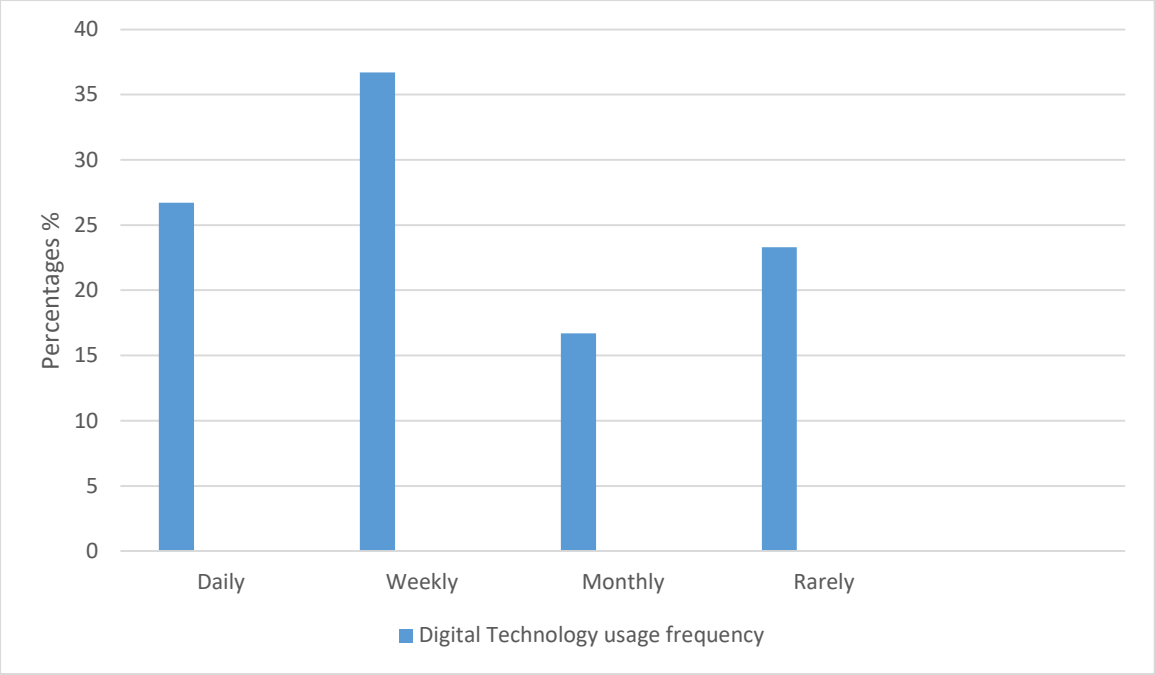

Figure 1: Digital technologies usage frequency

Based on the above graph, all respondents concurred on using digital technologies in fish trading, though the frequency varied due to different work positions. Approximately 26% of the respondents indicated that they use some sort of digital technology daily, whilst 36% use it on a weekly basis, a few (16%) use digital technology on a monthly basis, and lastly, approximately 28% rarely use digital technology for fish trading. Following these findings, the reason for low preference to use digital technology is due to a lack of information about these technologies and how they can boost Lake Harvest's fish trading on online marketplaces. Also, it was revealed that most of Lake Harvest's customers, mostly retailers, still prefer the traditional way of selling their products, whereby consumers physically go to shops to purchase their products, resulting in the organization not investing much in digital marketing. Respondents suggested that collaborations between fish industry actors need to encourage digital technology usage from the fish products producers, suppliers, retailers, and consumers to drive a more efficient way of doing business, which is profitable to all. While it was acknowledged that digital technologies are becoming more and more popular for marketing, especially post the Covid-19 era, with the usage of social media platforms such as WhatsApp and Facebook

marketplace, these are mostly utilized by individual farmers rather than the organization at large. In that regard, it can be concluded that at Lake Harvest, more awareness about online marketing is needed, and its contribution to the organization's growth is yet to be grasped.

Ultimately, the researcher observed that while digital technology has, to some extent, been embraced by Lake Harvest in many facets of operations, online marketing has hardly been given time. Hence, there is an immediate need for training targeted at elevating digital skills and improving supply chain management policies and practices, respectively. A participant stressed the issue by saying: "More training and capacity-building for fishers to fully understand this digital system is needed, but also, the concept of digitalization and online marketplace utilization."

After the discussion on the frequency of digital technology usage, and thereby touching upon the different levels of adoption of the digital technologies, the participants were asked a follow-up question about the challenges they encountered in adopting the technologies. The responses are summarized in Table 4.2 below.

Table 2: Summary of responses about the challenges in adopting digital technologies

ITEM	**RANK %**	
	AGREE	*DISAGREE*
High costs	83%	17%
Limited internet connectivity	67%	33%
Lack of technical skills	37%	63%
Resistance to change	50%	50%
Concerns over data security or privacy	23%	77%

The previous analysis acknowledged diverse responses, mostly influenced by the respondents' own positions and, of course, the departmental functions, some of which included very little application of digital technologies in their day-to-day operations. Since much of Lake Harvest's activities at the farm and warehouse level, like fish farming and packaging, are carried out on-site, consequently, the use of digital tools is still low, and more traditional means are commonly adopted. Even though such was the observation, 83% of the respondents cited that the biggest barrier to adopting digital technology is the high implementation cost. Another 67% believed that poor internet connectivity is a major challenge. This challenge arises since the company has not put in place any investment in high-speed internet infrastructure as this would have required huge capital. Under such conditions, most employees feel that manual processes are more affordable and quicker.

Other constraints that severely impacted the digital transformation process included budgeting for one thing and upgrading the infrastructure, staff development, and proper integration of the technologies for another. On the side of challenges was resistance to change, split evenly (50% agree and 50% disagree). The slow digital uptake of supply chain technologies is further blamed on a lack of expertise and digital awareness in management and employees.

4.2.2 Marketplaces for Lake Harvest's fish products

Increased product quality, decreased operating cost, enhanced response to market needs, and cooperation among supply chain members are expected to give a competitive advantage to the digital supply chain. When respondents were asked in what marketplaces Lake Harvest (LH) promotes its products, 78% of them answered that LH still heavily relies upon more traditional channels of distribution, such as supplying big supermarkets like OK, Pick'n'Pay, Bonmarché, etc., to its very own chain of retail outlets.

As for its online presence, Lake Harvest has fair visibility online. It uses social media, primarily Facebook and WhatsApp, for marketing its products. Furthermore, LH also runs a website through which it advertises its products, special offers, etc., and customers can place orders with it. There is also a live chat feature, together with instant responses to customer queries, which improves the efficiency of the service provided on its website.

The above-mentioned digital opportunities have helped Lake Harvest in its business operations, widening its market reach. Therefore, digital marketing has turned into an attractive and profitable option. Consider some views of the said respondents:

"Many people are generally sceptical about trying new things. So, before the COVID-19 pandemic, our organization's online marketing presence was very minimal as clients were just comfortable going into a shop and buying their groceries. However, during and post-COVID-19, we witnessed an increase in online orders and purchases, especially on Facebook and WhatsApp" -F3

"Lake Harvest's marketing strategy has changed over the years, it used to mostly sell to retailers with physical shops but over the years with digital technology presence, the organization also adopted new ways of doing things since a lot of people are always online so having ads and pop-ups on the mostly used platforms such as WhatsApp, Instagram and Facebook has significantly improved our products presence in the market" – F21

"I do not know if I should say that we are in the Stone Age, but we work very much with physical market -shops to sell our products, you see in this digital era, there's need to have our products presence online and having content creators to market our products to increase visibility and push volumes." -F9

Finally, viewpoints from other stakeholders revealed a certain degree of scepticism towards new technology adoption in the fish industry. Many of these actors, especially the independent fish farmers, considered what they do and the way they do it well enough to be profitable, especially since they sell fresh fish almost directly at the farm gate, with no logistics cost to bear. Employees of Lake Harvest also disclosed that the majority of their fresh fish clients reside in urban centres where retail outlets are easily available. In such areas, it is common for customers to prefer visiting supermarkets in person to check out the freshness of products before purchasing, as there remains an overall hesitancy to ordering fish online from quality perspectives at delivery.

Also, Zimbabwe's rural populations also face various barriers to digital adoption given constricted finances and unreliable electricity supply. Consequently, these people generally opt to purchase canned fish products instead. However, Lake Harvest chiefly deals in fresh and frozen fish, not canned products, which makes it less competitive in those remote markets. Therefore, most of the company's clientele is concentrated in urban areas.

There's also stiff competition in the market especially with a lot of imports from South Africa and Mozambique making it a challenge for Lake Harvest to push their sales.

*"Our products are compromised as there is now a new crop of marketers called **"runners"** bringing in fish products from SA mostly frozen and canned fish and from Mozambique mostly mackerel and dried fish as well as fish mongers locally who sell similar products (imitations) as that of Lake Harvest though theirs at cheaper products as the quality will be compromised."- F16*

From the findings presented above, it can be concluded that Lake Harvest's marketing is still mostly the traditional one of physically selling their products though albeit adopting new technologies -online marketing platforms to market their products. Notable barriers to utilizing online platforms can be attributed to loyal old-fashioned clientele buying directly from supermarkets, and also that online purchases are still a new thing in the Zimbabwean context, as a lot of people are not yet used to ordering goods online. However, it is interesting to note that with the emergence of social media platforms such as WhatsApp Business and Facebook allowing for easy marketing, reaching far markets and increasing market base, Lake Harvest is also trying to increase its visibility on these platforms.

4.2.3 Impact of digital technology on fish supply chain efficiency

Fishery technology, coming up with the various kinds of ICT gadgets for use in the fish industry, includes such devices as RFID, wireless communication systems, or laser scanning. ICTs rightfully cause the enhancement of integration and data visibility, which consequently facilitates the connectivity of the supply chain. So, connectivity stands for how digital links among stakeholders within and outside the supply chain affect the performance by enabling access to a multitude of information. Regarding the inventory

management of Lake Harvest, findings show that empowered departments within the supply chain are able to track inventory levels, product flows, and cycle times with a higher degree of accuracy through the use of these digital tools. The collection of such information reduces capital requirements and inventory holdings by facilitating accurate forecasting for decision support in marketing, pricing strategies, production planning, and supplier selection.

In addition, ERP and PLM systems ensure the collection and dissemination of relevant information both between production sites and suppliers. Particularly, artificial intelligence aids Lake Harvest in forecasting supply-demand trends from historical and real data sets to create dynamic operational strategies. AI optimizes the allocation of scarce resources across the supply chain for maximum outputs and creates response strategies to accommodate fluctuations in demand and ensure the equitable distribution of products.

AI has been used in forecasting and risk assessment, particularly under unpredictable circumstances, such as those presented by the COVID-19 pandemic; however, forecasting remains a complicated process, given that it relies on a large number of internal and external variables, including reliable databases, complex algorithms, and markets that are stable. Should the forecasting process go wrong, this could mean grave financial losses; hence, despite the benefits that come from digital tools, human oversight must still prevail in order to reduce the risk of going wrong.

According to most respondents in the logistics domain, greater visibility and digital integration open a channel for timely sharing of trustworthy information. This reduces incidences of communication breakdowns and technical glitches across departments by enhancing visibility over suppliers, producers, and customers. Delivery vehicle digital tracking systems, for instance, allow monitoring in real time of the status of deliveries and prevent misbehaviour, delays, and remedies to transportation issues. At Lake Harvest, such integration has brought yet another dimension of efficiency to logistics planning as the logistics team now schedules transportation and gives delivery routes to a few vehicles to be used, thus reducing fuel cost and time-to-delivery.

One respondent saw a major drawback in the local fish trade, which is the lack of supply traceability in the remotest areas where internet connectivity was poor or did not exist. This is something the organization cannot readily solve and has to depend on manual delivery methods that build-up delays in providing feedback to decision-makers. To make matters worse, there is an erratic power supply in Zimbabwe, which is a prerequisite for the storage of perishable fish products. Often, the companies are forced to use alternative energy supplies such as generators or gas, which are both costly and not sustainable in the long run.

The digital tools have equally changed communications within the supply chain. The means of communication on faster, cheaper, and less assumed bases range from mobile phones, emails to platforms such as WhatsApp, Zoom, Google Meet, etc. These channels

support real-time exchanges, with suppliers and clients discussing orders and logistics. Mass messaging promotes communication among stakeholders, saving time and facilitating coordination. Moreover, these digital platforms also keep communication trails, encouraging accountability among employees. To promote these changes, organizations will have to be adjusted to accommodate transparent/internal/external communication in real-time since it is vital to the operations of the digital supply chain. Sharing knowledge and synchronizing data are, therefore, part and parcel of this transformation.

In addition, the company has also adopted several digital payment options such as online banking, Ecocash, and InnBucks. These payment channels have had a good impact on operations as they provide faster confirmation of payments, thereby enabling the company to fast track payment of prepaid orders.

In this way, digital technology has the potential to improve fish supply chain activities by eliminating human errors, minimizing financial loss, and increasing inefficiencies associated with manual handling. According to Schrauf & Bertam (2016), companies operating in a digital supply chain environment can improve operational efficiency by 4.1% in a year and grow revenues by 2.9% in a given year. Tangible benefits such as these show how fish supply chains need to continue to invest in digital technologies for better performance results.

4.3 Summary

The research findings shed light upon the fact that digital technologies have significantly enhanced Lake Harvest's supply chain performance by ensuring more efficient supply chain management. The findings of the study indicate that digital tools help in managerial effectiveness by restructuring the supply chain and hence increasing its functional capability and operational competency in general. Intervening challenges are preventing truly large-scale adoption and integration of digital supply chain systems: scarce financial support, lacking strategic direction, and insufficient managerial expertise needed to steer the digital transformation. Additionally, resistance to change on the part of staff and customers alike and the hesitancy in the whole community to embrace new technologies and ways of doing things make it hard to electrify digital applications in SCM and logistics optimization.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Introduction

The preceding chapter was concerned with the presentation, interpretation, and analysis of data collected from Lake Harvest employees relating to the influence of the application of digital technologies on supply chain management, logistics efficiency, and the visibility of the organization in the online marketplace. The current chapter brings together the major insights that have come from the study by discussing the conclusions drawn from the findings and the recommendations that are made for Lake Harvest management, as well as considerations for future academic research. The present chapter is split into various sections that include the summarization of the study, conclusions, and general recommendations.

5.2 Summary

This study examined the impact of digital technologies on fish supply chain management at Lake Harvest in Zimbabwe, focusing on three main objectives: to explore the impact of digital technology on fish supply chain management, to examine the effect of online marketplaces and logistics optimization on supply chain efficiency, and to identify the benefits and challenges of adopting digital technologies in the fisheries sector. The research adopted a quantitative design, collecting data through structured questionnaires from Lake Harvest employees, retailers, and fish farmers, and the responses were analyzed using statistical techniques in SPSS. The findings revealed that the integration of digital platforms has contributed significantly to enhancing supply chain efficiency, particularly through improved order processing, real-time tracking, and instant payment systems such as Ecocash, InnBucks, and online banking. The study also found that online marketplaces and social media platforms like WhatsApp Business, Facebook, and TikTok have increased customer outreach and market visibility. However, challenges such as high implementation costs, poor internet connectivity, and limited stakeholder buy-in were highlighted as barriers to full digital transformation. Overall, the results demonstrate that digital technology adoption positively influences supply chain management at Lake Harvest, though targeted interventions are required to overcome existing constraints.

5.3 Conclusions

With world businesses continually transforming, it is inevitable that supply chain organizations will gradually adopt digital technologies to satisfy their customers' ever-changing needs for speed, efficiency, and competitiveness. This research corroborates

that digital technologies significantly enhance supply chain performance. Organizations that incorporate these technologies witness improvements in operational processes, responsiveness to customer needs, and financial results. The findings substantiated the fact that through adopting digital technologies, Lake Harvest was able to enter into new markets; the company also used digital marketing platforms for product promotion, which increased sales and helped reduce risk during transport through vehicle tracking systems.

According to respondents, all agree that digitization improves managerial efficacy as it transforms the traditional supply chain framework, optimizes logistics management functions, and improves organizational capacities. Thus, a digital strategic roadmap is necessary as it acts as a reference guide for technology deployment in various stages of the supply chain, hence preventing ad hoc or misplaced implementation attempts.

However, the gap between what digital solutions exist and how these technologies are used has also been highlighted within the research. While benefits are lauded across the board, actual adoption of digital solutions is not widespread enough. Uptake of technology is resisted primarily by the lower cadre of staff due to a lack of proper training and the preference to cling to the older ways of doing things. Poor enforcement, coupled with the passive stance by management in terms of policy implementation toward digital modalities, makes the full digital integration sluggish.

5.4 Recommendations

The path to digitalization being multifaceted necessarily requires a coordinated effort involving numerous projects and initiatives. Digitized supply chain management allows organizations to surmount operational problems, further improving the general performance of a business regarding delivery, implementation, and competitive advantage. By way of the results established through this study, these action points are proposed to stakeholders in fish farming:

Stakeholder Engagement That is Inclusive:

All departments and key stakeholders should be involved in the initiation of digital transformation work. This transformation can only be accomplished through an approach that is united and cooperative, as opposed to one that places responsibility on a single department. To gain wider acceptance, clear communication about potential financial and operational benefits should be extended individually to each department. In the same way, sharing real-life success stories or case examples of digital transformation can assist in winning support from the departments or individuals who are not yet convinced. A lack of stakeholder buy-in could very well result in resistance in the workplace, internal operational inefficiencies, and ultimately a dissatisfying experience for customers.

Technologies and Emerging Trends:

In making a meaningful digital transformation, organizations should adopt emerging technologies that increase further user engagement and allow unobstructed integration between digital tools and the conventional methods of doing things. While IT teams will continue to lead the implementation, integration, and integration of digital tools with traditional methods of doing business, executive leadership must promote the defining of operational workflows, link initiatives back to corporate objectives, validate system performance, and critique the actual implementation in value terms with sufficient timeliness.

On a Financial Note:

Cost being a big barrier to change on technological platforms, organizations should diligently go about budgeting and doing return-on-investment studies for all fair digital tools. These cost-benefit analyses, when well-conveyed, would assist leadership in decision-making on investment and attracting funding from both internal and external sponsors.

5.5 Future Research Directions

Future researchers may consider trying to carry out the digital transformation roadmap suggested herein in other industries or broader organizational contexts. Adding IT-centric firms' views into the mix and merging those insights together with those of fish industry stakeholders could lead to innovative collaboration. Specifically, these cross-industry collaborations could become powerful, well-scaled digital transformation models applicable in resource-constrained settings.

• Cross-sector research from another agricultural industry: Future research could investigate the application of digital technology in the fish industry and other agricultural industries such as poultry, horticulture, or beef in Zimbabwe. This would provide cross-sector best practice and challenges.

•Longitudinal Impact Analysis: Longitudinal survey tracking the long-term implications of digital technologies on operational performance, revenue growth, and customer satisfaction in Lake Harvest and other firms would lead to sustainability and payback learning.

•Emerging Technologies Role: Subsequent studies can investigate how much farther digital technologies such as Artificial Intelligence (AI), blockchain, and predictive analytics can go toward facilitating inventory, demand planning, and traceability across the fish supply chain.

•Rural Digital Inclusion and Access: Since rural regions were found to have limited access to digital services, it might be worth researching the difficulties and advantages of bringing digital supply chain services to excluded groups in the future.

• Employee Adoption and Change Management: As some of the employees were said to resist change, future digital studies can examine organizational culture, training, and leadership roles to make digital changes easier.

• Public-Private Models of Collaboration: Future studies can examine how collaboration models between public government institutions, technology companies, and agribusiness companies can hasten digital change in the whole agriculture and fishery industries.

• Policy and Regulatory Frameworks: Another potential space that could be explored is how national ICT policy, data protection policies, and e-commerce legislation in Zimbabwe support or hinder digital innovation within the country's agro-industries.

With this focus, future scholars can build on this research as a starting point to create a richer, more practical understanding of digital transformation in agriculture and supply chain management.

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APPENDIX ONE: RESEARCH QUESTIONNAIRE

FACULTY OF COMMERCE

RESEARCH SURVEY QUESTIONNAIRE

Introduction

My name is Sharai Mercy Maraidza, a 4th-year marketing student at Bindura University of Science Education. I am conducting research on "The Impact of Digital Technologies on Fish Supply Chain Management: A Study of Online Marketplaces and Logistics Optimization. A Case Study of Lake Harvest."

This study focuses on how digital technologies, such as marketplaces and logistics tools, are transforming the fish supply chain. It explores how these innovations can improve efficiency, reduce costs, and enhance market access for fish products, particularly in the context of Lake Harvest. This questionnaire is designed for individuals involved in the fish supply chain, including employees of Lake Harvest, fish farmers, and fish retailers.

Your participation in this research is highly valuable, as it will provide insights into the adoption and effectiveness of these technologies within the fish industry. The findings will contribute to a better understanding of how digital tools can optimize supply chains and support decision-making. All responses will be strictly confidential and used solely for academic purposes.

Contact details

Phone number: 0786692049

Email address: sharaimercym@gmail.com

Instructions

Kindly tick or fill in your response in the appropriate box provided to each of the questions below. Your participation in this study is very important. However, you can choose not to participate, and you can stop at any time without any negative

consequences. Please answer the questions as honestly as possible. This should not take more than a few minutes of your time.

SECTION A. GENERAL INFORMATION

1. Gender

☐ MALE ☐ FEMALE

2. Age Group

☐ Under 20 ☐ 20-29 YEARS ☐ 30-39 YEARS ☐ 40-49 YEARS ☐ 50 and above

3. Level of Education

☐ No formal education ☐ Primary school ☐ Secondary school ☐ Diploma ☐ Bachelor's degree ☐ Postgraduate degree

4. Years of experience in the fish supply industry

☐ less than 1 year ☐ 1-3 years ☐ 4-6 years ☐ More than 6 years

5. Industry Role

☐ Lake Harvest Employee ☐ Fish Farmer ☐ Retailer (e.g., market vendor, supermarket supplier, fish monger) ☐ Other (please specify): _____

SECTION B: DIGITAL TECHNOLOGY IN SUPPLY CHAIN MANAGEMENT

6. Do you use digital technologies (e.g., online marketplaces, mobile money platforms, social media) for selling or buying fish?

☐ Yes ☐ No

7. If you use digital technology, how frequently do you use it for fish trading?

☐ Daily ☐ Weekly ☐ Monthly ☐ Rarely ☐ Never

8. Perceived Benefits of Digital Technology

Please indicate your level of agreement with each statement below. Use the following scale when responding (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5= strong agree

	Statement	Strongly Disagree(1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree(5)
8.1	"I feel that digital technology gives me control over my work processes."	☐	☐	☐	☐	☐
8.2	"Using digital technology in my work makes things more convenient."	☐	☐	☐	☐	☐
8.3	" I am usually among the first to try new digital tools for work."	☐	☐	☐	☐	☐
8.4	" I feel confident that the digital systems I use will perform reliably."	☐	☐	☐	☐	☐
8.5	" I actively seek out the latest digital solutions that can improve my work."	☐	☐	☐	☐	☐

9. Please indicate which of the following factors are challenges in adopting digital technologies (Select all that apply):

☐ High costs ☐ Limited internet connectivity ☐ Lack of technical skills ☐ Resistance to change ☐ Concerns over data security or privacy ☐ Other (please specify): _____

SECTION C: ONLINE MARKETPLACES IN FISH SUPPLY CHAIN

10. Do you sell fish through online marketplaces?

☐ Yes, frequently ☐ Yes but rarely ☐ No

11. If yes, which platforms do you use? (Select all that apply):

☐ Facebook Marketplace ☐ WhatsApp Business ☐ Own e-commerce website
☐ Instagram Marketplace ☐ Other (please specify): _____

12. Perceived effectiveness of Online Marketplaces.

Please rate your agreement with the following statements regarding your online selling experience (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree):

	Statement	Strongly Disagree(1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree(5)
12.1	**"**Using online marketplaces has increased my customer base."	☐	☐	☐	☐	☐
12.2	"Online platforms help me reduce operational costs."	☐	☐	☐	☐	☐
12.3	"Online transactions are faster and more efficient."	☐	☐	☐	☐	☐
12.4	"Customer engagement has improved through online sales channels."	☐	☐	☐	☐	☐

SECTION D: LOGISTICS OPTIMIZATION IN THE FISH SUPPLY CHAIN

13. Has digital technology improved the efficiency of fish distribution and delivery?

☐ YES ☐ NO

14. If yes, please indicate which of the following have improved due to digital technology (Select all that apply):

☐ Reduced delivery times ☐ Lower transportation costs ☐ Fewer lost or damaged goods ☐ Improved stock management ☐ Other (please specify): _____

15. Digital logistics performance.

Please rate your agreement with the following statements regarding the digital services you use (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree):

	Statement	Strongly Disagree(1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree(5)

15.1	"The digital platforms I use are reliable."	☐	☐	☐	☐	☐
15.2	"Digital transactions are processed quickly."	☐	☐	☐	☐	☐
15.3	"Customer support for digital platforms used in fish supply chain management is responsive."	☐	☐	☐	☐	☐
15.4	"The digital systems provide accurate and up-to-date information."	☐	☐	☐	☐	☐

OPEN-ENDED QUESTIONS ON LOGISTICS OPTIMIZATION

16. What do you understand by the term Supply Chain Management?

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17. Is there a link between digital technologies adoption and supply chain management performance?

---

18. Has Lake Harvest adopted any Supply Chain technologies? If yes, list them

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19. What are the challenges that Lake Harvest encounters when supplying their products?

SECTION E: OPEN-ENDED QUESTIONS

20. In what ways has digital technology changed how fish businesses operate?

_____

21. Give an example of how digital technology tools have helped you save money, work faster, or solve a problem in your business.

_____

22. Can you compare your business performance before and after adopting digital technology? What major differences have you noticed?

_____

23. What new digital tools would make the fish supply chain better?

_____

APPENDIX 2DATASET SHEET ONE

dustry Ro	Gender	Age Group	ucation Le	s of Experi	igital Tech	quency of	Likert 8.1	Likert 8.2	Likert 8.3	Likert 8.4	Likert 8.5	nges in Ad	ls Fish Onl	tforms Us	Likert 12.1	Likert 12.2	Likert 12.3	Likert 12.4	oved Effic	ovements	Likert 15.1	Likert 15.2	Likert 15.3	Likert 15.4
Lake Harv	Male	50 and above	Bachelor's	More than	Yes	Weekly	4	5	5	5	4	Lack of te	Yes but ra	WhatsApp	5	4	3	5	Yes	Fewer los	3	3	3	3
Lake Harv	Female	50 and above	Bachelor's	More than	Yes	Weekly	3	5	4	5	5	Concerns	Yes but ra	Other: spe	5	5	4	4	Yes	Fewer los	4	5	3	4
Lake Harv	Male	30-39 Years	Bachelor's	More than	Yes	Daily	3	4	3	4	3	High costs	Yes, frequ	WhatsApp	4	3	3	3	Yes	Reduced c	5	3	3	4
Lake Harv	Female	50 and above	Bachelor's	More than	Yes	Weekly	5	3	4	4	5	Other: ins	Yes, frequ	Other: spe	4	5	4	4	Yes	Improved	4	4	5	5
Lake Harv	Male	40-49 Years	Postgradu	More than	Yes	Rarely	4	4	4	5	3	Other: ins	Yes but ra	Instagram	3	3	3	4	Yes	Other: bet	5	5	5	3
Lake Harv	Female	30-39 Years	Bachelor's	More than	Yes	Rarely	4	4	3	5	5	Lack of te	Yes but ra	Own e-cor	4	5	3	3	Yes	Other: bet	3	4	3	3
Lake Harv	Male	30-39 Years	Bachelor's	More than	Yes	Weekly	4	4	5	5	3	Concerns	No	N/A	3	4	4	3	Yes	Improved	3	3	4	4
Lake Harv	Female	40-49 Years	Bachelor's	More than	Yes	Rarely	4	3	5	5	5	Resistance	No	N/A	5	3	5	5	Yes	Fewer los	3	5	5	5
Lake Harv	Male	50 and above	Postgradu	More than	Yes	Monthly	3	3	3	4	5	Resistance	Yes but ra	Own e-cor	5	3	3	3	Yes	Other: bet	4	3	4	4
Lake Harv	Female	30-39 Years	Postgradu	More than	Yes	Monthly	3	5	3	4	5	Concerns	No	N/A	5	5	5	3	Yes	Improved	3	4	5	4
Lake Harv	Male	50 and above	Diploma	More than	Yes	Rarely	3	5	5	4	4	High costs	Yes but ra	Facebook	3	3	3	5	Yes	Reduced c	3	3	5	5
Lake Harv	Female	50 and above	Postgradu	More than	Yes	Weekly	3	3	5	5	3	Lack of te	Yes, frequ	Instagram	4	5	3	4	Yes	Fewer los	5	3	5	4
Lake Harv	Male	50 and above	Diploma	More than	Yes	Weekly	3	3	3	5	4	Concerns	Yes but ra	Instagram	4	3	4	3	Yes	Lower trar	5	4	5	4
Lake Harv	Female	30-39 Years	Bachelor's	More than	Yes	Monthly	5	3	3	4	3	Limited in	Yes, frequ	Facebook	5	5	4	5	Yes	Lower trar	5	3	3	3
Lake Harv	Male	50 and above	Bachelor's	More than	Yes	Monthly	5	5	4	4	3	Limited in	Yes but ra	WhatsApp	4	5	5	3	Yes	Lower trar	5	4	3	3
Lake Harv	Female	30-39 Years	Postgradu	More than	Yes	Monthly	3	3	5	5	5	Limited in	Yes but ra	Own e-cor	4	3	3	4	Yes	Fewer los	5	5	3	4
Lake Harv	Male	40-49 Years	Diploma	More than	Yes	Rarely	4	5	5	4	5	Concerns	No	N/A	3	3	3	3	Yes	Fewer los	4	5	3	3
Lake Harv	Female	30-39 Years	Bachelor's	More than	Yes	Weekly	4	5	3	3	4	Other: ins	Yes but ra	Other: spe	3	3	5	4	Yes	Lower trar	4	3	3	4
Lake Harv	Male	40-49 Years	Postgradu	More than	Yes	Daily	5	3	3	3	3	Lack of te	Yes but ra	Instagram	4	3	3	4	Yes	Other: bet	4	5	5	3
Lake Harv	Female	40-49 Years	Postgradu	More than	Yes	Weekly	3	5	5	5	3	Limited in	No	N/A	3	5	5	4	Yes	Improved	3	4	3	4
Retail Sho	Male	20-29 Years	Diploma	4-6 years	Yes	Weekly	4	5	5	5	4	Other: ins	Yes but ra	WhatsApp	3	4	3	3	Yes	Other: bet	3	5	4	3
Retail Sho	Female	20-29 Years	Secondary	1-3 years	Yes	Daily	4	5	3	3	3	Limited in	No	N/A	4	4	3	5	Yes	Lower trar	4	5	3	3
Retail Sho	Male	20-29 Years	Bachelor's	4-6 years	Yes	Weekly	4	4	4	3	4	Concerns	No	N/A	5	4	3	4	Yes	Reduced c	4	3	3	4
Retail Sho	Female	30-39 Years	Diploma	1-3 years	Yes	Daily	4	3	4	4	5	Lack of te	No	N/A	3	5	5	5	Yes	Reduced c	4	5	3	3
Retail Sho	Male	20-29 Years	Secondary	4-6 years	Yes	Daily	5	4	5	3	3	Other: ins	Yes but ra	Instagram	4	5	3	3	Yes	Lower trar	4	5	5	3
Retail Sho	Female	20-29 Years	Secondary	1-3 years	Yes	Weekly	5	3	3	3	3	Resistance	No	N/A	3	3	5	4	Yes	Other: bet	3	4	5	3
Retail Sho	Male	30-39 Years	Secondary	1-3 years	Yes	Rarely	3	4	4	4	3	Lack of te	Yes but ra	Instagram	4	5	5	3	Yes	Improved	5	4	3	3
Retail Sho	Female	30-39 Years	Secondary	4-6 years	Yes	Rarely	3	3	5	5	5	Concerns	Yes but ra	Instagram	5	4	5	4	Yes	Reduced c	3	4	3	3
Retail Sho	Male	30-39 Years	Secondary	4-6 years	Yes	Weekly	5	3	5	5	5	Resistance	Yes but ra	Instagram	3	3	3	5	Yes	Reduced c	5	5	4	4
Retail Sho	Female	30-39 Years	Bachelor's	1-3 years	Yes	Monthly	3	4	3	3	3	Other: ins	Yes, frequ	Other: spe	4	3	3	3	Yes	Other: bet	3	4	3	3

DATASET SHEET 2

Respondents ID	Scm understanding	Digital link to scp	SC Tech Adopted?	LH Supply Challenges	Digital Impact	Digital Benefits	Perf. Before/After Dig	New Digital Tools
Lake Harvest Employee	Manage product flow	Yes, improves tracking	Delivery tracking	Bad roads	Sell via WhatsApp	WhatsApp avoids transport	Sell more via WhatsA	App for direct sales
Lake Harvest Employee	Planning, sourcing, delivering	Reduces supply errors	WhatsApp/email comms	Fuel delays	EcoCash payments	FB ads vs agents	Walked to text	GPS for deliveries
Lake Harvest Employee	Movement goods start to finish	Enhances inventory control	Digital inventory	High transport cost	Connect online	Faster online orders	Fewer customers befo	Simple online order sys
Lake Harvest Employee	Manage supplier/distributor	Enables real-time monitoring	Online delivery tools	Internet issues (remote)	Advertise on FB	Mobile pay saves fees	Less transport now	Tool to predict price
Lake Harvest Employee	Ensure timely delivery	Increases visibility/control	Fish stock systems	Long deliveries	Reduced transport cost	App for stock, no book	Sales more organized	Fish market website ZW
Lake Harvest Employee	Coordinate prod/delivery	Improves coordination	GPS trucks	Lack cold storage	Manage orders on phone	Maps avoid traffic	Better profit view	WhatsApp bot for orders
Lake Harvest Employee	Includes transport, inventory	Speeds up communication	Order management (compute	Truck breakdowns	Track deliveries	Sell without stall rent	Didn't know stock leve	Digital cold alert
Lake Harvest Employee	Supports smooth operations	Aids in demand forecasting	Demand apps	Weather delays	Faster comms	WhatsApp for bulk coord.	Save time/effort	Solar digital scale
Lake Harvest Employee	Reduces costs, improves service	Boosts efficiency	Mobile money	Poor comms	Customers order home	Online orders reduce waste	More FB customers	Mobile pay instant receipts
Lake Harvest Employee	Avoids delays/shortages	Improves decision-making	Supplier comms tools	Late delivery complaints	Market price updates onli	Phone calc for cost mgmt	Faster EcoCash pay	Tool to match buyers
Lake Harvest Employee	Raw materials to sales	Cuts operational costs	Warehouse software	Staff shortage (peak)	Sell outside area	GPS solved delivery issue	Used to miss orders	Free SMS for prices
Lake Harvest Employee	Helps meet demand	Expands customer reach	Digital sales systems	Power cuts	No market needed	Phone call vs travel	Less waste now	App for fish demand
Lake Harvest Employee	Multiple partners	Ensures transparency	Barcode scanners	Hard to keep fresh	Records on phone	Online sell during lockdow	Less stressed tracking	Connect fish/transporters
Lake Harvest Employee	Maintain product quality	Enables performance tracking	Delivery route planning	Lack packaging	Bulk orders via social	Digital receipts track pay	Sold in one town only	WhatsApp for bulk orders
Lake Harvest Employee	Fast, affordable delivery	Speeds up deliveries	Fish temp monitor	Supplier input delays	Follow stock on apps	Weather app avoids loss	Avoid running out	Booking for shared deliv
Lake Harvest Employee	Enhances competitiveness	Links suppliers/buyers	Transport scheduling	System errors (delivery)	Better sales management	Less fuel with planning	Make better decisions	Digital wallet fish
Lake Harvest Employee	Tracks/controls inventory	Optimizes logistics	Track harvest to shop	Can't meet all orders	New customers via ads	Repeat customers online	No records before	Voice app for elderly
Lake Harvest Employee	Improves customer satisfaction	Eases reporting/auditing	Online marketing	Changing prices (fuel/pac	Plan with weather/trans	Sell more via social	Profit up with online	Online tech training
Lake Harvest Employee	Promotes resource efficiency	Secures data storage	E-commerce sales	Theft/damage (transport)	No physical shop	SMS for stock alerts	Work more efficiently	Cloud track storage
Lake Harvest Employee	Integrates logistics	Helps manage perishables	Tablets/phones for updates	Hard to reach rural	Online video for quality	Phone records avoid theft	More trust online	AI chatbot for buyers
Retail Shop Employee	Reduce waste, sustainability	Supports smart planning	ERP systems	High logistics costs	Software for stock/deliver	Track prevent loss	Faster, fewer delays	Central supply dashboard
Retail Shop Employee	Links all supply players	Integrates business functions	Digital stock control	Load-shedding (cold room	Sales up (online)	Logistics app saves fuel	Fewer complaints	Integrate log/inv sys
Retail Shop Employee	Controls business costs	Simplifies payments	GPS delivery trucks	Unreliable internet (regic	Faster, organized comms	Stock sys reduce waste	Fulfill more orders	Auto demand forecast
Retail Shop Employee	Helps in demand forecast	Prevents overstocking	Inventory software	Truck delays	Reach more online	Online less paper	Less transport waste	Real-time temp sensors
Retail Shop Employee	Matches supply/demand	Expands market access	WhatsApp for team	Fish spoilage (remote)	Automated data/reports	WhatsApp solved delays	Improved delivery spe	Mobile delivery confirm
Retail Shop Employee	Manages delivery risks	Strengthens partnerships	Order systems	Lack skilled staff (logistics	Timely delivery updates	Auto reports help decide	Better team comms	CRM linked to sales
Retail Shop Employee	Adapts to market changes	Increases agility	Mobile data monitor	System crashes (busy)	Less paper, more digital	Sales tool reduces error	Better product track	Digital driver check-in
Retail Shop Employee	Oversees product life cycle	Tracks products end-to-end	Cold chain tech	High demand vs plan	Easier logistics manage	Digital inv avoids overstock	Improved record keep	AI optimize routes
Retail Shop Employee	Key for freshness (fish)	Reduces delivery time	Delivery track tool	Bad supplier data	Improved online service	GPS recovered truck	Sales up after digital	Cloud comms for field
Retail Shop Employee	Ensures continuous flow	Bridges remote supply gaps	Logistics schedule	Coordination delays	Targeted, cheap marketin	Mobile manage during COV	More accurate reports	Supply risk alert


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