BUSINESS MANAGEMENT REVIEW
2025 vol 28, No. 1
https://doi.org/10.56279/bmrj.v28i1.8828

Research Article

BMR, 28,1

111

Digitalization in Logistics and Supply Chain Management for Agro-Processing SMEs in Kahama and Msalala – Tanzania

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Abstract

This study explored the growing landscape of Logistics and Supply Chain Managemnent (LSCM) focusing on Small and Medium Enterprises (SMEs) in Tanzania. The purpose was to examine on how digitalization is adopted and utilized in the agro-processing sector by SMEe in Kahama and Msalala districts to enhance their LSCM practices. Through the lense of Technological Acceptance Model, Resource Based View and Institutional Theory framework, the study employed a qualitative case study design in which pattern matching technique was used for data analysis. The main findings reveal that there are varying levels of digital adoption across SMEs, improved efficiency for digitally transformed SMEs curtesy of realtime data and well informed decision-making. The fndings further indicate some common barriers to succesfull digital transformation such as lack of digital skills, limited access to digital technologies and resistance to change among some SMEs. The paper highlights that digital adoption can be accelerated by removing impediments through establishing supportive and context sensitive regulatory framework as well as advocating for digital transformation by different actors in the digital ecosystems

Key Words: Digitalization, Agro-processing, Tanzania, SMEs, SCM.

Received: 27 August 2024
Revised: 30 December 2024
Accepted: 10 July 2025
Published: 10 August 2025

Citation: Semkunde, M (2025). Digitalization in Logistics and Supply Chain Management for Agro-Processing SMEs in Kahama and Msalala – Tanzania. *Business Management Review,* ***28*****(1), 111-125**.
https://doi.org/10.56279/bmrj.v28i1.8828

Introduction

Globally, digital transformation has strongly influenced innovations in business practices and industries at different levels accross all sectors (Narula & Sabharwal, 2024; Gillpatrick, 2019; Ndung'u, 2018; Linh *et al.*, 2019; Sharma, 2019). Among others, the Logistics and Supply Chain Management (LSCM) industry has witnessed an advancement driven by the evolving digital technologies (Bigliardi *et al.*, 2022; Dholakia & Kshetri, 2004; Linh *et al.*, 2019). Through these fast evolving technologies, companies acquire unique opportunities to improve operations, escalate efficiency and enhance their decision-making processes (Bouwman *et al.*, 2018; Carmela *et al.*, 2020; Nair & Nontenja, 2023; Rajahonka & Villman, 2019).

Despite the benefits emanating from digitalization that have been widely acknowledged by different scholars, the debate exist on the practical application and its influence on Small and Medium-sized Enterprises (SMEs), specifically in the developing countries frinequalities due to access and affordability barriers, while others argue for targeted interventions and supportive policies to ensure an inclusive digital transformation (Federal Ministry For Economic Cooperation and Development, 2017; Henry, 2019; International Telecommunication Union, 2019).

The literature on LSCM highights that digital transformation in different parts of Sub-Saharan Africa (SSA) is still considerably low, compared to international standards (Bigliardi et al., 2022; Buys et al., 2009). There exists a digital divide with large number of Africans in rural areas living with limited access to make a basic telephone call, while other regions (urban) are saturated with fast internet access and advanced digital telecommunication systems (Bigliardi et al., 2022). Logistics systems inefficiencies are among the highest in the region due to a lack of enabling infrastructure, which results in inflated prices and higher costs of doing business (Kuteyi & Winkler, 2022). However, there is still potential for digital transformation in SSA since it is one the possible and a must do means that different actors including agro-processing SMEs can adress some of the challenges mentioned earlier (Nair & Nontenja, 2023; Namagembe & Mbago, 2023). According to Bigliardi et al. (2022), the adoption of digital technologies has the potential to offer exceptional opportunities for efficiency, transparency,and innovation among SMEs.

In developing countries such as Tanzania, digital transformation can significantly benefit SMEs in the agro-processing sector by enhancing their competitiveness and sustainability (Nair & Nontenja, 2023; Namagembe & Mbago, 2023).

While studies have highlighted the potential of digitalization of LSCM in addressing supply chain challenges, its extent, practices and impacts within agro-processing paricularly in rural SMEs remain underexplored (Nabulongo et al., 2023; Olaniyi Adeniran et al., 2024). In the same thread, the digital adoption by SMEs engaged in agro-processing in Tanzania is currently under documented, as such, it is difficult to mark both its success stories and painpoints (Namagembe & Mbago, 2023). This study therefore, intends to investigate further into the adoption of digitalization in revolutionizing LSCM practices within SMEs through a qualitative research investigation. The study aims to add significant knowledge to the scholarly discussion, provide policy recommendations and practical insights on the process of digital transformation in SMEs within the context of Tanzanian agro-processing, specifically in Msalala and Kahama districts. In so doing, it intends to address the folowing key research questions; what is the current level of digitalization in LSCM by agro-processing SMEs in Kahama and Msalala Districts? Which are the most used digital technologies by these SMEs? What are the perceived impacts does the digitalization hold for the SMEs in the agro-processing sector? What are the main barriers preventing the agro-processing SMEs from integrating digital technologies into their LSCM? How ready are the actors/organizations for digital adoption?

Theoretical Background and Review of Literature

Utilizing well-established theories and concepts like the Technology Acceptance Model (TAM), Resource-Based View (RBV) and Institutional Theory, provides an analytical framework that offers guidance for comprehending the intricacies and complexities of digital transformation in SMEs engaged in agro-processing. Through this framework, a structured technique for data gathering, analysis, and interpretation by integrating contextual effects outside the organization as well as within organizational aspects is developed (Antonisch, 2010).

Technology Acceptance Model

According to the TAM, individuals's attitude toward using the system, which perceived usefulness and perceived ease of use define, unswervingly governs whether they intend to utilize and accept technology or innovation (Wu & Chen, 2017). TAM is extensively used in various contexts, which makes it highly common. The two most important elements of TAM model are: perceived usefulness which shows the prominence and subjective capabilities of individualsor firms to use technological or innovation base applications in a way to derive maximum utility of his/her or their work to perform in an efficient way (Olaniyi Adeniran et al., 2024). The perceived ease of use relates to how an individual feel or firms easiness and capable to use technological or innovative base applications with quite low efforts (Davis, 1989). It was quite apparent that both the factors influenced by the number of external factors through which the end-use of the actual system could be ceased for a while. The earlier studies mainly offered the numerous external factors that affect the use of the actual system, including social factors, cultural factors, and political factors (Olaniyi Adeniran et al., 2024; Schmidthuber et al., 2020; Hess et al., 2014; Davis, 1989).

In the current study's context, TAM is adopted to provide insights on the various factors that agro-processing SMEs consider prior to adopting emerging digital LSCM technologies. The parceptions of SMEs' owners, managers, and employees on the potential and actual usefulness of adopting digital technologies for LSCM are explored based on the guidence from TAM (Olaniyi Adeniran et al., 2024). Additionally, the TAM can help identify barriers and facilitators to technology adoption within these SMEs (Linh et al., 2019).

The Resource-Based View

A resource-based view suggests that resource choice and accumulation are a function of both within-firm decision-making and external strategic factors (Cuthbertson & Furseth, 2022). Within-firm managerial choices are guided by an economic rationality and by motives of efficiency, effectiveness and profitability (Rao & Brown, 2024). External influences are strategic industry factors that impact the firm, including buyer and supplier power, intensity of competition, and industry and product market structure (Rao & Brown, 2024; Elia et al., 2021). These factors influence what resources are selected, as well as how they are selected and deployed. Based on the resources availability, firms can be in the pole position to adopt new technologies or lag behind (Elia, et al., 2021). While the theory is widely used in large firms, its application in LSCM has not been comprehensively explored, predominantly

regarding how specific resources contribute to LSCM capabilities of rural and peri-urban based agro-processing SMEs (Rao & Brown, 2024; Elia et al., 2021). As such, there is a notable lack of thoroughly synthesis that links the characteristics of resources particularly their uniqueness, value, scarcity, and exceptionality with specific LSCM outcomes within agro-processing SMEs.

Institutional Theory

Institutional theory posits that internal and external environmental pressure significantly affects organizational goals and decision making (Zhu & Sarkis, 2007). Institutional pressure is defined as the impact of the institutional environment that take account of social norms, rules, and culture, on the organizational form, structure, or behaviour (Zhu & Sarkis, 2007). Scholars have extended institutional pressure into three-dimensions namely coercive, mimetic, and normative pressure (Sarkis et al., 2010).

Coercive pressures induced both formal and informal stress from powered organizations, such as government institutes, regulatory standards, and social expectations in which the organization operates (Zhu & Sarkis, 2007). In this case, the coercive pressure in the form of rules and regulations can influence decisions of the firms operating in the existing structures. The owners and managers, including those from the agro-processing SMEs might be subjected by coercive pressure from government regulations to adopt digital practices in their organization, otherwise, they may face punishment from the regulator, such as penalties or legal actions (Sarkis et al., 2010).

Normative pressures result from standardized norms of professional groups, such as formal educational institutions, professional associations, NGOs, suppliers, customers, and the general public (Majid et al., 2020). In response to digitalization in the agro-processing LSCM practices, the firms may abide by the external stakeholder's guidelines, standards, and norms (Lavhelani, 2023; Scott, 1995). Industry standards and government regulations as part of normative pressures play a significant role in shaping SMEs' decisions regarding technology adoption (Scott, 1995). Normative pressure is fueled by specific programmes that are designed to encourage digital adoption in the LSCM such as legal requirements for record keeping through electronic fiscal device (EFD) or finacial incetives for new technologies adoption.

Mimetic pressures occurs when an organization wishes to cope with uncertainty by imitating the activities of successful competitors in the same business environment (Hoejmose et al., 2014). In this case, firms including agro-processing SMEs are motivated to imitate the digitalization behaviour of other firms they consider reliable and prosperous within their networks especially when organization goals are ambiguous, technologies are less understood, or they operate in an ambiguous environment (Adeniran et al., 2024; Gupta et al., 2020).

Though criticised for being too theoretical (Adeniran et al., 2024; Sarkis et al., 2010), the insights from institutional theory lay down the foundation for exploring the viability, profitability and indeed survival of digitalization among SMES. This study argue that the success on digitalizing LSCM practices among agro-processing SMEs in Kahama and Msalala districts typically depend on the existing institutional milieu.

Empirical Evidence

At the global scale, there are varied levels of digitalization among SMEs operating in the aro-processing sector. Depending on the regionally contexts, the Developed countries have demontrated the high level of digitalization compared to those from developing countries due to regional and contextual factors (Arroyabe et al., 2024). Within Sub Saharan Africa, specifically in Tanzania, the current adoption rates are low with significant number of the few SMEs relying on basic technologies enchored on mobile communication and simple accounting softwares (Kapinga & Montero, 2017; Kwilasa, 2017; Mazungunye, 2020). Scholars such as Kapinga and Montero (2017) point out that dispite the fact that the SMEs in the agro-processing sector are benefiting from the use of digital tools such as smart phones, adoption rates remain considerable low due to low awareness and limited access to technology. Most studies on adoption have failed to address contextual factors for low adoption rates due to their generalization of the findings based on quantitative methodologies (Nkwabi et al., 2019; Namagembe & Mbago, 2023). This gap points to a need for research exploring localized barriers to adoption in regions like Kahama and Msalala, where socio-economic conditions may differ from other settings.

Digital tools such as IoT, big data analytics, GPS tracking, and mobile-based applications are increasingly being explored by SMEs to improve supply chain visibility and logistics efficiency (Oriekhoe et al.,2024; Daniel & Archie, 2024). Conversely, these technologies often remain aspiring for the SMEs located in developing countries due to affordability challenges (Bigliardi et al., 2022).

Countrywise, the digital divide is common in Tanzanian where studies have shown limited use of advanced tools between urban, peri-urban and rulal contexts (Mhlanga, 2021). There is lack of cost-effective solutions to digital tools where SMEs use simple tools hence they fall short of addressing more complex logistical challenges (Saengchai & Jermsittiparsert, 2019). Moreover, there is a tendency in the literature to overemphasize the potential of technologies like blockchain and Artificial Intelligence (AI) for SMEs (Namagembe & Mbago, 2023; Saengchai & Jermsittiparsert, 2019). Based on the current digital infrustructure and expertise in these regions, SMEs in Kahama and Msalala are unlikely to prosper.

Digital transformation and automating the logistics and supply chain is associated with improved supply chain efficiency, speed up processes, provision of better insights, cut down manual errors, and eventually help to reduce costs (Agu et al., 2024). The agro-processing SMEs in Developing countries including Tanzania need to embrece Digitalization to mitigate the traditional LSCM disruptions by improving visibility and response times (Bigliardi et al., 2022). However, studies in Tanzania have indicated mixed results towards digital transformation among SMEs in agro-processing sector. A study by Nkwabi et al. (2019) reported on improved efficiency and customer satisfaction while Namagembe & Mbago (2023) found the existance of limited gains due to poor digital infranstructure and limited digital literacy. Moreover, other studies often focused survey methods conducted in urban based SME's (Mhlanga, 2021), thus calling for the current study which is contextualized under qualitative approaches.

Existing research demonstrates existance of substantial barriers towards digitalization in the LSCM practices. Among others, the no sense of urgency, lack of industry specific guidelines, lack of digital skills and talent and high implementation and running cost are the most significant barriers to digital transformation of supply chain (Bigliardi et al., 2022). Additionally, the complex regulatory frameworks, resistance to change among staff and strugle to justify the return on investment for SMEs adoption worsen the LSCM digital transformation in Tanzania (Namagembe & Mbago, 2023; Abiodun et al., 2021; Mhlanga et al., 2021). Some scholars point out that while the government is trying to incentify the digital adoption through policies, the context related factors such as bureaucracy often disrupt these initiatives (Schmidthuber *et al.*, 2020). As such, it becomes crucial to investigate and understand the specific barriers that SMEs encounter during their digitalization processes so as to facilitate the creation of more effective solutions and strategies tailored to their unique circumstances.

Successful digitalization initiatives in agro-processing SMEs depend directly on their digital readiness, measured through their level of maturity in the ensuing the following dimensions: technological resources, business processes, management capacity, human capacity, and corporate culture (Leso et al., 2024). Institutional readiness is enhanced by investiment in capacity building initiatives through trainings and financial incentives (Kalbarczyk et al., 2021). In Tanzania, capacity-building initiatives are often fragmented and fail to address the specific needs of SMEs in agro-processing (Nkwabi et al., 2019). The literature on institutional readiness in Tanzania indicate the limited focus on tailored initiatives for SMEs operating in rural and peri-urban settings where well-intentioned initiatives are undermined by poor digital infranstructure and limited connectivity (Mhlanga et al., 2021). Moreover, the research on institutional readiness focuses more on big companies and other specific to identify digital maturity index than measure the digital readiness level especially for SMEs (Rafiah et al,. 2022). To adress these research gaps, context specific research initiatives designed to include the SMEs that have been for so long left in the mainstream literature due to the continued focus on context blind approaches.

Tanzania, a developing economy, boasts a thriving agro-processing sector that is essential to its economic growth, generating jobs, adding value to agricultural products, and boosting export revenues (Kapinga & Montero, 2017; Kwilasa, 2017; Mazungunye, 2020). Evidence from the literature unveils that SMEs in this industry frequently face logistical challenges that impede their ability to expand and compete (Nkwabi et al., 2019; Mtaturu & Mbailuka, 2020). The general performance of these SMEs might be impacted by problems including ineffective logistics visibility throughout the supply chain (Namagembe & Mbago, 2023; Bigliardi et al., 2022; Linh et al., 2019; Nkwabi et al., 2019; Saengchai & Jermsittiparsert, 2019; USAID, 2018). This study is needed to analyse the adoption of digital technologies on LSCM practices and its impact in addressing the aforementioned LSCM challenges.

Methodology

This study used qualitative multiple-case study (Yin, 2014; Saunders et al., 2009) to explore how digital technologies are being adopted and utilized by SMEs in Kahama and Msalala.

Districts to improve their LSCM practices, specifically in the agro-processing sector. Purposive sampling technique (Gentles et al., 2015; Balakrishnan & Forsyth, 2019; Bryman, 2016; Yin, 2014) was used for selection of the target population which included owner/managers, SMEs staff and supply chain managers from various agro-processing firms in the two districts. Additionally, the participants selected had somehow developed strategies to digitalize and integrated their logistics and supply chain system to improve their business practices. Data were collected from semi structured interviews, focus groups discussions and participants observations (Bryman, 2016) in real time (Balakrishnan & Forsyth, 2019; Bryman, 2016). The sample size was determined iteratively based on data saturation, which was the point at which no new information or themes emerged from the data collection process (Balakrishnan & Forsyth, 2019; Bryman, 2016; Yin, 2014). To reach the saturation point, 42 individuals in total were required. Of the 42 participants, 25 came from Kahama and 17 from Msalala. Participants' real identities were protected by providing fictitious name to participants (Palinkas et al., 2015).

Study Area

The current study was conducted in Kahama and Msalala districts of Tanzania, the two districts were chosen because of the factors that align with the objectives of this study. Among others, Kahama and Msalala are strategically located as the trade hub that links to the great lakes East African countries (Nkwabi et al., 2019). This provide the high potential for export markets of the agro-prossesed products to the coutries such as Burundi, Uganda, Republic Demoracy of Congo and Rwanda (Kisanga, 2015). Furthermore, Kahama and Msalala districts have a mix of urban, peri-uban and rural settings (Semkunde et al., 2022) enabling this study to capture a broad specrum of SMEs operating in different contexts. Such a mix ensures the findings are representative of similar contexts in Tanzania and other developing economies. Lastly, Kahama and Msalala are key agricultural hubs within the Shinyanga Region, known for their vibrant agro-processing industries (Mazungunye & Punt, 2022).

Data Analysis

Data analysis started with transcribing the audio recorded interview and summarize the interview transcripts for coding data (Yin, 2014). The mind map was developed based on data collected from the interview transcripts, serving as an initial step in identifying emerging patterns within the dataset (see Figure 1). Sorting the coded data into broad thematic groups according to relevance, frequency, and significance was the fourth stage (Eldh et al., 2020; Bruscaglioni, 2016). The researcher made sure that the categories capture important facets of technology adoption and obstacles in a logical, mutually exclusive, and thorough manner (See Figure 2). MAXQUDA software was used to organize and analyse the data collected from the interviews. Since qualitative studies aim to describe and explain a pattern of relational interactions, the pattern-matching logic technique recommended by Yin (2014) was used to analyse the case studies. Such logic compares an empirically based pattern (one based on the results) with a predicted pattern (Yunis et al., 2019).

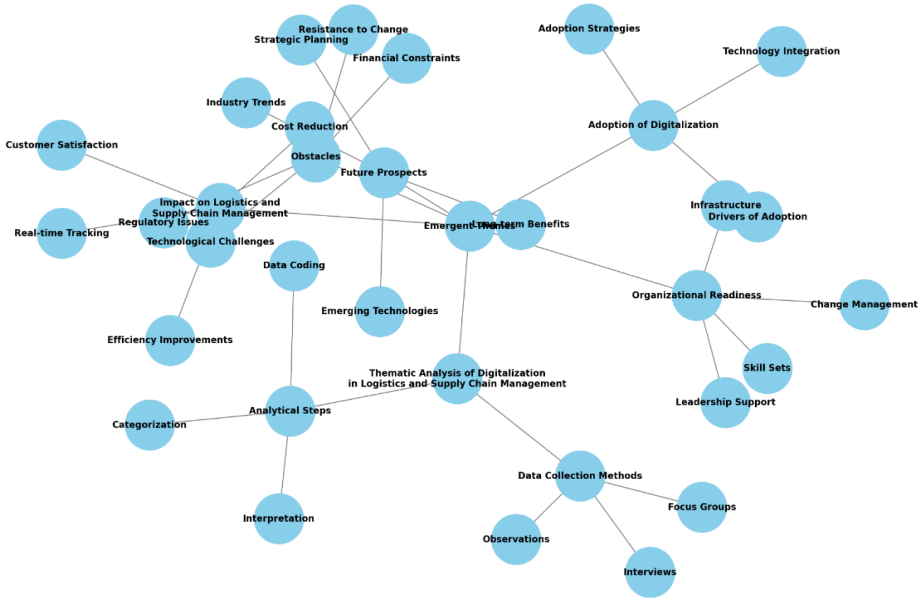

Figure 1: The mind map showing the initial step of data analysis generated out of the collected data from the interiew transcripts

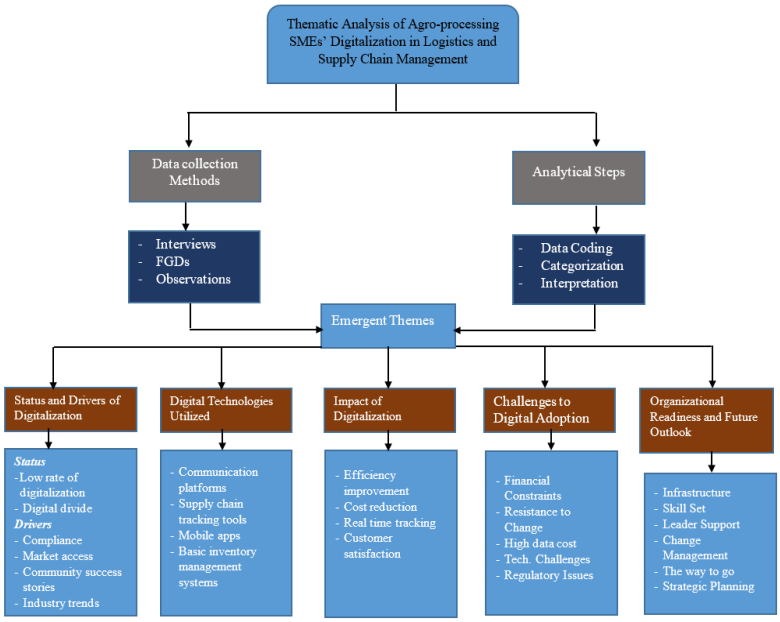

Figure 2: Thematic analysis of digitalization in logistics and supply chain management, showing how themes, sub-themes, and supporting information relate to one another based on data collected from Kahama and Msalala District areas in Tanzania.

Results of the Findings

Drawing on the transcribed interviews and guided by a rigorous thematic analysis approach, this section presents the key findings that emerged from the qualitative data. The analysis of the interview data unfolded five overarching themes: (i) the status and drivers of digitalization, (ii) digital technologies utilized, (iii) the impact of digitalization on LSCM, (iv) challenges associated with digital adoption, and (v) organizational readiness and future outlook. These themes reflect both the commonalities and divergences in participants' experiences, offering detailed insights into the evolving dynamics of digital transformation within the LSCM context.

To provide contextual grounding for the thematic analysis, the section begins with a detailed account of the demographic characteristics of the participants, thereby enhancing the interpretive depth and situating the findings within the broader analytical framework of the study. By anchoring the thematic results within this demographic context, the analysis ensures that the emerging themes are meaningfully linked to the real-world conditions and diversity of the study population.

Participants' Demographic Characteristics

The data provided in Table 1 summarises the demographic characteristics of a sample size of 42 individuals. The sample is predominantly male (59.5%), with females accounting for 40.5%.The majority of the individuals have at least two years of secondary education (62%) followed by Pprimary school level (26%) and tertiary school level (12%). The age distribution is comparatively balanced, ranging from 21 to 58 years, guaranteeing newer and experienced participants. All of the participants were in the agro-processing SMEs ocupying different roles in the LSCM activities. Since Kahama is mostly urban and peri-urban district, majority of the participants are located in urban and peri-urban (59.5%) while the remaining (40.5)% dwells in rural and peri-urban areas of Msalala district. Considering potential limitations of the data, such as the sample size and representativeness of the population being studied, this initial analysis justifies the representativeness of the sample size of the study.

Current Status of Digitalization Adoption among Agro-processing SMEs

The results point to a diverse landscape of digitalization adoption among SMEs engaged in agro-processing in the Districts of Kahama and Msalala. Some SMEs have fully embraced digital technologies, including communication platforms and inventory management software. However, other SMEs are still in the early phases of digital adoption and face obstacles like staff skill gaps and restricted access to technology. This finding is illuminated by the following quotes from Mkoma and Maria during the interviews conducted in Kahama and Msalala District respectively.

> "Digitalization is still in its early stages here."

> "We have started integrating some basic digital tools."

Table 1: Demographic characteristics of participants from Kahama and Msalala Districts

Participants	Age	Gender		Educational Background	Geographical Context	
	Years	Male	Female		Kahama	Msalala
13	20 – 29	6	7	Secondary (6) Tertiary (2)	8	5
11	30 – 39	6	5	Primary (2) Secondary (4) Tertiary (2)	6	5
11	40 – 49	8	3	Primary (5) Secondary (3) Tertiary (1)	7	4
7	50 – 59	5	2	Primary (6) Secondary (1)	4	3
42		**25**	**17**		**25**	**17**

Source: Author

Observations from the field indicated that Msalala agro-processing SMEs had the lowest level of digital adoption than Kahama. This is attributed by the higher levels of urbanization in Kahama as compared to Msalala. From the FGDs conducted in Msalala, participant 6 stated connectivity issues to be the reason behind low adoption rates.

> "Connectivity issues also pose a challenge."

Researcher's hermeneutic view is that even the disparities in the level of education attainment has been the justification for the digital divide among SMEs located in Msalala against those from Kahama.

The interviews and FGD conducted with various actors in the agro-processing sector of Kahama and Msalala Districts have revealed several key drivers of digitalization adoption among SMEs. Central to this adoption is the perceived enhancement of operational efficiency and productivity, which many businesses recognize as crucial for maintaining competitiveness in an increasingly digital marketplace. SMEs reported that digital tools such as mobile phones and basic inventory management software significantly streamline processes, reduce errors, and facilitate better decision-making. As quoted below, Maimuna and Mange from Kahama and Msalala illuminate this finding.

> "Recently, though, we've started using mobile phones and some basic apps to help manage our logistics better."

> "The main motivation was the need to improve efficiency and reduce the errors and time we spend on paperwork."

Additionally, compliance and market access emerged as a pivotal driver, with digitalization enabling businesses to reach wider markets and engage more effectively with customers. Tax authorities and consulting actors emphasized on how digitalization supported regulatory compliance while SMEs underscored the role of digitalization in meeting customer expectations and improving service delivery the following quotes to justify this finding from Ester, Daniel, David and Maria representing the two Districts illustrate these findings.

> "We have implemented several initiatives to leverage technology in tax collection"

> "We utilize digital platforms for tax planning, electronic filing of tax returns, and accessing updated tax regulations and rulings."

> "To stay competitive and up-to-date with industry standards."

> "There is a growing demand from our customers for more transparency and real-time updates, which digital tools can provide."

Additionally, the community's success stories and peer adoption have sparked interest in digital technologies and increased confidence in them, underscoring the significance that social and professional networks play in advancing digital transformation. Stories from Amina and Peter from Kahama as well as participant 2 in one of the FGDs in Msalala illuminates these results.

> "A friend of mine who also runs a shop suggested that I try using a mobile app to keep things more organized."

> "Also, seeing other cooperatives benefit from digitalization encouraged us to try it out."

"We heard about the benefits of using digital tools from other farmers in nearby areas who had tried them."

The way the researcher has interpreted these results highlights the complex ways that SMEs in the agro-processing sector in the districts of Kahama and Msalala are being driven by digitalization. A complex web of technological, economical, and societal factors interact to impact the adoption of digital instruments.

Digital Technologies Utilized by Agro-processing SMEs

Digital technologies that are most frequently used by SMEs engaged in agro-processing include communication platforms, supply chain tracking tools, and basic inventory management systems. The main purposes of these technologies are to facilitate communication with suppliers and customers, increase decision-making processes, and better visibility of inventory. For inventory management system, majority of Agro-processing SMEs in the study areas utilized computer software systems, specifically Microsoft spreadsheets and mobile phone apps. This has been reported in most of the interviews and FGDs conducted, as depicted by the quotes from John and Peter, representing Msalala and Kahama respectfully.

"Recently, though, we've started using mobile phones and some basic apps to help manage our logistics better."

"I rely on basic digital tools such as spreadsheets for tracking quality measures, recording sales results, and maintaining documentation."

This finding was also apparent during FGDs conducted with different actors within the agro-processing SMEs in both Districts. The quotes bellow from participant 4 and 6 in a FGD conducted in Kahama.

"We use spreadsheets to manage stock levels and anticipate demand."

"I use mobile phone apps to manage my product information including stock levels."

The researcher also observed in many of the businesses visited where the mobile phone apps and computer systems were in use to keep and track record.

As far as streamlining communication with suppliers, customers and transporters is concerned, some SMEs in agro-processing employed text messages, WhatsApp texts, emails and device tracking software for tracking movements of goods from one point to another. These findings were observed and revealed during interview sessions as James, Amina and Paul illuminate through the following quotes.

"With GPS, we can find the best routes and bad roads."

"We use SMS to confirm orders with buyers and to arrange transport with drivers."

"Our business has tracking devises installed to all our boda bodas."

"We also use email for communication and occasionally utilize mobile apps for quick access to information."

The researchers interpretation of these findings is that, utilization of these digital technologies were influenced by the degree of urbanization, firm's readiness to adopt and resource availability. The agro-processing SMEs from Kahama were ahead on sophisticated digital adoption compared to those from Msalala. In addition, the well established firms were advantageous in terms of resource availability and readiness to adopt digitalization.

Impact of Digitalization Adoption by Agro-processing SMEs on LSCM

SMEs who have effectively incorporated digital technologies claim considerable gains in SCM and logistics procedures, notwithstanding obstacles. Benefits include improved decision-making based on real-time data insights, expedited order processing and delivery times, and higher efficiency in inventory management resulting to customer satisfaction with ultimately cost reductions. This is supported by the following quotes from different actors as recorded during interviews and the last two quotes from FGDs in both Kahama and Msalala Districts.

"Communication has improved, making it easier to coordinate with buyers and transporters."

"I can use my smartphone camera to confirm the genuine product by only scanning the package."

"We experience fewer delays and misunderstandings because everyone involved in the process gets timely updates."

"Using spreadsheets allows us to systematically track quality parameters during production and analyse trends over time."

"Digital tools have enhanced our ability to analyse customer data and adapt our marketing strategies accordingly."

"Helps in preventing stockouts and overstocking."

According to the researcher's analysis of the data, SMEs in the Kahama and Msalala Districts that process agricultural products have seen a significant transformation in their use of basic digitalization technologies for SCM and logistics. Adoption of digital tools results in significant cost savings, greater supply chain coordination, better market access, higher operational efficiency, and improved compliance. The competitiveness and sustainability of SMEs in the agro-processing sector are boosted by these effects taken together.

Challenges Encountered by Agro-processing SMEs in Digital Adoption

The results point to a number of obstacles preventing supply chain operations from fully integrating digitalization. These difficulties include employees' lack of digital skills, infrastructure limitations, restricted access to reasonably price technological solutions, reluctance to change, and the lack of institutional support mechanisms. This finding was significantly apparent across all participants included in this study as illustrated in the quotes from interviews and FGDs below.

"All staff are not proficient in using spreadsheets and other digital tools effectively."

"Some farmers are hesitant to change from traditional methods."

"Most people are used to traditional approaches, changing them needs time"

"Not everyone in our community can afford a mobile phone."

During FGD, participants raised the issues related to cost of hardware, high cost of maintenance and limited resources due to the smaller size of the firms and rurality. This is illuminated by the quotes from Participant 3, 1, 7 and 3 respectively.

"One challenge is the initial cost of implementing and maintaining digital systems."

"Connectivity issues also pose a challenge, particularly in rural areas."

"Limited resources and funding constraints also pose challenges."

"High cost of data and digital equipments such as computers and smart phones."

Another thread of obstacles was directed towards institutional ecosystem. Despite local governments' and private sectors' efforts to streamline digitalization, the speed is not appreciated particularly in the remote areas. Most of the campaigns are reported to target large organizations and SMEs located in urban centres for different reasons. Interviews with participants from remote areas indicated that the government concentrate with large tax payers while private sector's focus is in urban centers. The quotes below illustrate these findings.

"We haven't received specific government support."

"I have not seen any institution that creates awareness on digital adoption among SMEs in our area."

"I think the government is interested only with large farms because of tax collection issues."

The data, as interpreted by the researcher, demonstrate the complexity of the impediments SMEs in the agro-processing sector confront in implementing digital tools. A comprehensive and coordinated strategy is needed to overcome these challenges, one that includes enhancing digital literacy through focused training programs, boosting financial support, developing a culture of openness to change, and establishing supportive regulatory frameworks in addition to improving technological infrastructure.

Organizational Readiness and Future Outlook for the Agro-processing SMEs

Adoption of digitalization is highly dependent on organizational readiness. SMEs that have proactive change management techniques, innovative cultures, and supportive leadership are more likely to be able to overcome obstacles and successfully use digital technology to boost their competitiveness and company growth. Findings from the empirical materials indicate a positive perception from managers and owners of SMEs as well as local government officials. The quotes bellow support this findings as pinpointed from both interviews and FGDs.

"We are ready for it, if we close our eyes we will be out of the business."

"The smart phones are our simple training facilities to cope with digitalization."

"I just want to say that while learning to use new technology can be challenging, it is worth it."

"We prioritize capacity-building for teachers to effectively use digital tools and resources in their classrooms."

"We collaborate closely with local businesses and organizations to leverage their resources and expertise in promoting digital inclusion."

The way the researcher interpreted the data on agro-processing SMEs' organizational readiness for digital adoption revealed a complex interrelated factors. Employee competencies organizational culture, availability of resources, leadership commitment and effectiveness in managing change are crucial for organization's readiness to embrace digital strategies.

The results point to a promising future for agro-processing SMEs in the districts under study in terms of digitalization adoption. SMEs understand how crucial digital technologies are to their ability to compete, reach new markets, and improve customer satisfaction. To address outstanding issues and guarantee the long-term viability of digital transformation initiatives, however, persistent work is required. A significant number of participants, including those representing the least adopting firms, government authorities and other actors confirmed this finding.

Based on the quotes below that were captured during interviews, FGD, and body language observed from owners and managers of the agro-processing SMEs in Kahama and Msalala, the future is exciting despite the fact that there is still a long way to go.

"I am optimistic about the future."

"As technology continues to evolve and become more affordable, more cooperatives and businesses in rural areas will embrace digital tools."

"As more businesses like ours see the benefits of even basic digital tools, there will be a gradual shift towards more advanced solutions."

Additionally, the government agencies ensured that digitalization is the only way to go for the future of agro-processing and other sectors during this fourth industrial revolution era. Various participants representing the government institutions were consistently quoted with enthusiastic positive perceptions as seen bellow.

"Tax inspectors will continue to play a crucial role in driving digital transformation in tax administration."

"We will advocate for policies that support digital literacy and ensure equitable access to digital tools."

"Digitalization will lead to more efficient tax advisory services, improved compliance rates, and enhanced financial management for businesses in rural areas."

According to the researcher's interpretation of the data, there is a generally good outlook for agro-processing SMEs in Kahama and Msalala Districts to adopt digitalization in the future. This is due to factors such as evolving market dynamics, growing digital literacy, supportive policies, and technological advancements.

Discussion of the Findings

Several key findings from the study on digitalization in agro-processing SMEs provide important insights into the uptake, difficulties, and effects of digital technologies in this industry. These results add to broader theoretical and empirical discussions on technology adoption in addition to highlighting the practical difficulties faced by SMEs in rural and peri-urban locations.

Agro-industry Basic digital technologies like smartphones, easy-to-use inventory management software, and basic data analytics tools are being adopted by SMEs more and more. The benefits of better decision-making, increased efficiency, and easier access to markets are what are driving this adoption. Throughout the supply chain, communication and coordination have been made easier by the widespread usage of mobile phones, which has made it possible to share information and solve problems in real time. This is consistent with the TAM (Olaniyi Adeniran *et al.*, 2024), which holds that these products' perceived utility and usability are key elements in their acceptance. This conclusion is further supported by the Diffusion of Innovations (DOI) hypothesis, which holds that SMEs are more likely to adopt these technologies since they provide relative advantages and are compatible with current workflows (Saro, 2023).

Within agro-processing SMEs, the adoption of simple digital tools has resulted in quantifiable gains in productivity and operational efficiency. The use of digital tools has made supply chain coordination, order processing, and inventory management much more efficient. As a result, there have been fewer operational expenses, fewer mistakes, and quicker turnaround times. This finding is consistent with that of Dhillon and Moncur (2023) who found that the rapid use of precision agricultural technology by farmers is made possible by the fact that even small-scale farmers in underdeveloped nations can now afford these technologies thanks to rising internet and mobile phone penetration as well as a global decline in data costs. The results validate the firm's RBV, which holds that digital capabilities and other strategic resources can result in competitive advantages. Businesses may improve their operational efficiency and improve their performance and market positioning by utilizing digital tools to their fullest potential.

Widespread adoption of more sophisticated digital technologies is hampered by a number of significant obstacles, such as poor connectivity, low digital literacy, and budgetary limitations. SMEs' capacity to fully utilize digital technologies that require steady internet access is hampered by connectivity concerns, especially in rural locations. This indicates a serious infrastructure vacuum that needs to be filled with investments in digital infrastructure and regulatory changes. Financial limitations are also a significant factor, since many SMEs find it difficult to pay for cutting-edge technologies and the related implementation expenses. This finding is congruent to Achandi et al. (2018) who revealed that women who process rice are unable to employ the newest technology because they do not have enough money. It is also consistent with that of Nkwabi et al. (2019), who found that Tanzanian enterprises' expansion is hindered by technological problems. Also, employees' low level of digital literacy emphasizes the necessity of thorough training programs to develop the requisite abilities. From the perspective of institutional theory, these constraints reflect broader structural and normative pressures, including weak infrastructure, limited support systems, and insufficient regulatory incentives that shape organizational behaviour and limit innovation. Additionally, from a Resource-Based View (RBV) standpoint, the inability to access or develop critical resources such as digital skills and infrastructure undermines the firm's capacity to build competitive advantage through technological innovation.

Conclusions and Implications

The results of this study provide important new information about how Tanzanian agro-processing SMEs in the Districts of Kahama and Msalala are embracing digitalization. The study has shed light on the current state of the industry's digital transformation, emphasizing the potential and difficulties SMEs have when incorporating digital technology into their SCM and logistics operations. Key findings include the different degrees to which SMEs have adopted digitalization, common issues like scarce technology resources and gaps in digital skills, significant advantages in productivity and decision-making for SMEs that have adopted digital transformation, and the critical role that organizational readiness and collaboration play in fostering successful digital initiatives.

Policymakers, industry groups, technology suppliers, researchers, owners and managers of SMEs will be greatly impacted by these findings. Digital transformation can be accelerated and agro-processing SMEs' competitiveness can be increased by implementing strategies to remove obstacles to digital adoption, improve training in digital skills, encourage collaborative collaborations, and establish supporting regulatory frameworks. Furthermore, in order to guarantee digitalization efforts' long-term viability and impact on business performance, it is imperative that they be continuously monitored and evaluated.

From a theoretical standpoint, this study affirms the relevance and applicability of the TAM, the RBV, and Institutional Theory in understanding digital adoption among agro-processing SMEs in rural Tanzania. The TAM effectively explains how perceived usefulness and ease of use influence SMEs' decisions to adopt basic digital tools such as mobile apps and inventory software. The RBV framework highlights that firms with better internal capabilities such as access to digital skills, financial resources, and leadership support are more likely to adopt and benefit from digital technologies. Institutional Theory further provides insight into how external pressures including regulatory mandates (coercive), professional norms (normative), and peer imitation (mimetic) shape the digital behaviour of SMEs. Collectively, these theories offered a robust lens to interpret the dynamics of digital transformation in resource-constrained and institutionally complex environments.

Building on the results of this study, future research endeavours should investigate a number of these topics in more detail. The long-term effects of digitization on agro-processing SMEs, including financial performance, market competitiveness, and sustainability outcomes, can be evaluated through longitudinal studies in the future. Examining innovations and digital solutions designed specifically for the agro-processing sector can also shed light on specialized technologies that deal with particular supply chain opportunities and problems

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