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To cite this article: Dickson Utonga, Charles Stephen Tundui & Eliaza Mkuna (2026) Harnessing performance through digital technology adoption: an empirical analysis of SMEs in the Tanzanian fruit juice processing industry, Cogent Business & Management, 13:1, 2612771, DOI: [10.1080/23311975.2026.2612771](https://doi.org/10.1080/23311975.2026.2612771)

To link to this article: <https://doi.org/10.1080/23311975.2026.2612771>



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Published online: 14 Jan 2026.



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Harnessing performance through digital technology adoption: an empirical analysis of SMEs in the Tanzanian fruit juice processing industry

Dickson Utonga^{a,b} , Charles Stephen Tundui^a  and Eliaza Mkuna^a 

^aDepartment of Economics, Mzumbe University, Morogoro, Tanzania; ^bDepartment of Project Planning and Management, Tengere Institute of Community Development, Arusha, Tanzania

ABSTRACT

This study examines the effect of digital technology adoption (DTA) on the performance of small and medium-sized enterprises (SMEs) in the Tanzanian fruit juice processing industry. The study uses data from 390 SMEs across Dar es Salaam, Arusha and Mbeya regions. Utilising a quantitative approach, it employed Partial Least Squares Structural Equation Modelling to analyse the data. The results show that DTA significantly improves the performance. Furthermore, entrepreneurial orientation, organisational readiness and external environment each exert a significant direct influence on the performance. However, the external environment negatively moderates the adoption–performance relationship, suggesting that highly supportive environments may lead SMEs to adopt digital tools superficially. In contrast, more challenging environments motivate SMEs to leverage digital tools strategically. Entrepreneurial orientation slightly diminishes the benefits of adoption among resource-constrained SMEs, whereas organisational readiness shows no significant moderation effect. This study extends the Resource-Based View Theory by demonstrating DTA's potential to enhance SMEs' performance. Empirically, it offers sector-specific evidence on the effect of DTA on SMEs' performance in Tanzania. The study also provides practical insights for SMEs, policymakers and development stakeholders, recommending that SMEs incorporate digital tools into their core functions. Additionally, government and private-sector entities should invest in SME-focused training programmes to build the skills needed for effective digital transformation. Business development actors, service providers and incubators should foster entrepreneurial mindsets through bootcamps, mentoring and accelerators. Policymakers should cultivate an enabling environment by investing in digital infrastructure and providing regulatory support for digital transformation.

ARTICLE HISTORY

Received 2 October 2025
Revised 27 November 2025
Accepted 1 January 2026

KEYWORDS

Digital transformation; digital technology adoption; SMEs performance; partial least squares structural equation modelling; fruit juice processing industry; Tanzania

SUBJECTS

Business, Management and Accounting; African Studies; Sustainable Development; Economics and Development

1. Introduction

Small and medium enterprises (SMEs) are widely acknowledged as engines of economic growth, employment and innovation in both developed and developing economies. Globally, SMEs account for around 90% of all businesses and more than half of global employment (Bayraktar & Algan, 2019; Hidayati et al., 2025; World Bank, 2025), contributing significantly to GDP and job creation (Agyapong et al., 2025). In developing economies, SMEs play a central role in production systems, fostering entrepreneurship and driving inclusive industrialisation (Adomako & Nguyen, 2020; Alshagawi & Mabkhot, 2024; Zahara et al., 2023). In Tanzania, SMEs employ nearly 4 million people, or 20–30% of the workforce, and contribute approximately 30–45% to national GDP (Matari, 2024; Tundui & Tundui, 2025). Beyond the economic contributions, SMEs help alleviate poverty, enhance food security and promote economic integration (Ishengoma & John, 2025; Kazungu & Kumburu, 2023; Tonya & Samwel, 2025). Understanding the dynamics of this sector is therefore crucial for advancing sustainable and inclusive growth in Tanzania.

CONTACT Dickson Utonga  dickiedannie@gmail.com  Department of Project Planning and Management, Tengere Institute of Community Development, Arusha, Tanzania.

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In Tanzania, the fruit juice processing industry stands as a high-potential subsector within the broader agro-processing economy, primarily driven by SMEs. These SMEs play an essential role in driving value addition, generating employment and fostering economic transformation across the country. By linking fruit producers to markets, the industry not only contributes to the national economy but also enhances food security, promotes economic diversification and supports export growth. The diverse range of fruits, such as mangoes, oranges, pineapples and guavas, provides a rich source of raw materials for fruit juice production (Dube et al., 2018). These resources have enabled numerous SMEs to thrive across the value chain, from production to packaging and distribution. However, despite its potential, the sub-sector faces several challenges that hinder reaching its potential. SMEs in the industry often struggle with limited market access, fluctuating sales, weak brand recognition, a fragmented value chain and inconsistent profitability (Dube et al., 2018; Matari, 2024; Tonya & Samwel, 2025). These barriers undermine the SMEs' ability to reach their full potential, limiting their capacity to drive economic growth and reduce poverty in Tanzania.

To address these challenges, digital technology adoption has become a crucial driver of SMEs' performance and sustainability globally. This adoption involves integrating digital tools and systems (resources) into business functions, which allows SMEs to streamline processes, improve customer engagement and better adapt to market demands. It fundamentally transforms how products and services are developed, promoted and delivered (Liguori et al., 2024). Using digital tools helps SMEs enhance competitiveness, foster innovation and drive growth in the shifting digital economy (Dimoso & Utonga, 2024). It encompasses various types of digital technologies, such as digital marketing platforms, including social media, marketplaces and online advertising tools, that help SMEs promote products and increase brand visibility (Almasi et al., 2023; Mushi, 2024). These tools also facilitate direct customer engagement at low cost and support distinctive market positioning (Gupta, 2023; Wan, 2023). Digital payment systems, such as mobile money services, mobile banking apps, POS systems, QR code payment options and online gateways, make transactions secure and traceable. They enhance cash flow and reduce reliance on cash (Sathish & Vidya, 2025; Son et al., 2019; Tarantang et al., 2019). Internal operations management solutions, like accounting, project management, inventory management and supply chain tools, improve efficiency. They also simplify workflows, increase transparency and optimise resource use (Anaba et al., 2024; Ria et al., 2023; Toromade et al., 2024). Successful adoption of these resources boosts SMEs' performance (Azubuike et al., 2025; Deku et al., 2024; Hoai et al., 2022; Mushi, 2024; Wibowo et al., 2020). However, adoption depends not only on SME capacity but also on supportive policies and investment environments.

Simultaneously, the Tanzanian government plays a substantial role in driving digital transformation by promoting the adoption of digital tools. Key government-led initiatives, such as the Tanzania Digital Economy Framework and the National ICT Policy, are strategically designed to improve digital infrastructure, enhance digital literacy and foster innovation across various sectors (United Republic of Tanzania, Ministry of Information, Communication and Information Technology, 2024). These instruments not only aim to build a technological foundation but also to empower SMEs by providing strategic direction for digital adoption. In parallel, substantial private-sector investments, donor-funded programs, and capacity-building initiatives work collaboratively to equip SMEs with the necessary skills, resources and pathways for a successful digital transition (United Nations Conference on Trade and Development, 2020). Such initiatives are crucial in strengthening SMEs' ability to integrate and leverage digital technologies, enabling them to operate more efficiently and competitively. This support is crucial for SMEs in potential subsectors such as the fruit juice processing industry, where digital technologies can drive productivity and competitiveness and promote sustainable growth.

Despite significant efforts to promote digital transformation, digital technology adoption among SMEs remains slow and uneven (Katalla & Masele, 2024; Majengo & Mbise, 2022). Even when adoption happens, its effect on SMEs' performance varies, with some SMEs experiencing significant gains in profitability, customer base, sales, market reach and overall performance, while others report little or no improvement (Mushi, 2024; Mwantimwa, 2019; Peter & Nnunduma, 2024; Shaitu, 2022). This difference in outcomes emphasises the importance of not assuming all SMEs benefit equally from digital adoption and highlights the need for a deeper understanding of these dynamics. This insight suggests that the link between digital technology adoption and SME performance depends on several exogenous factors,

including the external business environment, entrepreneurial orientation and organisational readiness (Da Silva et al., 2025; Faiz et al., 2024; Samsami et al., 2025). This interaction shows that SMEs operating in favourable regulatory and market conditions are better able to use digital tools effectively. Conversely, those in more challenging environments face greater obstacles to success. Additionally, SMEs with a strong entrepreneurial orientation are more likely to turn digital adoption into tangible performance outcomes. On the other hand, SMEs with insufficient organisational readiness often struggle to convert digital investments into sustained competitive advantage, limiting their potential for long-term growth and sustainability.

Although digital technology adoption among Tanzanian SMEs has received increased attention, there is limited empirical evidence on its effects on performance in the fruit juice processing industry. Most existing studies focus primarily on service-oriented SMEs, manufacturing SMEs, or the broader SME sector (Benard, 2020; Ishengoma & John, 2025; Mushi, 2024; Nyamwesa, 2024; Pasape, 2022), often neglecting industry-specific subsectors, such as fruit juice processing, with high growth potential. This focus creates a gap in understanding how digital technology adoption influences performance outcomes in this particular subsector. Additionally, the roles of external environment, entrepreneurial orientation and organisational readiness in shaping the relationship between adoption and performance remain largely unexplored in the industry. Recent studies indicate that factors such as entrepreneurial orientation can significantly impact performance in SMEs (Ngo, 2023; Octavia et al., 2020), and that the external environment (Fu et al., 2021) and organisational readiness (Jewapatarakul & Ueasangkomsate, 2024) also play a significant role, but how these factors shape the digital adoption-performance relationship within agro-processing industries, such as fruit juice production, remains unclear. This gap limits understanding of how these factors condition this relationship, especially under conditions that may enhance or hinder the adoption-performance relationship. Consequently, the specific mechanisms by which digital adoption improves sectoral performance remain poorly understood, hindering the development of targeted digital transformation strategies for this industry. Closing this gap is key to advancing theoretical frameworks and providing practical guidance to stakeholders in emerging economies seeking sustainable digital growth.

To address this gap, the study is grounded in the Resource-Based View (RBV) Theory (Barney, 1991; Wernerfelt, 1984) to explain the relationship between digital technology adoption and SMEs' performance. The Theory provides a lens for examining how SMEs can leverage digital tools to gain and sustain a competitive advantage in the fruit juice processing industry in Tanzania. By examining digital technology adoption through the RBV framework, the study highlights how SMEs can enhance their performance by effectively utilising valuable, rare, inimitable and non-substitutable technological resources. This approach provides for a deeper understanding of how digital technology can lead to superior performance outcomes. To achieve this end, the study aims to answer the following research question: *How does digital technology adoption influence the performance of SMEs in the Tanzanian fruit juice processing industry? Moreover, how is this relationship conditioned by the external environment, entrepreneurial orientation, and organisational readiness?*

Building on this context, the study provides the contributions digital technology can offer to SME in the Tanzanian fruit juice processing industry. In doing so, it makes three important contributions. Theoretically, it broadens the RBV Theory to the context of digital technology adoption in SMEs within the fruit juice processing industry in Tanzania. It not only shows how digital tools can serve as strategic ends but also explains the specific mechanisms by which they influence SMEs' performance. This extension of the Theory provides a clearer view of how internal technological resources interact with external environmental factors, thereby providing a framework for analysing digital transformation in SMEs. Empirically, the study advances sector-specific evidence from the Tanzanian fruit juice processing industry, offering insights into when digital adoption leads to actual performance gains. It also examines the moderating effects of key factors, including the external environment, entrepreneurial orientation and organisational readiness. Examining this context yields new insights into how these factors influence the link between digital adoption performance and SMEs. In practice, the study's findings offer guidance to SMEs, policymakers and technology providers on promoting digital transformation. They highlight effective strategies for using digital tools to improve operational efficiency, market competitiveness and sustainability. This contribution fills an important knowledge gap and supports the sustainable digital

transformation of SMEs in emerging economies, offering a pathway for both Theory and practice in the digital era. The rest of the paper is organised as follows. [Section 2](#) reviews the literature and Theory. [Section 3](#) describes the research methods, [Section 4](#) presents the findings and [Section 5](#) discusses the results. [Section 6](#) covers contributions, limitations and areas for future research. [Section 7](#) concludes with recommendations.

2. Literature review

2.1. Conceptual definitions

2.1.1. Digital technology adoption

Digital technology adoption refers to the process through which individuals, organisations, or societies incorporate digital tools and innovations into their operations and strategic activities. For SMEs, this involves more than just acquiring new technologies; it includes integrating digital tools into key business functions to boost productivity, efficiency and competitiveness (Rondonuwu et al., 2024). These technologies range from simple tools like email, social media and digital payment platforms to more advanced systems, such as cloud computing, data analytics, artificial intelligence and automation. As the global business environment becomes digitally inclined, these technologies have become essential for SMEs, especially in developing economies like Tanzania, where resource limitations make digital solutions a practical way to overcome challenges and improve operations. Digital tools facilitate SME decision-making, expand market reach, enhance the customer experience, and solidify their market position. For SMEs in developing countries like Tanzania, especially in the fruit juice processing industry, digital technology adoption can be achieved through digital marketing platforms like social media and search engine optimisation, as well as digital payment systems such as mobile payments like M-PESA, Halopesa, Airtel Money, online banking platforms and digital solutions for internal operations management systems such as procurement and accounting software, including QuickBooks and project management tools. These resources support marketing, transactions and internal operations, allowing SMEs to increase productivity, responsiveness and market engagement (Matari & Temba, 2025; Nasiri et al., 2022). In this context, the present study emphasises core aspects of digital adoption, including digital marketing platforms, digital payment systems and digital tools for internal operations management. It examines how digital tools in these domains influence SMEs' performance.

2.1.2. Small and medium enterprises

Small and Medium Enterprises (SMEs) are defined by their size, specifically in terms of employee count, capital investment and annual turnover. In Tanzania, SMEs are categorised according to the 2003 SME Development Policy (United Republic of Tanzania [URT], 2003), which distinguishes them into micro, small and medium-sized enterprises based on the number of employees and the level of capital investment in machinery. Micro-enterprises employ 1–4 people; small enterprises employ 5–49 people, with capital ranging from TZS 5 million to TZS 200 million; and medium enterprises employ 50–99 people, with capital ranging from TZS 200 million to TZS 800 million. This classification helps inform policy-making, enterprise support and research. Within this framework, SMEs in the fruit juice industry are those with 1–99 employees and capital investments ranging from below TZS 5 million to TZS 800 million. The role of SMEs in this sub-sector is crucial, as they contribute significantly to employment, GDP and value addition, particularly in agro-processing, where the adoption of digital tools can enhance performance and competitiveness.

2.1.3. SMEs performance

SMEs' performance refers to the degree to which a business achieves its goals and objectives, and can be assessed using both financial and non-financial indicators. Financial measures often include profitability, sales growth and market share, while non-financial measures may focus on operational efficiency, customer satisfaction, innovation and employee engagement (Kotane & Kuzmina-Merlino, 2017; Kourriche & Aboutafail, 2023). Performance assessment of SMEs also includes factors such as growth, productivity and market presence, which are particularly important for businesses in developing economies where

adaptability to changing market conditions and digital transformation is key to long-term success (Chong, 2025). In the context of digital adoption, SMEs' performance can be measured by improvements in market reach, customer engagement and financial outcomes such as profitability and sales growth (Cho & Pucik, 2005; Maduekwe & Kamala, 2016; Mushi, 2024). This study focuses on these dimensions, assessing how adopting digital marketing platforms, digital payment systems and internal operations management solutions enhances performance metrics such as profitability, sales growth and customer base expansion.

2.1.4. Fruit juice processing industry in Tanzania

The fruit juice processing industry in Tanzania represents an emerging subsector within the broader agro-processing industry. It is characterised by an increasing demand for both domestic consumption and export opportunities. Tanzania's wide variety of fruits – such as mangoes, oranges, pineapples and guavas – provides a strong foundation for the fruit juice processing industry (Dube et al., 2018). Despite its potential, the industry is predominantly made up of SMEs that face numerous challenges, including limited access to modern technologies, inadequate infrastructure and competition from imported products (Fintan & Mbura, 2024, 2025; Nkwabi, 2024). Digital adoption offers these SMEs a transformative opportunity to increase production capacity, improve operational efficiency and expand into new markets. Digital tools like social media, mobile payment systems and internal operations software enable SMEs to streamline operations, reduce transaction risks, improve financial recordkeeping and enhance customer engagement (Samundeeswari et al., 2025). These innovations not only improve operations but also enable SMEs to expand their reach beyond local markets, promoting both growth and sustainability. Understanding how SMEs in Tanzania's fruit juice processing sector leverage digital technologies to overcome challenges and improve performance is crucial for fostering economic growth and ensuring the sector's long-term success.

2.2. Theoretical framework

2.2.1. The resource-based View

The Resource-Based View (RBV) Theory states that a firm's internal resources and capabilities are key to achieving and maintaining a competitive advantage (Barney, 1991; Wernerfelt, 1984). RBV emphasises the significance of both tangible and intangible resources in driving superior firm performance. According to RBV, resources that are Valuable, Rare, Inimitable and Non-substitutable (VRIN) create a competitive advantage that is hard for competitors to imitate. Empirical research shows that firms with VRIN resources can outperform their competitors (Peteraf, 1993; Teece et al., 1997). This Theory highlights the importance of effectively leveraging internal resources, such as technology, culture and human capital, to gain a strategic edge.

In this study, the RBV framework is used to examine how SMEs in Tanzania's fruit juice processing industry utilise digital technology to improve their performance. Digital tools such as mobile payment platforms, inventory management systems, accounting software and digital marketing tools are essential resources. When combined with existing capabilities like skilled labour, managerial expertise and a strong organisational culture, these resources become valuable assets. As demonstrated by Da Silva et al. (2025) and Díaz-Arancibia et al. (2024), SMEs in emerging economies can gain a competitive edge by integrating digital technologies into their operations, streamlining processes, increasing customer engagement and expanding market reach. These capabilities help SMEs reduce costs, improve product quality and access new markets, creating firm-specific advantages that align with the VRIN framework criteria.

The RBV also emphasises the role of the external environment, entrepreneurial orientation and organisational readiness in how internal resources create value. For instance, a dynamic external environment may make digital capabilities rarer and more inimitable, thus enhancing their value. Furthermore, a strong entrepreneurial orientation, characterised by a firm's willingness to innovate and take risks, and organisational readiness, such as leadership support and resource availability, are essential for effectively leveraging digital tools. Recent empirical studies by Estensoro et al. (2022)

and Sipos et al. (2025) show that SMEs in emerging markets can leverage these digital tools to navigate external challenges and achieve a competitive advantage. This research builds on the RBV framework to examine how digital tools, when integrated with internal capabilities, drive SMEs' performance in Tanzania's fruit juice processing industry, with external factors influencing the strategic use of these resources.

2.3. Empirical literature review

2.3.1. Digital technology adoption and SMEs performance

Empirical evidence strongly supports the role of digital technology adoption in enhancing SMEs' performance, particularly in emerging markets. Studies have shown that digital tools, including e-commerce platforms, mobile payment systems, social media and internal management software, improve operational efficiency, facilitate market expansion and enhance customer satisfaction (Deku et al., 2024; Naibaho et al., 2025; Pratamansyah, 2024). In the Indonesian context, digital adoption has led to increased sales and improved customer experiences, while internal tools like accounting and inventory systems have reduced operational costs and boosted productivity (Hoai et al., 2022; Wibowo et al., 2020). In Tanzania, a study by Mushi (2024) reveals that digital marketing is a crucial aspect of digital technology and a valuable tool for enhancing the performance of service-sector-related SMEs. These findings are echoed across sectors, where digital marketing, digital literacy and real-time customer engagement directly contribute to improved sales performance and competitiveness (Roman & Rusu, 2022; Titis et al., 2024). Beyond sales and market access, digital technologies are shown to support better resource utilisation, financial management and data-driven decision-making, which are essential for sustained growth. In agro-processing and similar sectors, these tools contribute to quality control, supply chain coordination and operational transparency (Masi et al., 2021).

Scholars such as Hanelt et al. (2021) and Martínez-Caro et al. (2020) demonstrate that aligning digital tools with firm strategy and building a digital organisational culture enhances value creation and business performance. Studies rooted in the Resource-Based View (RBV) further support this by showing that the effectiveness of digital technology depends on its integration with a firm's capabilities and objectives (Llopis-Albert et al., 2021; Nambisan & Baron, 2019). However, despite the potential benefits, the positive effects of digital adoption are not automatic. Empirical studies from developing countries highlight key challenges, including high implementation costs, inadequate digital skills and resistance to change, which can hinder the effectiveness of digital tools in improving SMEs' performance (Shahadat et al., 2023). The impact of digital adoption on performance is contingent on factors such as the extent of adoption and managerial focus, with studies showing that it may negatively affect overall performance, particularly when adoption is too low or too high (Guo et al., 2023). Some studies argue that digital adoption does not always correlate with improved performance, with benefits being inconsistent across firms (Usai et al., 2021; Viète & Erdsiek, 2020). These mixed results highlight the importance of considering boundary conditions, such as external environment, entrepreneurial orientation and firm-specific characteristics, when evaluating the outcomes of digital adoption. The evidence thus points to the need for a strategic approach to digital adoption, with SMEs supported by appropriate infrastructure, training and a supportive policy environment. As illustrated by Duman and Akdemir (2021), digital adoption yields measurable improvements in profitability and productivity when supported by appropriate strategies and capabilities. For SMEs in the Tanzanian fruit juice processing industry, recognising and addressing these contextual setups is essential to harness the performance gains associated with digital adoption.

H1: Digital Technology Adoption (DTA) has a significant positive effect on SMEs' performance (PEF).

2.3.2. Other variables

The relationship between digital technology adoption and SMEs' performance is not always direct and can be moderated by other factors. These variables can either strengthen or weaken the positive impact of digital technology adoption, making it crucial to consider them for a thorough understanding of the

phenomenon. Based on the literature, several moderating variables are relevant for inclusion in the context of fruit juice industry SMEs in Tanzania.

2.3.2.1. Organisational readiness. Organisational readiness refers to the extent to which an organisation is prepared to adopt and implement new technologies. This includes factors such as the availability of financial resources, skilled human capital, and a supportive organisational infrastructure (Machado et al., 2021; Michelotto & Joia, 2024; Van Tonder et al., 2023). Studies suggest that SMEs with higher levels of organisational readiness are more likely to successfully adopt digital technologies and, consequently, experience greater performance improvements (Fabian et al., 2023). For instance, top management support and a proactive digital culture can significantly moderate the relationship between technology adoption and firm performance by facilitating smoother implementation and integration (Faiz et al., 2024). In the Tanzanian context, where SMEs often face resource constraints, organisational readiness can be a critical determinant of whether digital technology adoption translates into tangible benefits.

H2: Organisational Readiness (OR) has a positive and significant effect on SMEs' performance (PEF).

H3: Organisational Readiness (OR) positively moderates the relationship between Digital Technology Adoption (DTA) and SMEs' performance (PEF).

2.3.2.2. Entrepreneurial orientation. Entrepreneurial orientation (EO) refers to an SME's strategic mindset towards entrepreneurial activities. It reflects how an SME behaves in terms of innovativeness, risk-taking and proactiveness in pursuing new opportunities, competing in the market, and driving business growth. The entrepreneurial orientation of SMEs can significantly impact its performance outcomes (Alarape, 2013; 2013; Andriani et al., 2024; Bauweraerts et al., 2023; Dwumah et al., 2024; Fang et al., 2022; Khan et al., 2021; Mulyana & Hendar, 2023; Sudirman et al., 2025; Vrontis et al., 2022). Entrepreneurial managers are often more open to innovation, willing to take risks, and proactive in seeking out and implementing new technologies (Lin et al., 2020; Zacca & Selen, 2011). Their vision and leadership can drive the digital transformation process within the SME, ensuring that adopted technologies are strategically aligned with business goals and effectively utilised (Ari & Temizkan, 2025). Research indicates that entrepreneurial traits can enhance the adoption of digital tools in SMEs, thereby influencing their performance outcomes (Sudirman et al., 2025). In the fruit juice processing industry, managers with a strong understanding of both traditional processing methods and digital opportunities are better positioned to leverage technology for competitive advantage.

H4: Entrepreneurial Orientation (EO) has a positive and significant effect on SMEs' performance (PEF).

H5: Entrepreneurial Orientation (EO) positively moderates the relationship between Digital Technology Adoption (DTA) and SMEs' performance (PEF)

2.3.2.3. External environment. The external environment refers to the factors outside a firm's control that influence its operations, strategies and outcomes (Olaleye et al., 2024). For SMEs, this includes market forces, regulatory frameworks, technological trends and socio-economic conditions that shape both opportunities and threats in the business landscape (Banerjee, 2023). These external factors significantly moderate the relationship between digital technology adoption and SMEs' performance (Solichin et al., 2026). Specifically, issues such as competitive intensity, market dynamism and institutional support shape the extent to which digital tools translate into performance gains (*Ibid*). In competitive markets, SMEs may be compelled to adopt digital technologies as a survival strategy, thereby amplifying their positive impact on performance (Holl & Rama, 2024). Conversely, in more stable or less competitive environments, adoption may occur more slowly, resulting in fewer performance improvements. In Tanzania, government initiatives to promote digitalisation in agriculture and food processing have created a supportive environment for SMEs (Kitole et al., 2024). The availability of reliable internet access, affordable digital tools and relevant training programs directly influences the success of these digital adoption efforts.

H6: External Environment (EE) has a positive and significant effect on SMEs' performance (PEF).

H7: External Environment (EE) positively moderates the relationship between Digital Technology Adoption (DTA) and SMEs' performance (PEF).

3. Materials and methods

3.1. Study area

The study was conducted across three regions of Tanzania: Dar es Salaam, Arusha and Mbeya. These regions were selected for their active involvement in agro-processing and favourable economic, geographic and infrastructural conditions. Dar es Salaam, situated along the eastern coastline, is the commercial and economic hub of Tanzania. The region hosts a high concentration of enterprises and serves as a major centre for the trade and distribution of agricultural and processed goods. As the primary port and trade gateway in East Africa, it serves as a key centre for the distribution and marketing of agricultural products, including processed fruit juice. The region has a reliable communication infrastructure and widespread mobile phone use. As a result, digital technology is gradually being adopted across various business functions, including sales, payments, operations management and customer engagement.

In northern Tanzania, Arusha presents a blend of agricultural and tourism-driven economic activities. Many businesses operate in and around the region, particularly in areas with better transport access and potential markets. Situated in the northern highlands, the region benefits from a favourable climate and fertile soils that support the cultivation of a variety of horticultural crops, including fruits and vegetables. The fruits provide a reliable raw material base for fresh-juice processing enterprises. An entrepreneurial orientation among residents facilitates the growth of this business. The presence of an active entrepreneurial culture, especially among women who operate various businesses, is supported by improved digital connectivity. This enables them to explore online platforms, mobile banking and other digital services that enhance their business sustainability.

Mbeya region, situated in the southern highlands of Tanzania, is characterised by its strong agricultural orientation and productivity, as well as its strategic location as a regional trade corridor. The region produces a wide range of horticultural and food crops. These crops offer a lucrative avenue for fruit processing businesses, including fresh-juice enterprises. In addition, the region's position along key transport corridors linking it to neighbouring regions and countries has increased trade and enterprise growth opportunities. Although more peri-urban than Dar es Salaam and Arusha, Mbeya has seen growing interest in utilising digital tools. This is typically experienced in youth- and women-led businesses seeking to enhance their operational practices. The region's character, combined with expanding digital reach, enables the examination of technology adoption in settings where entrepreneurial activity is driven by local resource availability.

3.2. Research design and data collection

This study utilised a cross-sectional design to examine the effect of digital technology adoption on the performance of SMEs in the Tanzanian fruit juice industry. This design allowed for data collection at a single point in time, thus eliminating the potential confounding influence of time. To ensure a representative sample, a multistage sampling technique was employed. We first purposively selected three regions: Dar es Salaam, Arusha and Mbeya, due to their active engagement in agro-processing, vibrant entrepreneurial activities, and growing interest in digital activity. These regions were strategically chosen based on factors such as market accessibility, economic activities and SME density, making them ideal for studying digital adoption in SMEs. After selecting the regions, we further refined the sample by selecting the districts of Ilala, Ubungu, Kinondoni, Temeke, Arusha and Mbeya. These districts were selected based on accessibility to raw materials, proximity to markets, and the overall entrepreneurial environment. From each district, five wards were randomly selected, resulting in a total of 30 wards. Subsequently, 13 SMEs were randomly selected from each ward, ensuring a final sample of 390 SMEs across the three regions. Owners and managers of SMEs were selected as the units of inquiry due to their potential for decision-making and strategic planning. The sample size was calculated using Cochran's formula (Cochran, 1977), which is appropriate for large or undefined populations. Given the absence of a central SME registry, this formula was ideal for our study. A 4.96% margin of error was applied to balance accuracy with constraints like time, budget and field logistics. This decision aligns with the findings of Moore et al. (2013) and Naing et al. (2022), who suggest that maintaining a margin of error below 5% enhances the reliability of results while ensuring sufficient statistical power. The calculation yielded a final sample size

of 390 SMEs, which provided an adequate basis for analysis. The sample size calculation procedure is presented in Equation 1.

$$n_0 = \frac{Z^2 \times p \times q}{e^2} \quad (1)$$

where: n_0 = The estimated sample size; z =z-score corresponding to the desired confidence level (1.96 for 95%); p =proportion of the population (0.5, as an estimate to maximise sample size); $q=1-p$ (thus also 0.5); e = margin of error (0.0496 or 4.96%).

By substituting these values, we obtain:

$$n_0 = \frac{1.96^2 \times 0.5 \times 0.5}{0.0496^2} = 390$$

Thus, 390 SMEs were surveyed for this study.

From the 390 SMEs, we collected data using a semi-structured questionnaire that combined both quantitative and qualitative information. The questionnaire was divided into five sections: introduction; SME profile; digital technology usage; factors influencing digital technology adoption; digital adoption and moderating variables; and performance indicators such as sales, customer and profitability. The development of the questionnaire was informed by an extensive literature review, ensuring that the items were relevant and comprehensive. The data collection exercise took place between December 2024 and April 2025 and was conducted by a team of 10 trained enumerators. To accommodate varying infrastructure conditions and minimise data loss, the team utilised both paper-based and Google Forms questionnaires. Since the enumerators recorded the responses to the questionnaire during the interviews, all selected respondents were actively engaged in the study. Enumerators also clarified where required to ensure consistent and accurate responses. Before proceeding with full-scale data collection, a pilot test was conducted with 30 SMEs in Dar es Salaam to refine the questionnaire and address any ambiguities in the instrument. The pre-test ensured that the questions were understandable and suitable for the local context. After revisions based on the pre-test feedback, the main data collection exercise was finally undertaken.

3.3. Study approval and ethical considerations

This study received formal ethical approval from Mzumbe University, Tanzania (Ref. No. PhD/FSS/MZC/04/T.20, approved on 10 October 2024; and Ref. No. MU/PhD/FSS/MZC/122511112/T.20, approved on 24 December 2024). Additionally, research authorisation was obtained from the President's Office – Regional Administration and Local Government (PO-RALG) (Ref. No. AB.307/323/01), as well as from the Regional Administrative Secretariats of Dar es Salaam (Ref. No. EA.260/307/02B/132), Arusha (Ref. No. FA.255/232/01/A/94) and Mbeya (Ref. No. DA.191/228/01/194). Further permissions were secured from the respective district and municipal councils where data collection took place: Mbeya City Council (Ref. No. HB.385/387/2A/305), Arusha City Council (Ref. No. AB.27/381/01/A/227), Kinondoni Municipal Council (Ref. No. HB.345/133), Dar es Salaam City Council (Ref. No. DCC/AF.3), Temeke Municipal Council (dated 8 January 2025) and Ubungu Municipal Council (Ref. No. AB.94/216/02/101). Additional administrative approval was sought from Ward Executive Officers before engaging with study SMEs. All participants received detailed information about the study's objectives, procedures and benefits, and were explicitly informed of their rights to decline or withdraw without consequence. Written informed consent was obtained from each SME owner-manager prior to the commencement of data collection. The study was conducted in full compliance with internationally recognised ethical standards, including the principles of the Declaration of Helsinki, with strict safeguards to ensure confidentiality, anonymity and voluntary participation.

3.4. Variables and measurements

Guided by the theoretical framework and empirical literature, we developed measurement items that reflect the operational realities of SMEs. The endogenous construct, SMEs' performance, was modelled as

a reflective latent variable comprising three indicators: sales growth, customer base expansion and profitability (Cho & Pucik, 2005; Maduekwe & Kamala, 2016; Mushi, 2024; Serrasqueiro et al., 2023). The central exogenous construct, digital technology adoption, was conceptualised as a second-order formative construct, operationalised through three first-order reflective constructs: digital marketing (Ainin et al., 2015; Alalwan, 2018; Chatterjee & Kar, 2020; Mushi, 2024; Tiago & Veríssimo, 2014; Trainor et al., 2014), digital payment (Alharthey, 2023; Dlodlo & Dhurup, 2010; Sharabati et al., 2024) and digital solutions for internal operations management (Lutfi et al., 2022; Mujalli et al., 2024; Ugbebor et al., 2024), each measured using three items. The relationship between digital adoption and SMEs' performance was hypothesised to be conditioned by internal and external factors. To account for this, we customised reflective constructs representing the external environment (Auwal et al., 2018; Deku et al., 2024; Hansen et al., 2009; He & Wu, 2024; Ntshangase & Ezeuduji, 2025; Oliveira & Martins, 2010; Saruchera & Mpunzi, 2023; Ta & Lin, 2023; Ullah et al., 2023), entrepreneurial orientation (Alarape, 2013; Covin & Wales, 2012; Dwumah et al., 2024; Hervé et al., 2020; Khan et al., 2021; Mulyana & Hendar, 2023; Roux & Bengesi, 2014; Sudirman et al., 2025) and organisational readiness (Chen et al., 2024; Fatorachian et al., 2025; Ifinedo, 2011; Kadiyono & Sulistiobudi, 2024; Öri et al., 2024; Özşahin et al., 2022; Zhen et al., 2021) to evaluate their interaction effect. Each of these constructs was measured using three items, designed on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). A detailed overview of the constructs, indicators, items and measurements is provided in Table 1.

3.5. Analytical framework

We analysed data using SmartPLS 4, a widely recognised software for Partial Least Squares Structural Equation Modelling (PLS-SEM). It is suitable for complex models involving reflective and formative constructs, non-normal data distributions and medium sample sizes (Hair et al., 2021). Before the analysis, we conducted data management, including checks for missing data, response coding and consistency verification. The study's conceptual framework, depicted in Figure 1, guided testing of the hypothesised relationships in Section 2.3 and evaluation of the path model in Figure 2. The model incorporated a Higher-Order Construct (HOC) structure, with Digital Technology Adoption (DTA) modelled as a second-order formative construct, including conceptualizations of Digital Marketing Platforms, Digital Payment Systems and Internal Operations Management Solutions. We utilised a repeated indicators

Table 1. Constructs, indicators and measurement items.

Higher-order construct	Lower-order construct	Item code	Item statement
Digital Technology Adoption (formative)	Digital Marketing (reflective)	DM1	We use digital marketing platforms to promote our products.
		DM2	We invest in online advertising to reach customers.
		DM3	We interact with customers through digital platforms to respond to inquiries and feedback.
	Digital Payment (reflective)	DP1	We actively use mobile money services for business transactions.
		DP2	We can manage and integrate digital payment systems into our transactions.
		DP3	We regularly receive and make payments using online or electronic payment platforms.
	Internal Operations Management Solutions (reflective)	IOS1	We utilise digital tools to manage our finances.
		IOS2	We employ inventory management tools to optimise stock levels and track goods.
		IOS3	We utilise digital systems for record-keeping to ensure accuracy, accessibility and compliance.
	SMEs' performance (reflective)	PEF1	Digital tools have enabled us to reach new markets and increase our sales.
		PEF2	We have attracted more customers via digital tools.
		PEF3	Profit margins have improved since the adoption of digital technology.
	Entrepreneurial Orientation (reflective)	EO1	We pursue uncertain digital opportunities, aiming for high returns.
		EO2	Our SME introduces digital innovations regularly.
		EO3	We act on emerging digital trends before competitors do.
	External Environment (reflective)	EE1	Technologies shift regularly.
		EE2	Competitors regularly use digital tools.
		EE3	Government incentives facilitate digital adoption.
	Organisational Readiness (reflective)	OR1	We have the infrastructure to support digital solutions.
		OR2	Staff possess the necessary skills to use digital tools.
		OR3	SME has the financial capacity to invest in digital technology.

Source: Research construction, 2025.

small-scale, owner-managed businesses predominate. These enterprises, although entrepreneurial in nature, often face limitations in accessing capital, technology and formal business support, which can hinder their growth and innovation potential. Regarding gender representation, women accounted for 58.97% of SME leadership, signalling a notable shift towards gender inclusivity in the Tanzanian agro-processing sector. This is a compelling indicator of the rising role of women entrepreneurs, reflecting broader societal trends towards gender equity and empowerment of women in economic activities. The average operational lifespan of SMEs determined in this study was 3 years, emphasising the competitive nature of the sector, where businesses are in their infancy or transitioning to more established operations. This finding indicates an evolving market with high levels of entrepreneurial turnover and reinvention. Educationally, 42.1% of respondents had completed secondary education, while 48.7% held post-secondary or higher qualifications. This educational attainment indicates a leadership base well-equipped to engage with digital tools and innovations. Finally, on average, SMEs in this study employed only three people, indicating the small-scale nature of the industry. While this demonstrates flexibility and agility, it also highlights significant challenges in resource allocation, operational capacity and scaling. The small size of these enterprises often limits their ability to leverage economies of scale, adopt more advanced digital innovations, and compete with larger, more resource-rich players.

4.2. Common method bias

This study, which relied on data from a single source, acknowledges the potential risk of Common Method Bias (CMB), a significant concern that can distort results and conclusions (Kock, 2015). To mitigate this risk, we employed several strategies. First, we developed a questionnaire based on a comprehensive literature review, ensuring that the items were relevant and exhaustive. A pilot survey was then conducted with 30 SMEs, not included in the final analysis. We used the feedback from the pilot to refine the questionnaire, enhancing both its reliability and user-friendliness. Informed consent was subsequently obtained from all respondents, with both verbal and written consent secured, ensuring participants were fully informed of the study's objectives and assured of the confidentiality and anonymity of their responses. To assess CMB, we conducted a full collinearity test as per the guidelines of Kock et al. (2021). We built a dummy construct and a structural model, which we regressed on all latent constructs. The results obtained, presented in Table 2, reveal that all VIF values fell well below the accepted threshold of 3.3, ranging from 1.061 to 1.625. These findings confirm that CMB did not significantly impact the model, and the parameter estimates derived from the analysis were reliable.

4.3. Measurement model evaluation

4.3.1. Validation of measurement model (lower-order constructs)

This study examined the effect of digital technology adoption on the performance of SMEs in the fruit juice processing industry in Tanzania. We used PLS-SEM to analyse the path model shown in Figure 2, which includes a higher-order construct of digital technology adoption (DTA). Our analysis began by assessing the measurement model for lower-order constructs to ensure reliable measurement of each latent variable.

Table 2. Full collinearity assessment – VIF values for latent constructs.

Construct	CBM	Threshold (3.3)
CBM	-	NA
DM	1.326	Below
DP	1.405	Below
IOS	1.625	Below
EO	1.137	Below
OR	1.091	Below
EE	1.061	Below
PEF	1.473	Below

Source: Smart PLS output, 2025.

Table 3. Outer loading matrix construct reliability and validity.

Construct	Indicator	Loadings	VIF	α	Rho_a	Rho_c	AVE
DM	DM1	0.934	3.596	0.916	0.917	0.947	0.857
	DM2	0.927	3.423				
	DM3	0.916	2.967				
DP	DP1	0.927	3.438	0.911	0.913	0.944	0.849
	DP2	0.920	2.892				
	DP3	0.916	3.066				
EE	EE1	0.929	3.041	0.906	0.914	0.941	0.842
	EE2	0.910	2.944				
	EE3	0.914	2.883				
IOS	IOS1	0.900	2.473	0.883	0.883	0.927	0.810
	IOS2	0.895	2.403				
	IOS3	0.904	2.569				
OR	OR1	0.914	3.036	0.906	0.912	0.941	0.841
	OR2	0.921	2.813				
	OR3	0.917	2.988				
PEF	PEF1	0.907	2.794	0.903	0.908	0.939	0.837
	PEF2	0.907	2.745				
	PEF3	0.931	3.169				
EO	EO1	0.922	3.184	0.914	0.922	0.946	0.853
	EO2	0.914	3.058				
	EO3	0.934	3.239				

Source: SmartPLS output, 2025.

Only after confirming the reliability of these constructs did we proceed to analyse the higher-order construct, providing a robust and valid evaluation of the model's relationship. The lower-order constructs included Digital Marketing platforms (DM), Digital Payment Systems (DP), Internal Operations Management systems (IOS), Organisational Readiness (OR), Entrepreneurial Orientation (EO), External Environment (EE) and SMEs performance (PEF). Evaluating the psychometric properties of these constructs was critical to ensuring the robustness of the measurement model and the accuracy of subsequent analyses.

Indicator reliability was assessed by examining factor loadings; all item loadings exceeded the recommended threshold of 0.70 (Hair et al., 2021), as shown in Table 3. This confirms that each observed item contributed meaningfully to explaining its associated latent construct, reducing measurement error. Multicollinearity was evaluated using the Variance Inflation Factor (VIF), a standard diagnostic tool for detecting redundancy in reflective measurement models (Fornell & Cha, 1994). VIF values below the suggested cut-off of 5 (Hair & Alamer, 2022) indicate acceptable collinearity. As shown in Table 3, all VIF values were below this threshold, confirming the absence of problematic multicollinearity and ensuring that each indicator contributed uniquely to its construct.

Next, internal consistency was evaluated using Cronbach's alpha (α), composite reliability (rho_c) and internal consistency reliability (rho_a). All constructs exhibited strong internal consistency, with α and rho_c values exceeding 0.80, and rho_a values ranging from 0.88 to 0.94 (Hair et al., 2019; Nunnally & Bernstein, 1994). These results exceed the minimum threshold of 0.70, indicating reliable measurement of the latent constructs. Convergent validity was verified using Average Variance Extracted (AVE), with all constructs achieving AVE values above 0.50, ranging from 0.810 to 0.857. This confirms that more than 80% of the variance in the indicators is explained by their respective constructs, demonstrating strong convergent validity (Fornell & Larcker, 1981).

Discriminant validity was evaluated using the Fornell-Larcker criterion, cross-loadings and the HTMT ratios. As shown in Table 4, the square root of each construct's AVE exceeds its correlations with other constructs, confirming discriminant validity (Fornell & Larcker, 1981). The cross-loadings matrix in Table 5 further supports the distinctiveness of each construct, as each item loads more strongly on its designated construct than on any other. Additionally, all HTMT values were below the conservative cut-off of 0.85 (Henseler et al., 2015), providing further evidence of empirical distinctiveness among constructs. These findings confirm that the lower-order constructs are reliable and valid, establishing a strong foundation for the subsequent analysis.

4.3.2. Validation of the measurement model (higher-order construct)

4.3.2.1. Formative constructs validation. We conceptualised and operationalised DTA as a second-order formative construct comprising three dimensions: DM, DP and IOS. This reflective-formative specification

Table 4. Fornell-Larcker criterion (on the LHS) and Heterotrait-Monotrait ratio (on the RHS).

EO	PEF	Or	IOS	EE	DP	DM	DM	DP	EE	IOS	OR	PEF	
						0.926	DM						
					0.921	−0.096	DP	0.106					
				0.918	0.002	−0.027	EE	0.037	0.032				
			0.900	−0.036	0.410	0.382	IOS	0.425	0.455	0.053			
		0.917	0.018	−0.044	0.012	−0.024	OR	0.065	0.037	0.064	0.034		
	0.915	0.244	0.397	0.148	0.319	0.206	PEF	0.224	0.351	0.163	0.443	0.269	
0.923	0.264	0.049	0.221	−0.055	0.012	0.043	EO	0.046	0.020	0.061	0.246	0.053	0.288

Source: SmartPLS output, 2025.

Note: LHS stands for left-hand side and RHS stands for right-hand side.

Table 5. Cross-loading matrix.

	DM	DP	EE	IOS	OR	PEF	EO
DM1	0.934	−0.070	−0.052	0.351	−0.009	0.181	0.052
DM2	0.927	−0.091	−0.027	0.348	0.018	0.229	0.055
DM3	0.916	−0.107	0.005	0.362	−0.078	0.161	0.012
DP1	−0.110	0.927	−0.007	0.370	−0.011	0.263	0.012
DP2	−0.057	0.920	0.040	0.418	−0.002	0.311	0.013
DP3	−0.100	0.916	−0.031	0.340	0.050	0.306	0.008
EE1	−0.002	0.021	0.929	−0.007	−0.017	0.149	−0.022
EE2	−0.050	0.004	0.910	−0.037	−0.063	0.124	−0.057
EE3	−0.026	−0.020	0.914	−0.056	−0.046	0.134	−0.076
IOS1	0.367	0.365	−0.015	0.900	0.029	0.365	0.180
IOS2	0.332	0.377	−0.003	0.895	0.011	0.362	0.198
IOS3	0.332	0.364	−0.078	0.904	0.009	0.345	0.217
OR1	−0.084	−0.013	−0.074	−0.011	0.914	0.206	0.051
OR2	0.005	0.005	0.011	0.007	0.921	0.243	0.039
OR3	0.004	0.042	−0.065	0.054	0.917	0.219	0.047
PEF1	0.187	0.286	0.113	0.342	0.207	0.907	0.232
PEF2	0.143	0.285	0.157	0.332	0.245	0.907	0.227
PEF3	0.229	0.303	0.137	0.411	0.219	0.931	0.263
EO1	0.045	0.008	−0.064	0.213	0.014	0.236	0.922
EO2	0.023	0.032	−0.034	0.194	0.042	0.224	0.914
EO3	0.050	−0.005	−0.053	0.204	0.076	0.267	0.934

Source: SmartPLS output, 2025.

Table 6. Outer weights, outer loadings and VIF.

Dimension	Outer weight	T- statistics	p values	Outer loadings	VIF
DM	0.291	2.498	0.013	0.459***	1.287
DP	0.507	4.603	0.000	0.712***	1.320
IOS	0.569	4.936	0.000	0.888***	1.531

Source: SmartPLS output, 2025.

Note. ***Significant at 1%.

reflects the multidimensional nature of digital adoption in SMEs, with each dimension capturing a distinct facet of technological adoption. The higher-order construct (DTA) was modelled using the repeated-indicator approach, which is well established for estimating reflective–formative hierarchies in the PLS-SEM framework (Becker et al., 2012). In validating this DTA construct, we placed particular emphasis on two aspects: (1) assessing multicollinearity among the lower-order constructs (LOCs) and (2) establishing the statistical relevance of each LOC through its outer weights and loadings, in line with best practices for formative measurement models (Hair et al., 2019; Sarstedt et al., 2019). To evaluate multicollinearity among the LOCs forming the DTA construct, we examined VIFs. As shown in Table 6, all three dimensions (DM, DP and IOS) exhibited VIF values well below the commonly accepted threshold of both 3.3 and 5 (Diamantopoulos & Siguaw, 2006; Hair et al., 2011), indicating that multicollinearity was not a concern in the model. Furthermore, bootstrapped outer weights indicated that each LOC contributed significantly to the formation of the DTA HOCs. Among the dimensions, IOS exhibited the most significant weight ($\beta=0.569$, $p<0.01$), followed by DP ($\beta=0.507$, $p<0.01$) and DM ($\beta=0.291$, $p<0.05$). As reported in Table 6, all outer weights were statistically significant, confirming that each dimension contributed meaningfully to the DTA. The outer loadings for these LOCs, in Table 6, were likewise significant: DM (0.459), DP (0.712) and IOS (0.888), all with p -values <0.01 , thereby providing further support for the construct validity of the DTA in the model.

4.3.2.2. Model fit assessment. We evaluated the overall fit of the model using Standardised Root Mean Square Residual (SRMR), Normed Fit Index (NFI) and distance-based indices (d_ULS and d_G). First, we

Table 7. Model fit indices.

Index	Saturated model	Estimated model
SRMR	0.039	0.039
d_ULS	0.179	0.179
d_G	0.163	0.163
Chi-square	390.003	389.902
NFI	0.889	0.889

Source: SmartPLS output, 2025.

Table 8. Inner VIF values and effect size.

Path	VIF	Effect size
DTA → PEF	1.024	0.264
EE → PEF	1.008	0.054
EE × DTA → PEF	1.010	0.029
EO → PEF	1.031	0.062
EO × DTA → PEF	1.010	0.009
OR → PEF	1.012	0.085
OR × DTA → PEF	1.012	0.000

Source: SmartPLS output, 2025.

examined the SRMR, which measures the average discrepancy between observed and model-implied correlations. The SRMR values for both the saturated and estimated models were 0.039 (Table 7), which is well below the commonly accepted threshold of 0.08 (Hair et al., 2019; Hu & Bentler, 1999), indicating that the models fit the data with minimal residual variance. This indicates that the model reproduces the observed correlations with high predictive accuracy. Next, we assessed the NFI, which compares the chi-square value of the proposed model to that of a baseline (null) model. The NFI value for the model was 0.889 (Table 7), slightly below the traditional benchmark of 0.90 (Bentler & Bonett, 1980). According to Nabi et al. (2025), NFI values above 0.90 are typically considered indicative of a good fit, while values between 0.80 and 0.90 are considered adequate. Furthermore, Singh (2009) suggests that an acceptable NFI should range from 0.6 to 0.9. Thus, in this study, an NFI value of 0.889 falls within the acceptable range, indicating an adequate fit. Additionally, we examined the d_ULS and d_G values, which are distance-based fit indices assessing the difference between the empirical and model-implied covariance matrices, and obtained values of 0.179 and 0.163, respectively (Table 7). Both values fall within acceptable limits, indicating that the discrepancies between the observed and predicted covariance structures are relatively small. These results further suggest that the model is well-specified and fits the data with minimal errors.

4.4. Structural model evaluation

4.4.1. Multicollinearity assessment

The structural model assessed both the direct effects of DTA on PEF and the moderating effects of EE, OR and EO on the DTA-PEF relationship. Before interpreting the structural paths, multicollinearity among the predictor constructs was examined using the inner VIFs. As reported in Table 8, all VIF values were below the conservative threshold of 3, with the highest value being 1.031, confirming that multicollinearity was not a concern in the constructs.

4.4.2. Effect size

Effect size quantifies the strength of the relationship between a predictor and an endogenous variable in PLS-SEM. As shown in Table 8, DTA demonstrated a substantial effect size on SMEs performance ($f^2 = 0.264$), falling between Cohen's (1988) medium (0.15) and large (0.35) thresholds. This indicates strong practical relevance. In contrast, external environment ($f^2 = 0.054$), organisational readiness ($f^2 = 0.085$) and entrepreneurial orientation ($f^2 = 0.062$) showed small to moderate effect sizes. These values exceed Cohen's small-effect threshold (0.02) but remain below the medium threshold, suggesting meaningful yet comparatively smaller impacts. The moderating effects were minimal. EE×DTA ($f^2 = 0.029$) showed a small effect, EO×DTA ($f^2 = 0.009$) showed a negligible effect and OR×DTA ($f^2 = 0.000$) showed no observable effect.

4.4.3. Coefficient of determination (R^2)

We assessed the explanatory power of the model using R^2 , which quantifies how well the exogenous variables explain the variance in SMEs performance. The R^2 for SMEs' performance was 0.350, with an adjusted R^2 of 0.338, demonstrating that the model explains about 35% of the variance. This R^2 value, aligned with Chin's (1998) guidelines, indicates moderate explanatory power, confirming the model's effectiveness in accounting for variations in SMEs performance.

4.4.4. Predictive relevance

The model's out-of-sample predictive performance was assessed using PLSpredict in SMART PLS 4, focusing on the key endogenous construct, SMEs performance, in line with guidelines that predictive assessment be centred on the primary target variable (Shmueli et al., 2019). PLSpredict results in Table 9 demonstrated strong predictive performance for SMEs performance. All three indicators exhibited positive Q^2_{predict} values (Table 9), demonstrating that the PLS-SEM predictions outperformed the naïve benchmark based on indicator means (Shmueli et al., 2019). Furthermore, prediction errors were evaluated using the RMSE statistic, given its sensitivity to larger errors and suitability for business research applications (Shmueli et al., 2019). To further assess predictive accuracy, the PLS-SEM RMSE values were compared with those of the linear model (LM) benchmark, which is obtained by regressing each endogenous indicator on all exogenous indicators (Danks & Ray, 2018). The PLS-SEM approach produced lower RMSE values for all three indicators, as shown in Table 9. According to the criteria set out by Shmueli et al. (2019), the PLS-SEM RMSE values in this study did not exceed the LM benchmarks, confirming the model's strong predictive power. This strengthens confidence in the model's reliability and demonstrates its practical significance.

4.5. Structural model analysis and hypothesis testing

The structural model is assessed after the measurement model is validated (Hair et al., 2019). Hypotheses are tested using bootstrapping with 5,000 subsamples to estimate path coefficients, t-statistics, confidence intervals (CI) and p -values (Ringle et al., 2022). A t -value outside the range of -1.96 to $+1.96$ and a p -value below 0.05 indicate statistical significance. The results of the structural model analysis are shown in Table 10.

4.5.1. Direct effects on SMEs performance

The structural model was evaluated using PLS-SEM to examine the effects of digital technology adoption on SMEs performance in the Tanzanian fruit juice processing industry. Figure 3 presents the path model, and Table 10 summarises the estimated path coefficients. Digital technology adoption demonstrated a

Table 9. PLSpredict Prediction statistics for SMEs performance (MV level).

Indicator	Q^2	PLS-RMSE	LM-rMSE	PLS-MAE	LM-MAE
PEF1	0.219	0.469	0.473	0.376	0.384
PEF2	0.253	0.466	0.475	0.377	0.387
PEF3	0.310	0.433	0.445	0.353	0.365

Source: SmartPLS output, 2025.

Table 10. Summary of path coefficients and hypothesis testing results.

Hypothesis	Path	β	t-value	p -value	95% CI		Results
					2.5%	97.5%	
H1	DTA $\rightarrow$ PEF	0.419	10.270	0.000	0.339	0.499	Supported
H2	OR $\rightarrow$ PEF	0.237	5.523	0.000	0.152	0.323	Supported
H3	OR $\times$ DTA $\rightarrow$ PEF	0.015	0.302	0.762	-0.084	0.108	Not supported
H4	EO $\rightarrow$ PEF	0.204	5.181	0.000	0.125	0.282	Supported
H5	EO $\times$ DTA $\rightarrow$ PEF	-0.075	1.831	0.067	-0.159	0.003	Marginal
H6	EE $\rightarrow$ PEF	0.188	4.818	0.000	0.114	0.265	Supported
H7	EE $\times$ DTA $\rightarrow$ PEF	-0.139	3.070	0.002	-0.229	-0.051	Supported

Source: SmartPLS output, 2025.

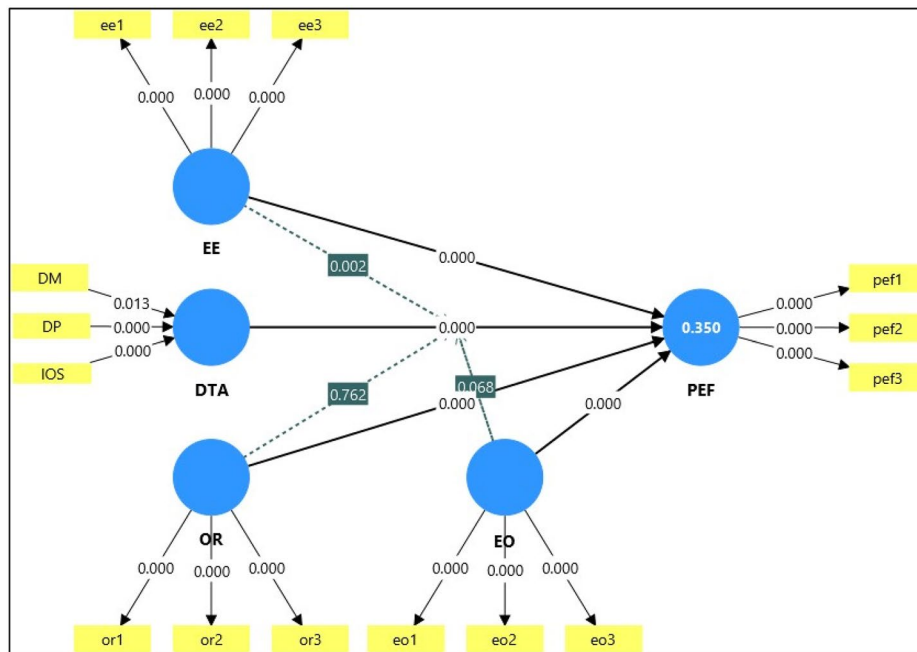


Figure 3. Path analysis results.
Source: SmartPLS output, 2025.

strong and statistically significant positive effect on SMEs performance ($\beta=0.419$, $p<0.01$). This coefficient represents the largest effect size in the model, indicating that digital technology adoption is the most influential predictor of SMEs performance among the constructs examined. This finding provides empirical support for H1, which posits that digital technology adoption has a significant positive effect on SMEs performance. In addition, the model examined the effect of the external environment, organisational readiness and entrepreneurial orientation. These constructs were specified not only as direct predictors of SMEs performance but also as moderators of the relationship between digital technology adoption and SMEs performance. As shown in Table 10, the external environment had a significant direct effect on SMEs performance ($\beta=0.188$, $p<0.01$), supporting H6, which states that the external environment has a positive and significant effect on SMEs performance. Similarly, organisational readiness demonstrated a significant positive effect on SMEs performance ($\beta=0.237$, $p<0.01$), lending support to H2, which states that organisational readiness has a positive and significant influence on SMEs performance. Furthermore, entrepreneurial orientation had a meaningful, statistically significant positive effect on SMEs performance ($\beta=0.204$, $p<0.01$), supporting H4, which posits that entrepreneurial orientation has a positive and significant effect on SMEs performance. These results indicate that, while digital technology adoption remains the dominant construct in influencing SMEs performance, each of the other constructs, i.e. external environment, organisational readiness and the entrepreneurial orientation, contributed meaningfully and independently to SMEs performance improvement.

4.6. Moderation effects

This study hypothesised that the external environment, organisational readiness and entrepreneurial orientation would moderate the relationships between digital technology adoption and SMEs performance. PLS SEM enhances the accuracy of moderator effect estimates by correcting errors that could weaken the relationships, thereby improving the validation of theoretical models (Chin et al., 2003). To test the moderating effects, interaction terms were created by multiplying the exogenous variables (external environment, organisational readiness and entrepreneurial orientation) with the HOC construct, digital technology adoption. The results, presented in Table 10, show a statistically significant negative interaction effect ($\beta = -0.139$, $t=3.070$, $p<0.01$) of the external environment on the relationship between digital technology adoption and SMEs performance, as illustrated in the interaction plot in Figure 4. This finding

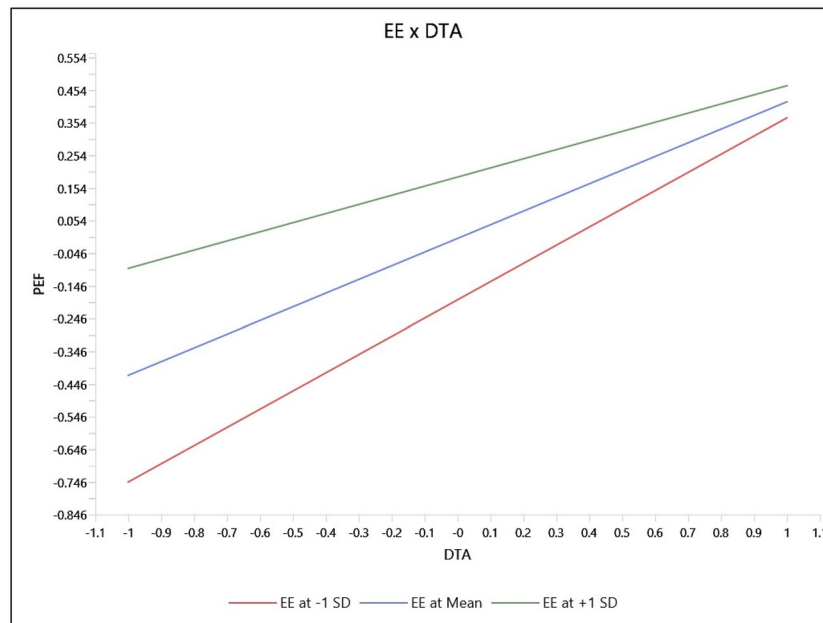


Figure 4. Interaction plot – $EE \times DTA \rightarrow PEF$.

Source: SmartPLS output, 2025.

contradicts H7, which anticipated a positive moderating influence. In contrast, the interaction effect of organisational readiness on the relationship between digital technology adoption and SMEs performance was statistically insignificant ($\beta=0.015$, $t=0.302$, $p=0.762$), implying that organisational readiness does not significantly moderate the effect of digital technology adoption on SMEs performance, and thus, H3 is not supported. The interaction effect of entrepreneurial orientation was marginally significant and negative ($\beta = -0.075$, $t = 1.831$, $p=0.067$), offering only tentative evidence against H5, which predicted a positive moderating effect. These findings highlight the complexity and varying influences of the moderators in this context.

5. Discussion of findings

5.1. Direct effect

The direct effects analysis demonstrates that digital technology adoption, along with the external environment, organisational readiness and entrepreneurial orientation, all have a significant positive effect on SMEs performance in the fruit juice processing industry in Tanzania. These findings lay a foundation for further examination of each factor's influence and their roles in shaping performance outcomes, which are discussed in detail in the following subsections.

5.1.1. Digital technology adoption and SMEs performance

The current study examined the effect of digital technology adoption on SMEs performance in the Tanzanian fruit juice processing industry. As shown in Table 10, digital technology adoption had a strong, statistically significant positive effect on SMEs performance ($\beta=0.419$, $p<0.01$). These findings indicate that SMEs that effectively adopt and integrate digital tools, particularly digital marketing platforms, digital payment systems and internal operations management solutions, are more likely to achieve improved performance outcomes. Such outcomes include increased sales, improved customer acquisition and enhanced profitability. From a theoretical perspective, the findings align with the RBV framework, which posits that firm performance is primarily driven by the valuable resources a firm possesses and by how effectively they are utilised (Barney, 1991; Wernerfelt, 1984). In this context, integrating digital tools into SME operations builds a strategic resource base that meets the VRIN criteria (valuable, rare, inimitable and non-substitutable), thereby creating a sustainable competitive advantage. Moreover, when combined

with other internal capabilities such as skilled labour, management expertise, and organisational culture, these resources create SME-specific capabilities that are difficult for competitors to imitate and adaptable to changing market conditions.

These findings are consistent with previous research showing that digital technology adoption improves operational efficiency, expands market reach, improves customer satisfaction and ultimately strengthens overall firm performance (Deku et al., 2024; Naibaho et al., 2025; Pratamansyah, 2024). Evidence from recent studies further demonstrates that SMEs adopting digital tools often experience direct commercial benefits, including increased sales and improved customer experiences (Fatorachian et al., 2025; Ismael et al., 2025; Mittal et al., 2025). Similarly, internal management systems, such as accounting and inventory management, have helped reduce operational costs and boost productivity (Hoai et al., 2022; Wibowo et al., 2020). In the Tanzanian context, Mushi (2024) emphasises the role of digital marketing in driving SMEs performance in Mbeya City, supporting the findings of this study. This finding aligns with broader trends where digital adoption in SMEs, particularly in developing countries, leads to competitive advantages such as market expansion and enhanced operational efficiency (Roman & Rusu, 2022; Titis et al., 2024). Beyond direct sales impacts, digital adoption improves financial management, resource utilisation and data-driven decision-making, all of which are essential for long-term growth and sustainability. The findings of this study also support those of Hanelt et al. (2021) and Martínez-Caro et al. (2020), who emphasise that aligning digital technology adoption with a firm's strategic goals and fostering a digital culture are critical for maximising performance outcomes. However, these results contrast with other studies suggesting that the effects of digital adoption are not uniform, with benefits varying across different contexts (Guo et al., 2023; Usai et al., 2021; Viète & Erdsiek, 2020). This highlights the importance of recognising that the benefits of digital adoption are not guaranteed and must be tailored to the specific context of each firm to ensure reliable outcomes.

5.1.2. External environment and SMEs' performance

The findings of this study, shown in Table 10, indicate that the external environment has a significant positive effect on SMEs performance in the fruit juice processing industry, with a path coefficient of $\beta=0.188$ ($p<0.01$). This suggests that external factors such as market competition, regulatory frameworks and institutional support shape SMEs performance in this context. These results indicate the importance of strategic alignment with the external environment for SMEs looking to enhance their competitiveness and operational success. From the RBV perspective, this aligns with the notion that a firm's competitive advantage is not solely dependent on its internal resources but is also influenced by the external environment. Additionally, the findings align with RBV's assertion that a firm's success is contingent on its ability to align internal resources with external opportunities (Barney, 1991). In this case, favourable external conditions, such as supportive government policies and market stability, enable SMEs to leverage their internal capabilities better, thereby improving their performance outcomes. This view is supported by Kitole et al. (2024), who highlight that the Tanzanian government's initiatives to promote digitalisation have created a favourable ecosystem for agro-processing SMEs. Previous research also supports this contention, showing that SMEs operating in favourable external environments, characterised by institutional support and market stability, are more likely to achieve competitive advantage and improved performance (O'Cass & Sok, 2015). The findings from this study further affirm that a firm's ability to capitalise on external opportunities alongside its internal resources is crucial for enhancing performance and maintaining a competitive advantage in the contemporary business landscape.

5.1.3. Organisational readiness and SMEs' performance

The findings of this study, shown in Table 10, indicate that organisational readiness has a direct, significant and positive effect on SMEs performance. This result underscores the crucial role of internal capabilities in fostering business success in the SME context. This result supports the RBV Theory, which asserts that a firm's competitive advantage is shaped by its internal resources and capabilities (Barney, 1991). In this case, organisational readiness, encompassing financial resources, skilled human capital, technological infrastructure and a supportive organisational culture, serves as a key enabler for SMEs to adopt and effectively implement digital tools. The significance of these capabilities is especially evident

in the context of SMEs in Tanzania, where resource constraints often limit the adoption of digital tools. The study suggests that SMEs with higher organisational readiness are better equipped to overcome these limitations, enabling them to leverage digital technologies more effectively and thereby improving efficiency, innovation and competitiveness. Empirical research supports this notion, as studies have shown that SMEs with high levels of organisational readiness are more likely to benefit from digital technology adoption. For instance, Michelotto and Joia (2024) and Machado et al. (2021) highlight that organisational readiness contributes to a firm's ability to integrate digital tools, thereby enhancing performance. In the Tanzanian context, the findings are consistent with Ishengoma and John (2025), who argue that SMEs with sufficient internal capabilities, such as technological infrastructure, are better positioned to address digital adoption challenges and improve performance. Similarly, the availability of financial and technological resources, as determined by Omrani et al. (2024), facilitates the investment in digital solutions, while a digitally skilled workforce ensures the successful implementation of these technologies, leading to productivity improvements (Kallmuenzer et al., 2025). Additionally, strong leadership and management support, which are integral aspects of organisational readiness, are essential for aligning digital initiatives with business goals and fostering a culture that embraces technological change. Thus, this finding emphasises that organisational readiness is crucial for SMEs in emerging economies such as Tanzania to successfully adopt digital technologies, and that targeted investments in key internal capabilities are essential for achieving sustained performance and gaining a competitive edge.

5.1.4. Entrepreneurial orientation and SMEs' performance

Entrepreneurial orientation, as shown in Table 10, was found to have a significant and positive direct effect on SMEs performance ($\beta = 0.204$, $p < 0.01$). This finding reinforces the idea that an entrepreneurial mindset is vital to improving business performance. According to the RBV Theory, this context shows the strategic stance of an SME, characterised by innovativeness, risk-taking and proactiveness- traits that help SMEs spot and capitalise on emerging opportunities. These qualities enable SMEs to adapt to market changes and manage uncertainty (Sudirman et al., 2025; Vrontis et al., 2022). In highly competitive environments, these capabilities become vital for business success. SMEs with a strong entrepreneurial orientation are better equipped to pursue product and process innovations, introduce market-driven changes, and adopt flexible strategies, all of which contribute to superior performance. The positive relationship between entrepreneurial orientation and SMEs performance is well-supported in the literature. Studies show that entrepreneurial orientation contributes to performance across various contexts and the relationship is dynamic, with different dimensions of EO, such as risk-taking, playing a particularly strong role in driving performance (Alarape, 2013; Andriani et al., 2024; Bauweraerts et al., 2023; Khan et al., 2021). This highlights the notion that entrepreneurial leaders tend to be more open to innovation, willing to experiment with new technologies and proactive in aligning strategic goals with operational execution (Dwumah et al., 2024; Fang et al., 2022; Lin et al., 2020). Their ability to lead change and inspire a shared vision allows SMEs to integrate digital tools more effectively into their business processes (Ari & Temizkan, 2025; Zacca & Selen, 2011). This alignment not only facilitates technology adoption but also maximises its impact on productivity and competitiveness. In subsectors such as fruit juice, entrepreneurial managers who understand both domains can leverage digital technologies to drive transformative growth. Therefore, cultivating entrepreneurial orientation within SMEs becomes a strategic asset, not only for fostering innovation but also for translating digital adoption into measurable performance gains.

5.2. Moderation analysis

5.2.1. Moderation effect of the external environment

External environment on the relationship between digital technology adoption and SMEs performance ($\beta = -0.139$, $p < 0.01$). This suggests that the external environment plays a crucial role in determining how effectively SMEs can leverage digital technologies to enhance their performance. In highly supportive environments, characterised by established business networks, traditional methods and stable market conditions, SMEs may not perceive an immediate need for digital adoption. As a result, the integration of digital technologies may be superficial, limiting their potential to deliver substantial performance

improvements. On the other hand, in more challenging environments where factors such as weak institutional support or unstable market conditions prevail, SMEs are more likely to view digital technologies as a strategic necessity. In these contexts, digital technologies become critical to survival, prompting a more thorough and strategic adoption that ultimately enhances SMEs performance. This finding aligns with the Resource-Based View (RBV) Theory, which posits that both internal capabilities and external conditions shape a firm's competitive advantage. In supportive environments, SMEs can rely on traditional resources such as business networks and established methods, reducing the urgency to adopt digital technologies. This leads to shallow integration of digital technologies, preventing firms from realising their full potential. In contrast, in more resource-constrained and turbulent environments, digital technology becomes a rare and valuable resource, essential to maintaining competitiveness. According to RBV, this strategic adoption of digital tools offers SMEs a unique, inimitable advantage, enhancing their performance and competitive edge.

These findings are consistent with previous empirical studies that highlight the moderating role of the external environment in shaping the effectiveness of digital adoption. For example, Rajala and Hautala-Kankaanpää (2023) argue that environmental turbulence heightens the need for digital transformation, making digital tools more valuable in dynamic and uncertain settings. This supports the view that SMEs in challenging environments are more likely to adopt digital technologies strategically, as they offer a vital resource for survival. However, the literature offers contrasting findings. Some studies suggest that in supportive environments, digital adoption is enhanced by complementary effects, where stable conditions foster more successful integration of digital technologies (Kallmuenzer et al., 2025). This argues that well-established business networks and market stability can facilitate digital integration, thereby amplifying its benefits. In contrast, the present findings suggest a compensatory effect, where in less favourable external conditions, digital technologies serve as a necessary substitute for structural and operational resources. In these contexts, digital tools help SMEs overcome challenges such as limited access to infrastructure or support, providing the agility, efficiency and resilience needed to sustain performance. This contrasts with studies that show complementary effects in stable environments, where external conditions enhance the adoption and benefits of digital tools. Our results argue that the lack of favourable external resources can lead SMEs to adopt digital technologies out of necessity rather than opportunity, making the strategic integration of digital tools crucial for performance improvement.

5.2.2. Moderation effect of entrepreneurial orientation

The moderation analysis shown in Table 10 indicates a marginally significant negative interaction effect of entrepreneurial orientation (EO) ($\beta = -0.075$, $p = 0.067$) on the relationship between digital technology adoption and SMEs performance. This suggests that when entrepreneurial orientation is high, the positive performance benefits of digital technology adoption may be slightly weakened. In this context, SMEs that embrace strong entrepreneurial postures may pursue multiple innovations concurrently. Without sufficient resources, such simultaneous pursuits can scatter managerial attention, stretch internal capabilities and degrade the effective implementation of digital tools, thereby reducing performance gains. From a theoretical standpoint, drawing on the Resource-Based View and the VRIN (Valuable, Rare, Inimitable, non-substitutable) criteria, digital technology adoption itself may constitute a VRIN resource when it is adequately aligned with internal capabilities. However, high entrepreneurial orientation may prompt firms to adopt a breadth of initiatives, diluting focus and undermining the 'rare' and 'non-substitutable' potential of the digital asset. In other words, despite entrepreneurial orientation typically being positive, it can undermine the VRIN status of digital adoption by dispersing efforts and reducing the inimitability of the digital resource base.

Empirical studies offer contrasting findings. For instance, research in emerging economies has confirmed a positive link between entrepreneurial orientation and both digital media adoption and SMEs performance. Effects of entrepreneurial orientation on social media adoption and SMEs performance: The moderating role of innovation capabilities found that entrepreneurial orientation positively influenced SMEs performance through social media adoption, with this effect moderated by innovation capabilities (Fan et al., 2021). Meanwhile, another study by Suder et al. (2025) showed that EO's positive effect on performance is strengthened under crisis conditions, with digitalisation, inter-organisational cooperation

and diversification as moderators. These findings diverge from ours, in which higher entrepreneurial orientation appears to weaken the DTA-performance link rather than strengthen it. The difference may stem from context: prior work often examines EO's direct effect or favourable moderating conditions. At the same time, our study captures a negative moderation in a setting characterised by limited resources and multiple digital initiatives. In this environment, high entrepreneurial orientation may lead to initiative overload rather than concentration, reducing the efficiency of digital adoption.

5.2.3. Moderation effect of organisational readiness

The findings of this study show that organisational readiness does not significantly moderate the relationship between digital technology adoption and SMEs performance ($\beta = 0.015$, $p = 0.759$). This suggests that for simpler digital technologies, such as mobile payments, social media marketing and e-commerce, performance benefits can be immediate and impactful, even with minimal organisational readiness. These technologies are relatively straightforward to implement, and SMEs in emerging economies can achieve quick gains without advanced internal preparedness. However, the findings also imply that organisational readiness becomes increasingly important for more advanced digital technologies. As SMEs progress towards digital maturity, tools that require more complex integration, such as robotics, demand higher levels of organisational readiness, including adequate technological infrastructure, skilled human capital and strategic alignment. In such contexts, the moderating influence of organisational readiness would likely be more pronounced, as its role in successfully adopting and integrating these technologies becomes critical for sustained performance improvements.

In the context of the RBV Theory in the VRIN criteria, the result suggests that those basic digital technologies function primarily as valuable and accessible resources, but may not yet require the full suite of internal VRIN resources (such as highly sophisticated infrastructure or rare human capital) to generate performance gains. However, RBV would predict that for more advanced digital technologies, which are more complex and costly, the role of internal organisational readiness becomes critical. In such cases, the resources must meet all VRIN criteria to produce a sustained competitive advantage. In other words, the non-significant moderating role of readiness here is consistent with the nature of the technologies studied (lower complexity, straightforward implementation). Empirical literature provides both support and contrast. On the one hand, Michelotto and Joia (2024) emphasise the importance of organisational readiness dimensions for successful digital transformation, thereby suggesting that readiness matters in many cases. On the other hand, Mutesi et al. (2025) show that simpler digital tools, like social media, can improve SMEs performance even with minimal organisational readiness. This contrasts with our findings, which show that the moderating effect of readiness is not significant in this context. The difference may stem from the nature and complexity of the technologies: when digital adoption moves from basic digital tools to advanced systems (AI, robotics, integrated platforms), organisational readiness likely becomes a stronger moderator. Therefore, our finding diverges from studies that assume readiness always enhances digital adoption outcomes, highlighting that its significance depends on technology complexity and contextual maturity.

6. Contributions, limitations and avenues for research

6.1. Contributions of the study

This study contributes to the RBV Theory by contextualising it to the digital technology adoption in the Tanzanian fruit juice processing industry. The findings provide valuable insights into the effect of digital technology as a strategic resource for improving SMEs performance. By building on the RBV, this study reveals the mechanisms through which digital adoption influences SMEs performance, demonstrating the interaction between internal technological resources and external environmental contexts. It strengthens the theoretical framework by showing how integrating digital tools with SMEs capabilities creates a sustainable competitive advantage.

Empirically, the study provides sector-specific evidence from Tanzania, enriching existing knowledge about the circumstances under which digital adoption leads to performance gains in SMEs. Examining moderating factors such as entrepreneurial orientation, organisational readiness and the external

environment sheds new light on the adoption process. These findings advance understanding of when digital adoption is most effective, emphasising that, although the external environment plays a significant role, entrepreneurial orientation has a marginal but meaningful impact on the strength of the adoption–performance relationship.

From a practical standpoint, the study offers SMEs, policymakers and technology providers a clearer understanding of the conditions that shape effective digital adoption. The findings show that aligning digital initiatives with internal capabilities and the external environment is crucial for achieving stronger performance outcomes. For SMEs, this implies that technological infrastructure, adaptability and an innovation-driven culture are vital for translating the adoption process into performance improvements. For policymakers, the results emphasise the significance of broader ecosystem factors, such as infrastructure, regulatory clarity and institutional support, in enabling SMEs to leverage digital technologies more effectively. Likewise, the study underscores that technology providers play a key role in ensuring digital solutions reflect the operational realities of SMEs, suggesting that solutions customised to organisational needs and market conditions tend to be more impactful.

In essence, this study illuminates the transformative potential of digital technology adoption for SMEs. It offers a roadmap for navigating the digital adoption process, accounting for interactions between internal resources and external factors. This theoretical and empirical contribution enriches the literature on digital transformation in SMEs and offers practical solutions for improving competitiveness and sustainability in emerging markets.

6.2. Limitations and avenues for research

Despite its valuable contributions, this study has several limitations that open avenues for future research. Firstly, focusing on SMEs within the Tanzanian fruit juice processing industry offers rich contextual insights but restricts the generalisability of the findings to other sectors or national contexts. Digital adoption dynamics are likely to differ across industries with varying technological intensities, competitive pressures, and regulatory frameworks, and future research could replicate or expand this work across multiple sectors and countries to identify sector-specific or cross-contextual patterns.

Secondly, the cross-sectional design limits the ability to establish causal relationships or to capture how digital adoption and its performance outcomes change over time. Longitudinal, panel, or mixed-methods approaches would enable researchers to observe digital transformation as a dynamic process, providing deeper insights into temporal shifts in adoption behaviour, capability development and environmental influences.

Thirdly, the marginally significant negative interaction between entrepreneurial orientation and digital technology adoption – SMEs performance relationship raises conceptual questions that warrant further empirical investigation. This pattern suggests that entrepreneurial orientation may not consistently improve digital adoption outcomes and may interact with organisational or contextual factors in more complex ways. Future studies could explore different dimensions of entrepreneurial orientation and test for mediating or moderating mechanisms, such as absorptive capacity, strategic alignment, or market turbulence. Qualitative research could shed light on how SMEs interpret opportunities and risks related to digital technologies and how these interpretations influence adoption and performance outcomes.

Lastly, additional research could broaden the theoretical framework by incorporating perspectives such as dynamic capabilities, institutional Theory, or socio-technical systems Theory to better explain the link between internal capabilities, external conditions and digital adoption outcomes.

7. Conclusion and recommendation

7.1. Conclusion

Digital technology adoption is increasingly recognised as a strategic pathway for enhancing the performance, competitiveness and long-term sustainability of SMEs. Given its growing significance across various sectors, it is essential to understand how such adoption influences performance within specific contexts. Based on data collected from 390 SMEs within Tanzania's fruit juice processing industry across

six districts, this study demonstrates that the adoption of digital technology exerts a notably positive effect on SMEs performance. Furthermore, the analysis affirms that entrepreneurial orientation, organisational readiness and external environmental factors positively influence SMEs performance, thereby underscoring the importance of internal capabilities and contextual conditions. However, moderation analysis indicates that the external environment negatively moderates the relationship between adoption and performance, suggesting that in highly supportive settings, SMEs may adopt digital tools superficially. Conversely, in more challenging environments, adoption is more strategic and performance-oriented. Entrepreneurial orientation exhibits a marginally significant adverse moderating effect, suggesting that highly entrepreneurial SMEs may experience resource dispersion, thereby slightly undermining the benefits of digital adoption. Organisational readiness did not demonstrate a significant moderating effect, implying that performance improvements attributable to digital technologies can be realised even with limited internal resources and preparedness.

This study contributes to Theory by extending the Resource-Based View (RBV) framework to the context of digital technology adoption in SMEs. It emphasises how integrating digital tools with organisational capabilities creates a sustainable competitive advantage and demonstrates how internal resources interact with external conditions to influence performance outcomes. Empirically, it offers sector-specific evidence from the Tanzanian fruit juice industry, deepening understanding of when and under what circumstances digital adoption results in tangible performance improvements. Practically, the findings guide SMEs, policymakers and technology providers: effective digital adoption requires aligning technological initiatives with internal capabilities and the external environment, while supportive policies, infrastructure and customised technology solutions increase the likelihood of successful adoption and enhanced performance.

Despite these contributions, the study has limitations that highlight areas for future research. Its focus on a single sector in Tanzania restricts generalisability and subsequent studies could explore other industries or national contexts to assess cross-contextual applicability. The cross-sectional design also limits causal inference and understanding of temporal dynamics, emphasising the need for longitudinal or mixed-methods approaches. Additionally, the marginally significant negative interaction between entrepreneurial orientation and digital adoption merits further investigation, possibly through studies examining specific dimensions of entrepreneurial orientation, mediating mechanisms, or qualitative insights into SME adoption behaviours. Finally, extending the theoretical lens to include frameworks such as dynamic capabilities, institutional Theory, or socio-technical systems Theory could provide a richer explanation of how internal and external factors collectively influence digital adoption and SMEs performance. Overall, this study highlights that the performance benefits of digital technology adoption depend on the strategic alignment of internal resources with external opportunities and constraints, providing both theoretical insights and practical guidance for enhancing SME competitiveness in emerging markets.

7.2. Practical recommendations

Based on the findings of this study, the following recommendations are offered to inform SMEs, policymakers and development stakeholders on strategies to enhance digital technology adoption and drive performance improvements in the fruit juice industry and comparable SME sectors.

- i. Given the strong and positive influence of digital technology adoption on SMEs performance, SMEs should be encouraged to implement digital integration across key operational domains. These can include digital marketing platforms, digital payment systems and internal operations management solutions, including inventory, finance and supply chain management systems. Development agencies, ICT service providers and SME networks should support SMEs through awareness campaigns, practical demonstrations and subsidised access to affordable, scalable digital tools. Policymakers should incentivise digital adoption by offering innovation grants or digital investment credits to SMEs that adopt technology for business improvement.
- ii. The study emphasises that organisational readiness is an important factor directly influencing SMEs' performance. Capacity-building programs should aim to improve SME managerial skills, digital literacy and strategic planning. Government and private-sector entities should invest in SME-focused

training that enhances the technical and managerial skills needed for digital transformation. Importantly, targeted interventions should focus on women- and youth-led SMEs, which often face additional barriers to adoption.

- iii. Entrepreneurial orientation not only directly enhances SMEs performance but also minimally moderates the relationship between digital technology adoption and performance. To leverage its benefits, policy-makers, business development service providers and incubators should cultivate entrepreneurial mind-sets among SME owners and managers. Practical interventions such as entrepreneurship bootcamps, mentoring programs and start-up accelerators can help SMEs develop the skills to identify digital opportunities and integrate them effectively. This will ensure that entrepreneurial potential translates into sustained SME growth even when its moderating influence on digital adoption is limited.
- iv. The study found that the external environment significantly influences SMEs performance and moderates the effect of the digital adoption–performance link. Digitalisation strategies should be context-sensitive. Policymakers must create an enabling environment for investment in infrastructure, reliable and affordable internet connectivity, digital finance ecosystems and regulatory support to level the playing field for SMEs in under-resourced areas. Meanwhile, SMEs should adopt adaptive strategies by aligning their digital investments with prevailing market conditions, resource availability and competitive intensity. Business support organisations can assist SMEs in conducting external environment assessments to inform the development of their digital strategy.

Acknowledgements

We extend our sincere thanks to the management of the SMEs, the enumerators and the relevant government authorities for their valuable cooperation during the data collection process. We would also like to express our most profound appreciation to the late Dr Romanus Dimoso (PhD), who served as a major supervisor during the initial stages of the study, including data collection. His guidance and dedication greatly contributed to the development of this masterpiece. May his soul rest in peace. .

Authors contributions

CRedit: **Dickson Utonga**: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Visualization, Writing – original draft, Writing – review & editing; **Charles Stephen Tundui**: Supervision, Validation, Writing – review & editing; **Eliaza Mkuna**: Supervision, Validation, Writing – review & editing.

Disclosure statement

The authors reported no potential conflict of interest.

Funding

This research received no external funding.

About the authors

Dickson Utonga is a Doctoral candidate in the Department of Economics at Mzumbe University, Morogoro, Tanzania. He also works as a Lecturer at Tengeru Institute of Community Development (TICD) in Arusha, Tanzania. He has extensive experience in economics and business management. His research interests include digital transformation, development economics, macroeconomic dynamics, agricultural economics, business management, and development policy. He regularly publishes in renowned regional and international journals. Outside academia, he is a consultant with expertise in strategic planning, project management, and curriculum development. He is dedicated to developing evidence-based solutions through research.

Charles Stephen Tundui is a Professor at Mzumbe University, where he also serves as Deputy Principal at the Mbeya Campus College. He holds a PhD from the University of KwaZulu-Natal and has over thirty years of experience in project planning, management, and strategic planning. His areas of expertise include economics, microfinance, and entrepreneurship. Prof. Tundui has contributed extensively to both local and international journals through his publications. He also has significant consulting experience, having developed strategic plans for various councils and colleges in Tanzania.

Eliaza Mkuna is a Senior Lecturer in Agricultural Economics at Mzumbe University, Tanzania. He holds a PhD from the University of KwaZulu-Natal and a postdoctoral fellowship from the University of the Free State, both in South Africa. His career spans impactful roles as a Research Associate at AVRDC-The World Vegetable Center and collaborations on regional trade with Wageningen University. His expertise encompasses agricultural policy analysis, natural resource economics, and value chain development. He publishes and presents extensively on trade, agribusiness, and Africa's development agenda.

ORCID

Dickson Utonga  <http://orcid.org/0000-0001-9037-2825>
 Charles Stephen Tundui  <http://orcid.org/0000-0003-1461-7119>
 Eliaza Mkuna  <http://orcid.org/0000-0001-7682-0740>

Data availability statement

The dataset used during the current study is available from the corresponding author upon reasonable request.

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