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Supply Chain Risk Factors, Technological Capabilities, and Firm Performance of Small to Medium Enterprises (SMEs)

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This study examines the effect of supply chain risk factors on the performance of SMEs in the manufacturing sector of Harare and Zimbabwe. This study also explores the moderating role of technological capabilities in this relationship. A cross-sectional survey of 530 SME owners and managers was conducted via a structured questionnaire. Structural equation modeling (SEM) and moderated regression analysis were used to test the research hypotheses. The study revealed that financial constraints, the availability of skilled labor, information security, and supplier reliability positively influence both financial and operational performance. The results also revealed that technological capability moderates the effects of supply chain risk factors on firm performance. This study recommends that SMEs adopt artificial intelligence, machine learning, and data analytics to manage risk effectively. The key contribution of this study lies in its thorough analysis of diverse risk factors, identification of their positive influence on both financial and operational performance, and novel insight into the moderating role of technological capabilities.

1. Introduction

Globally, the SME sector is increasingly acknowledged as an instrument for economic growth and sustainability (Surya et al., 2021). SMEs provide jobs, reduce poverty, and enhance trade (Marughu & Akintoye, 2023). According to Nakayama (2016), SMEs constitute more than 99.7% of all enterprises, accounting for 70.2% of jobs in Japan. In developing nations such as Vietnam, SMEs account for 98% of the economy, 40% of the GDP, and approximately 50% of industrial production (Thu & Xuan, 2023). However, despite these substantial contributions, the SME sector is susceptible to various internal and external pressures that can impact its performance, survival, growth, and sustainability, with supply chain risk being a notable concern. For example, several researchers have noted that SMEs face stiff competition from large firms. They also face challenges related to protecting intellectual property and political risk, adapting to rapidly changing information technology, and navigating complex legal issues such as national and international trade laws, import/export regulations, and laws in transit states (Lobo et al., 2020).

The importance of SMEs varies worldwide due to their differing levels of economic growth (Muchaendepi et al., 2019). In Zimbabwe, during the colonial era, supply chain dynamics and economic policies were shaped by apartheid, catering primarily to minority groups. A decade after independence in 1980, the policy governing the SME sector was rooted in socialism and highly restrictive. Financial support was limited mainly to registered cooperatives, leaving individual businesses struggling to qualify for government programs (Mhembwe & Dube, 2017). The turning point came with the Economic Structural Adjustment Programme (ESAP) in 1991, which led to a partial shift in the government's approach toward SMEs. However, Zimbabwe's SME landscape continues to face policy-related, internal, and external supply chain risks that require urgent attention from the government and other stakeholders (Muchaendepi et al., 2019).

The ongoing economic meltdown in Zimbabwe, marked by hyperinflation and high interest rates, significantly threatens SMEs in the manufacturing sector by escalating supply chain vulnerabilities and eroding purchasing power. These SMEs also face challenges such as a hostile regu-

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latory environment, limited access to financial resources, inadequate management skills, poor logistics, and insufficient infrastructure (Maphosa & Maphosa, 2022; Matsongoni & Mutambara, 2021; Njanike, 2019). Chinakidzwa and Phiri (2020) noted that transportation issues hinder market access, whereas storage problems limit production capacity, compounded by a lack of appropriate technology and market intelligence. In light of these conditions, SMEs in manufacturing must proactively address supply chain risks and enhance their technological capabilities (Sopha et al., 2021).

Despite their crucial role in driving Zimbabwe's economy, many SMEs have underperformed, leading to numerous business failures (Dlamini & Schutte, 2020). A significant number of SMEs in Harare's manufacturing sector lack effective supply risk management programs, making them vulnerable to disruptions that can adversely affect their operational and financial performance. While the influence of supply chain risk on organizational performance is well recognized, SMEs often struggle with skill gaps, dependence on local suppliers, and information security issues. However, there is limited research on how these factors individually affect firm performance.

While numerous studies have explored supply chain risk in SMEs (Babu et al., 2021; Karmaker et al., 2023; Lukianchuk, 2015) and some have linked supply chain risk to firm performance (Chowdhury et al., 2019), none have specifically examined the impact of supply chain risk factors on the financial and operational performance of SMEs. Additionally, the role of technological capability in moderating the relationship between supply chain risk and firm performance remains unexplored. To address these gaps, this study employs the resource-based view (RBV) and transaction cost economics (TCE) theories to investigate the relationships among supply chain risk factors, technological capabilities, and firm performance in Zimbabwean manufacturing SMEs. The structure of the study is as follows: Section 2 reviews the relevant literature and formulates research hypotheses; Section 3 outlines the methodology; Section 4 presents the results and analysis; and Section 5 discusses the implications of the findings.

2. Literature review

2.1. Theoretical basis

The study is grounded in the resource-based view (RBV) and transaction cost economics (TCE) theories. The RBV posits that a company's competitive advantage and performance are determined by its unique and valuable resources and capabilities, with technological capability identified as a critical resource. This suggests that SMEs with strong technological capabilities are better equipped to manage and mitigate supply chain risk through advanced inventory management systems, real-time data analytics, and digital supply chain platforms that enhance visibility, agility, and responsiveness. Conversely, TCE theory emphasizes the role of transaction costs in shaping supply chain governance structures. It posits that firms select supply chain arrangements to minimize the costs associated with oppor-

tunism, information asymmetry, and risk. In this research, supply chain risk is closely linked to transaction costs, as managing risk often incurs additional expenses. TCE provides a framework for understanding how SMEs make decisions about supply chain governance and risk management strategies, illustrating how strong technological capabilities can lead SMEs to adopt advanced governance models, such as digital platforms or collaborative partnerships, to reduce transaction costs related to supply chain risks.

2.1. Supply chain risk

The concept of risk generally refers to the possibility of failure, harm, damage, or loss due to unexpected events. It can also encompass potential disruptions, uncertainties, and vulnerabilities that may impact the production, distribution, and delivery of goods, finances, and related information within a supply chain (Gao et al., 2020). SMEs are constantly exposed to various risks, and their vulnerability is heightened due to their limited financial and non-financial resources. Dvorsky et al. (2021) noted that risk management has become a critical issue affecting the performance of SMEs, often due to insufficient resources and support mechanisms for their risk management activities. According to Tan and Lee (2022), SMEs face risks such as interest rates, raw material prices, technological changes, supply chains, growth, and human resources. This study specifically focuses on financial constraints, the availability of skilled employees, supplier reliability, and information security risks.

2.1.1. Financial constraints

Financial constraints can be defined as the inability to access and access financial resources (Nikolov et al., 2021). They added that financial constraints can be attributed to poor accounting, financial, and regulatory systems; competition and policies affecting the supply of financing, such as interest rates; and the lack of awareness of available funding sources. Such limitations can exacerbate credit risk and transaction costs for SMEs. Financial constraints can manifest as operational risk, cash flow risk, investment and growth risk, debt risk, market and competitive risk, credit risk, and quality and productivity risk. Formal capital lenders often demand collateral to manage their risk exposure, but many SMEs often struggle to meet security requirements, limiting their access to financial resources (Kokeyeva, 2019). The ability of SMEs to effectively contribute to the economy hinges on their survival, yet the sector faces low survival rates. Approximately 20% of start-ups exit the market within their first year, with many others following in subsequent years. Only a small fraction achieves rapid growth. Ngassa et al. (2020) emphasized that various external and internal factors contribute to the short life expectancy of small enterprises, including financing obstacles, taxation, regulation, corruption, crime, early international expansion, and inadequate management skills.

2.1.2. Availability of skills

Previous studies have consistently highlighted the crucial role of skill availability in mitigating supply chain risk and ensuring success. Skills such as team motivation, managerial prowess, personal integrity, and sound decision-making are essential for overall firm performance (Popescu et al., 2020). Competencies also underpin vital aspects of supply chain management, including moral character, strategic planning, and flexibility in changing environments, with effective problem solving emerging as the key competency for manufacturing companies to manage supply chain risk. While skill shortages vary significantly between nations, there is a common concern about the inadequately prepared domestic workforce to meet the manufacturing sector's requirements (Heyns & Luke, 2012). Additionally, Piroșcă et al. (2021) highlight the growing demand for specialized skills among employers, exacerbating the supply-demand mismatch in the market. According to Prajogo et al. (2012), the availability of skilled workers is crucial for successful operations within the supply chain, even surpassing the importance of physical infrastructure and communication networks.

2.1.3. Supplier reliability

In today's global marketplace, firms increasingly rely on intricate supply chains to remain competitive (Mohammadi, 2020). A significant concern within this complex web is supply chain risk, particularly in procurement. Supplier reliability, defined as a supplier's ability to consistently deliver products, materials, or services on time, in expected quantities, and with agreed-upon quality standards, is critical (Zhu & Krikke, 2020). Organizations depend on their suppliers to fulfill commitments regarding quantity and quality (Niaz, 2022). However, factors such as bankruptcy, production delays, or natural disasters can disrupt this chain and lead to costly operational disruptions (Tseng et al., 2022). SMEs, which often rely on a limited number of suppliers, are particularly vulnerable to such disruptions. If a key supplier faces financial instability or quality issues, the repercussions are multifaceted, posing risks and challenges for organizations (Cadden et al., 2020; Khairunnisa & Shalihin, 2020). Unreliable suppliers can cause production bottlenecks, increase costs, and result in missed delivery deadlines (Toker & Pinar, 2019). They may also fail to meet quality standards, leading to defective products, rework costs, and potential damage to the company's brand reputation (Martinelli, 2019). Furthermore, late deliveries and unexpected supply shortages can disrupt cash flows, undermining the organization's financial stability and inflating costs (Niaz, 2022).

2.1.4. Information security

Threats to information protection are typically characterized by confidentiality, integrity, and availability (Obaidat et al., 2020). Confidentiality restricts access to sensitive and classified information, as disclosing such information to unauthorized parties can harm an organization's strat-

egy and competitiveness (Opudu & Ogoun, 2024). Currently, cybersecurity incidents are prevalent, with small and medium-sized enterprises (SMEs) being exceptionally vulnerable targets. The insufficient cybersecurity resources available to SMEs indicate a diminished capacity to combat cyberattacks. Moreover, owners and managers often face challenges due to a lack of awareness regarding the importance of security tools, leading to the slow adoption of cybersecurity measures (Rawindaran et al., 2023). While previous research has focused primarily on larger firms, SMEs—comprising a significant portion of the private business sector—represent a critical area for further investigation. The literature consistently highlights a lack of seriousness in SMEs' approach to cybersecurity threats, often showing little regard for normative pressures from the cybersecurity community or best practices.

2.2. Firm performance

Firm performance refers to an organization's ability to achieve its market goals and operational objectives (Taouab & Issor, 2019). It can be measured by reduced operational costs and improved profits (Islami et al., 2020) and reflects how effectively a company attains its market-oriented objectives and financial targets (Chukuigwe, 2022). Metrics for assessing firm performance include return on investment, sales growth, market share growth, and competitiveness (Irenaus et al., 2021). Effective implementation of both financial and nonfinancial performance strategies is important for achieving superior firm performance.

2.2.1. Operational performance

Operational performance encompasses quantifiable aspects of an organization's process, such as reliability, cycle time and inventory turns (Liu et al., 2020). Operational performance is characterized by a company's ability to reduce management expenses, order times, and lead times; improve raw material usage; and enhance distribution capacity. The key metrics for assessing operational performance include delivery speed, flexibility, cost, inventory, capital utilization, production quality, on-time delivery, production output, customer satisfaction, employee productivity, and inventory turnover (Ganbold et al., 2021; Liu et al., 2020; Maganha et al., 2020; Munir et al., 2020).

2.2.2. Financial performance

Financial performance refers to a company's financial state over a specific period, encompassing the funds raised and utilized, as assessed by measures such as the capital adequacy ratio, liquidity, leverage, solvency, and profitability (Akuku et al., 2023). Mahmudova (2023) defines financial performance as a metric indicating the extent to which economic goals are achieved. Bondinuba et al. (2022) identify four key areas of financial measures: efficiency, liquidity, profitability, and capital structure. They explain that capital structure assesses the use of owners versus borrowed capital, liquidity focuses on how easily business assets convert to cash during the operating cycle, efficiency

evaluates the management of business resources, and profitability indicates whether the organization is generating profits or incurring losses.

2.3. Technological capabilities

Technological capability encompasses the resources, skills, knowledge structures, and prior experiences that facilitate the generation and management of technological change. It is an ongoing process involving the absorption, application, transfer, and publication of technology, which enables businesses to deliver unique products and services. This process allows managers to focus on key factors that enhance company performance. Swaminathan (2022) emphasized that technological prowess enables businesses to improve their responsiveness and achieve profitability in fast-paced industries. In support of this view, Amesho et al. (2022) assert that technological capabilities are fundamental for competitive advantage, with knowledge, applications, and innovation being critical for the survival and growth of contemporary organizations. Additionally, to thrive in the global market, businesses must invest in technological capabilities.

2.4. Development of research hypotheses

Supply chain risk management is a crucial element of organizational leverage, significantly influencing firm performance. Manhart et al. (2020) and Munir et al. (2020) established that supply chain risk positively affects operational performance, whereas Yu et al. (2019) confirmed its positive influence on financial performance. Li et al. (2022) further demonstrated that supply chain risk significantly impacts firm performance. These findings underscore the essential role of supply chain risk in enhancing various dimensions of firm performance. However, despite numerous studies highlighting the importance of supply chain risk (Ghadge et al., 2022; Nguyen et al., 2021; L. Zhao et al., 2013), few have specifically examined its effect on financial performance. Thus, the following hypothesis is proposed:

H1: Supply chain risk has a positive effect on financial performance.

H2: Supply chain risk has a positive effect on operational performance.

Financial constraints have been shown to impact investment policy, which, in turn, affects firm performance—a key concern for both stockholders and management. Several scholars have demonstrated the significant influence of financial constraints on firm performance (e.g., Abdisa & Hawitibo, 2021; Altaf & Ahmad, 2019), whereas others have reported a negative relationship (e.g., Chan et al., 2010; Chen & Wang, 2012). Moreover, financial constraints also shape investment decisions, corporate value, and dividend policies (Kim et al., 2021). Access to financial resources plays a crucial role in firm survival, as it fosters short-term growth (Zhang & Lucey, 2022). Similarly, Danylkiv, Hembarska, and Voloshyn (2020) reported that external financing significantly influences the market entry of small firms, increasing competition by strengthening the playing field.

Kabbach-de-Castro, Kirch and Matta (2022) reported that the availability of internal financing constrains asset growth. They argue that firms able to raise more external funds than others grow faster. This focus on financial constraints in recent research is unsurprising. Kasoga (2020) established that the availability of skills positively influences financial performance. This means that skilled employees possess the necessary knowledge and expertise that allows them to complete tasks quickly and accurately, resulting in higher output and potentially increased revenue. Similarly, innovative and skilled employees can develop new products, services, or processes with the potential to generate additional revenue. Additionally, Li (2022) reported that organizations with a skilled workforce require less investment in training and development programs for basic skills, which enables them to save both time and money, allowing resources to be directed toward more strategic initiatives. Cindiyasari, Junarsin & Septiani (2022) reported that there is a significant relationship between firms' intellectual capital and financial performance.

Khan et al. (2021) noted that data breaches and unauthorized access to sensitive information may result in significant financial losses in the form of legal fees, customer complaints, and potential regulatory fines. Similarly, Ciuriak and Ptashkina (2021) emphasized that businesses that possess valuable intellectual property, trade secrets, and proprietary information should safeguard such information and assets to avoid financial losses due to theft or misuse. A study conducted by Chawla and Kumar (2022) revealed that failure to comply with data protection regulations can result in substantial fines and legal penalties that negatively impact financial performance. Hasan Ali, Kurnia & Thurasamy (2021) reported that the implementation of information security management systems positively influences firm performance.

Mohammadi (2020) asserted that the timely provision of reliable and dependable materials and goods reduces the need for costly expeditions, which can significantly increase procurement costs. Conversely, unreliable suppliers may cause delays or quality issues, leading to additional expenses, such as rush orders, rework, or penalties for failing to meet customer commitments that erode profit margins (Zhu & Krikke, 2020). Niaz (2022) noted that reliable suppliers help companies maintain efficient inventory levels, allowing businesses to minimize excess inventory-carrying costs and reduce the risk of overstocking or stockouts. Similarly, Tseng et al. (2022) asserted that unreliable suppliers can disrupt cash flow by causing delays in payments or necessitating unplanned capital investments to mitigate supply chain risk. Hence, we hypothesize the following:

H1a: Financial constraints have a positive effect on financial performance.

H1b: The availability of skills has a positive effect on financial performance.

H1c: Information security has a positive effect on financial performance.

H1d: Supplier reliability has a positive effect on financial performance.

There is consensus in the literature that firms with high financing efficiency or stable access to financing are likely to perform better. Excessive financial constraints can hinder firms' capital investment in research and development (R&D), innovation, and technological upgrades, thereby impeding productivity growth. However, financial limitations and heightened uncertainty may also drive firms to innovate and enhance productivity in pursuit of higher profits. Although many existing studies show a strong relationship between SME productivity and access to finance, many others suggest that the impacts on SME productivity and access to finance are mixed. Ferrando and Ruggieri (2015) reported that financial constraints significantly reduce employee productivity. On the other hand, Davenport (2005) explained that skilled employees possess the necessary expertise to help them complete tasks accurately and quickly, leading to improved productivity. Additionally, Alzoubi et al. (2022) explained that employees with the right skills are less likely to make mistakes or produce defective products, resulting in lower rates of errors and rework. Similarly, when employees possess the required skills, there is less need for extensive training programs, which can be costly and time-consuming. Oppong and Pattanayak (2019) examined whether investing in intellectual capital can improve the productivity of commercial banks in India. Using a panel of 73 commercial banks in India, they reported that some components of intellectual capital improve productivity, whereas others do not.

Cadden et al. (2020) highlighted that supplier reliability ensures seamless production processes by preventing interruptions due to shortages or delays, leading to improved operational efficiency. Reliable suppliers also provide higher-quality materials, reducing defects and minimizing rework, which enhances product quality and lowers operational costs (Khairunnisa & Shalihin, 2020). Furthermore, dependable suppliers often offer competitive pricing and favorable terms to long-term customers, positively influencing profit margins (Toker & Pinar, 2019). Additionally, cultivating long-term relationships with reliable suppliers fosters collaboration, mutual understanding, and customized solutions, which enhance communication and expedite problem resolution, thereby strengthening overall operational performance (Martinelli, 2019).

Several scholars have reported that implementing information security management systems positively impacts firm performance, particularly operational performance (Chege et al., 2020; Hasan et al., 2021). Robust security measures protect sensitive data and prevent unauthorized access, ensuring the confidentiality and security of critical operational information. Similarly, Yaacoub et al. (2022) noted that information security prevents disruptions from cyberattacks, technical failures, and other incidents, thereby maintaining continuous operations. Ilca et al. (2023) further reported that effective security measures enhance an organization's ability to address breaches swiftly, minimizing their impact on operations and customer trust. Perera et al. (2022) reported that failing to protect customer data can lead to negative publicity, reputational damage, reduced sales, difficulty attracting new customers, and ulti-

mately harming financial performance. Based on these insights, we hypothesize the following:

- H2a: Financial constraints have a positive effect on operational performance.
- H2b: The availability of skills has a positive effect on operational performance.
- H2c: Information security has a positive effect on operational performance.
- H2d: Supplier reliability has a positive effect on operational performance.

There are few studies on the moderating role of technological capability on the influence of supply chain risk factors on firm performance. The use of advanced technological tools helps identify potential disruptions early, allowing timely interventions to minimize their impact on firm performance (Ivanov et al., 2019). Moreover, technological capabilities support the creation of flexible supply chain models, which help organisations quickly adapt to changes in demand/supply by leveraging digital solutions and reducing the negative impact of disruptions on operational performance. Yenugula et al. (2023) noted that real-time monitoring and communication tools can reduce time and financial losses by facilitating rapid decision-making and coordination with suppliers. In addition, advanced technologies allow organisations to conduct scenario planning and simulations to assess the potential effect of supply chain disruptions on financial performance (Eslami et al., 2021). Moreover, technological capabilities provide enhanced visibility to supply chain operations, which helps identify potential bottlenecks, vulnerabilities, and alternative sources. This helps organisations reduce the impact of disruptions on financial performance (Mishra et al., 2022). Hence, the following hypothesis is proposed:

- H3: Technological capability moderates the effect of supply chain risk on financial performance.
- H4: Technological capability moderates the effect of supplier chain risk on operational performance.

Based on the preceding discussion, the research model below is proposed:

3. Research Methodology

3.1. Sample and Data Collection

The research utilized a cross-sectional survey to gather data. The target population for this study was the owners and managers of SMEs in the manufacturing sector of Harare, Zimbabwe. The sample size was determined to be 265 firms via Krejcie and Morgan's formula, and a total of 530 questionnaires were distributed to these firms. The questionnaires were sent via email to SME owners and managers in prominent business clusters such as The Complex, Gazaland, Mupedzanhamo, and Siya. The respondents were selected via stratified random sampling, and a high response rate of 79% was achieved, with 397 completed and returned questionnaires. The study included predominantly male (71.4%) and middle-aged (30–50 years) respon-

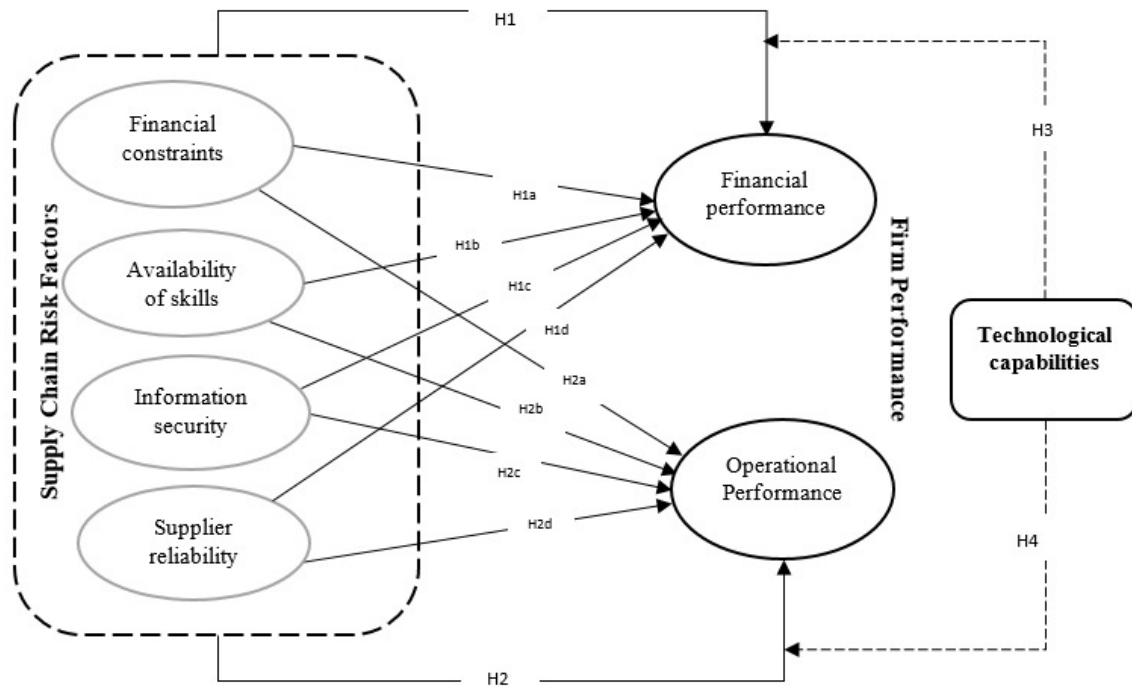


Figure 1. Research Model

dents, which provided a diverse range of perspectives for the study.

3.2. Measurement and Questionnaire Design

The research used a structured questionnaire to collect data. Previous studies were used to define the variables, and the questions on the questionnaire were adjusted to fit the current study. The questionnaire was divided into eight sections to gather information on various aspects, such as demographic characteristics, financial constraints, skills availability, supplier reliability, information security, technological capabilities, financial performance, and operational performance. The scales, items, and sources for the measurement are shown in the figure.

4. Results and discussion

4.1. Scale validation

Before structural equation modeling (SEM) was employed, a thorough validation process was conducted to ensure the reliability and validity of the study. Exploratory factor analysis (EFA) was performed to understand the variable structures and identify measurement items representing the underlying components. The Kaiser-Meyer-Olkin (KMO) test and Bartlett's sphericity test were used to assess sample adequacy, with the sample meeting the significance criterion in Bartlett's test ($p < 0.05$) and a KMO value of 0.637. The factor analysis with varimax rotation converged after 24 iterations, accounting for 70.713% of the total variance and revealing seven components: FCO, AVS, INS, SUR, OPE, FPE, and TEC. The reliability of the measurement items was confirmed, with all the constructs exhibiting Cronbach's alphas exceeding 0.7, indicating high depend-

ability. Additionally, all standardized factor loadings exceeded the minimum criterion of 0.6 ($p < 0.001$), and the average variances extracted (AVEs) for all the constructs surpassed the threshold of 0.5, confirming convergent validity (Fornell & Larcker, 1981). Table 2 shows the λ and CR values.

The measurement model was estimated in the study via maximal likelihood estimation (MLE). Supply chain risk was regarded as a second-order construct, with FCO, AVS, INS, and SUR serving as its representatives. Model fit indices, such as standardized factor loadings (λ), critical ratios (CRs), and average variance extracted (AVE), were evaluated to guarantee convergent validity. Several model fit metrics were employed, including the Tucker-Lewis index (TLI), comparative fit index (CFI), goodness-of-fit index (GFI), adjusted GFI (AGFI), normed fit index (NFI), Tucker-Lewis index (χ^2/Df), and root mean square error of approximation (RMSEA).

To ensure that the measurements used in the study were distinct from each other, we calculated the average variance extracted (AVE) and compared it to the squared interconstruct correlations (SICCs). We found that all AVEs were greater than the SICCs, indicating that discriminant validity was achieved, as recommended by Henseler et al. (2014). The results of the discriminant validity analysis are presented in Table 4.

4.2. Structural Equation Modeling (SEM)

The hypothesized relationships (H1a, H1b, H1c, H1d, H2a, H2b, H2c, and H2d) were tested via AMOS version 21 via SEM. The model fit indices indicated that the data were satisfactory: CMIN/DF = 3.10, GFI = .884, AGFI = .904, NFI =

Table 1. Measurement scales and their sources

Construct	Code	description	Source
Financial constraints	FCO1	Our firm has sufficient financial resources to meet its day-to-day operational needs	Ngassa et al. (2020), Yu et al. (2019)
	FCO2	Our firm can easily secure loans or credit when needed for supply chain investments	
	FCO3	Our organization negotiates favorable payment terms with suppliers to reduce financial strain	
	FCO4	Our organization regularly reviews and updates its risk management strategies to ensure financial stability	
Availability of skills	AVS1	Our organization has access to a highly skilled and trained workforce.	Ciuriak and Ptashkina (2021), Kasoga (2020), Khan et al. (2021)
	AVS2	Succession planning is a priority to ensure a seamless transition of skills and expertise.	
	AVS3	Our organization takes proactive measures to address skill gaps through recruitment or training.	
	AVS4	Knowledge transfer processes are in place to ensure the retention of critical supply chain knowledge.	
Information security	INS1	Our organization has robust measures in place to protect sensitive data.	Chawla and Mohammadi (2020)
	INS2	Our company regularly updates and monitors its cybersecurity practices.	
	INS3	We have a well-defined incident response plan in place to address data breaches or cyberattacks	
	INS4	Access to critical systems and data is restricted to authorized personnel only.	
Supplier reliability	SUR1	Our suppliers consistently meet their promised delivery schedules.	Cadden et al. (2020), Niaz (2022), Mohammadi (2020), Zhu and Krikke (2020)
	SUR2	Our suppliers have a low rate of defective or nonconforming products	
	SUR3	Our suppliers communicate proactively about any potential delays or issues with the supply chain	
	SUR4	Our suppliers are responsive to our changing needs and requirements.	
Operational performance	OPE1	Our organization consistently meets its production schedule.	Ganbold et al. (2021); Liu et al. (2020), Munir et al. (2020).
	OPE2	Our inventory turnover rate is optimized to minimize carrying costs.	
	OPE3	Our organization effectively manages and reduces lead times in its supply chain.	
Financial performance	FPE1	The profitability of our firm has improved over the past	Akuku et al. (2023), Bondinuba et al. (2022), Mahmudova (2023)
	FPE2	Our firm's return on assets (ROA) has increased over the past	
	FPE3	Our firm's gross profit margin has improved over the past	
Technological capabilities	TEC1	Our company uses data analytics and forecasting tools to optimize inventory management	Chege and Wang (2020), Mishra et al. (2022)
	TEC2	We have advanced information systems and software	
	TEC3	Our technology infrastructure enhances communication and collaboration with supply chain partners	
	TEC4	We regularly invest in upgrading our technological capabilities in the supply chain	

.856, TLI = .934, CFI = .936, and RMSEA = .057. [Table 5](#) presents the results of the hypothesis tests.

The moderated regression model is shown in [Table 6](#). The results indicated that the SCR, TEC, and FPE had statistically significant relationships ($t=5.192$, $p< 0.001$). This

suggests that the impact of the SCR on FPE is moderated by the TEC. Furthermore, the data demonstrated a statistically significant correlation ($t=6.020$, $p<0.001$) between the SCR, TEC, and OPE.

Table 2. Constructs, items, λ and CR

Constructs	Variable	Mean value	Standard deviation	λ	CRs	α
FCO	-	-	-	-	-	.922
	FCO1	3.78	.882	.741	9.228***	
	FCO2	4.01	.784	.704	10.529***	
	FCO3	3.80	.805	.619	14.146***	
	FCO4	4.00	.911	.807	13.706***	
AVS	-	-	-	-	-	.834
	AVS1	3.81	.819	.753	8.901***	
	AVS2	3.97	.762	.729	12.911***	
	AVS3	4.13	.787	.642	12.072***	
	AVS4	4.00	.82	.690	10.511***	
INS	-	-	-	-	-	.871
	INS1	4.41	.745	.718	-	
	INS2	4.23	.881	.609	12.842***	
	INS3	3.79	.704	.643	9.565***	
	INS4	4.17	.784	.677	11.215***	
SUR	-	-	-	-	-	.902
	SUR1	4.11	.875	.611	-	
	SUR2	4.01	.807	.744	11.589***	
	SUR3	4.32	.744	.710	9.126***	
	SUR4	3.87	.819	.605	13.676***	
OPE	-	-	-	-	-	.911
	OPE1	4.24	.885	.703	9.462***	
	OPE2	3.80	.915	.742	-	
	OPE3	3.98	.784	.662	10.731***	
FPE	-	-	-	-	-	.899
	FPE1	3.78	.782	.705	11.449***	
	FPE2	4.05	.744	.717	9.016***	
	FPE3	3.81	.815	.685	10.340***	
TEC	-	-	-	-	-	.862
	TEC1	4.22	.745	.703	-	
	TEC2	3.91	.915	.747	8.412***	
	TEC3	4.18	.882	.601	10.741***	
	TEC4	4.03	.881	.613	12.007***	

Note: CR is fixed; *** p < 0.001

Table 3. Measurement model fit indices

Fit indices	Measurement model	Recommended values	Sources
χ^2/Df	2.18	≤ 3.000	Hair et al. (2014), Nayanajith and Damunupola (2019).
GFI	.911	> 0.900	
AGFI	.941	> 0.900	
NFI	.952	> 0.900	
TLI	.940	> 0.900	
CFI	.963	> 0.900	
RMSEA	.052	< 0.080	

Table 4. AVEs and SICCs

Construct	FCO	AVS	INS	SUR	OPE	FPE	TEC
Financial constraints (FCO)	.717						
Availability of skills (AVS)	.321	.559					
Information security (INS)	.228	.332	.640				
Supplier reliability (SUR)	.202	.253	.307	.701			
Operational Performance (OPE)	.337	.276	.276	.222	.655		
Financial performance (FPE)	.313	.339	.301	.239	.322	.722	
Technological capabilities (TEC)	.285	.302	.224	.368	.241	.336	.666

Note: Diagonal elements in bold represent AVEs

Table 5. Hypothesis testing

	Hypothesized Relationships	SRW	CR	Remark
H1 _a	Financial constraints → Financial Performance	.309	8.927***	Supported
H1 _b	Availability of skills → Financial Performance	.204	10.375***	Supported
H1 _c	Information security → Financial Performance	.312	13.320***	Supported
H1 _d	Supplier reliability → Financial performance	.227	8.943***	Supported
H2 _a	Financial constraints → Operational Performance	.289	11.907***	Supported
H2 _b	Availability of skills → Operational Performance	.204	9.374***	Supported
H2 _c	Information security → Operational Performance	.222	10.328***	Supported
H2 _d	Supplier reliability → Operational performance	.307	12.923***	Supported

Notes: SRW standardized regression weight, CR critical ratio, ** significant at p<0.05, *** at p<0.001

Table 6. Moderated Regression

	Hypothesized relationship	Beta	t-statistic	p value
H3	TEC moderates the influence of SCR on FPE	.720	5.192	.001
H4	TEC moderates the influence of SCR on OPE	.701	6.020	.001

5. Discussion and implications

5.1. Discussion

Supply chain risk is a prominent topic in the business world, with numerous studies examining its impact on firm performance across various economic sectors (Munir et al., 2020; Nguyen et al., 2021; Yu et al., 2019). However, a significant gap exists in the literature, particularly with respect to the neglect of SMEs in the manufacturing sector. While a substantial body of research has addressed supply chain risk, most studies focus on developed economies, leaving developing countries, especially in the sub-Saharan region and Zimbabwe, underexplored. This study aims to provide a comprehensive understanding of the intricate relationship between supply chain risk and the performance of SMEs, offering novel insights into the moderating effects of technological capability on this relationship.

In this study, it was found that financial constraints have a positive effect on both the financial and operational performance of SMEs in the manufacturing sector in Zim-

babwe. This means that hypotheses H1a and H2a were supported. This finding is supported by Zhao (2016), who discovered that financial constraints impact investment policy, which in turn may affect firm performance. However, some researchers have reported a negative relationship between financial constraints and firm performance (Campello & Chen, 2010). Musso and Schiavo (2008) stated that financial constraints play a significant role in determining the probability of firm survival because access to external funds increases firm growth in the short run. Other scholars have found that firms with high financing efficiency or stable access to financing have a significantly positive effect on their operational performance. Strong financing constraints inhibit firms' capital investment in research and development (R&D), innovation, and technology upgrading, significantly hindering productivity improvement. Ferrando and Ruggieri (2015) noted that financial constraints significantly reduce employee productivity across all industries.

The study shows that having skilled employees has a positive effect on both financial and operational perfor-

mance. This means that hypotheses H1b and H2b were supported. This finding is supported by Kasoga (2020), who explains that skilled employees can complete tasks quickly and accurately, leading to higher productivity and increased revenues. Similarly, Alzoubi et al. (2022) reported that employees with the right skills are less likely to produce defective products, resulting in lower quality costs and error rates. The results also indicate that information security has a positive influence on both financial and operational performance, meaning that hypotheses H1c and H2c are supported. This finding is consistent with earlier studies that showed that information security breaches can lead to significant financial losses in the form of legal fees, customer notifications, and potential regulatory fines (Ciuriak & Ptashkina, 2021; Khan et al., 2021). Additionally, Chawla and Kumar (2022) noted that failure to comply with data protection regulations can result in substantial fines and legal penalties, negatively impacting financial performance.

This study shows that having a reliable supply positively impacts the financial and operational performance of SMEs in the manufacturing sector. This means that hypotheses H1d and H2d were supported. This finding is in line with Mohammadi (2020), who discovered that dependable suppliers deliver materials and goods on time and as agreed, reduce the need for expensive rush orders that can significantly increase procurement costs. Zhu and Krikke (2020) noted that reliable suppliers help companies maintain efficient inventory levels, reducing excess inventory-carrying costs and the risk of overstocking or stockouts. Additionally, the study revealed that technological capability moderates the impact of supply chain risk on firm performance. Ivanov et al. (2019) reported that advanced technological tools can help firms identify potential disruptions early, allowing timely interventions to minimize their impact on firm performance. Technological capabilities also enhance visibility in supply chain operations, helping to identify potential bottlenecks, vulnerabilities, and alternative sources. Chege and Wang (2020) explained that despite interest in new technologies, SMEs in developing countries still lack knowledge about adopting these technologies. Given the scarcity of empirical evidence on the moderating role of technological capabilities in the relationship between supply chain risk and firm performance, this finding represents a significant contribution to supply chain risk factors.

5.2. Practical implications

This research aimed to understand the connections between supply chain risk factors, technological capabilities, and firm performance. The study revealed that financial constraints, the availability of skilled labor, information security, and supplier reliability all have positive effects on

both financial and operational performance. Additionally, the research concluded that technological capability plays a role in moderating the impact of supply chain risk factors on the performance of SMEs in the manufacturing sector of Harare. These findings have practical implications. First, SMEs should diversify their supplier networks by engaging with at least three reliable suppliers per product category, which can help reduce dependence on a single supplier and enable quick adaptation in the event of supplier underperformance or disruptions. Second, SMEs should focus on building trust-based relationships with their supply chain partners, allowing for the sharing of critical information about potential risks and the development of mitigation strategies.

Third, SMEs should focus on attracting and retaining more skilled employees by addressing both intrinsic and extrinsic motivational factors. Extrinsic motivations can be addressed by offering competitive wages, attractive fringe benefits, performance-based bonuses, ensuring appropriate working conditions, and providing opportunities for promotion. Additionally, SMEs should invest in training and development programs to improve the competencies of their employees. It is also important for SMEs to recognize the importance of information security by promoting awareness among their employees. This includes educating them about passwords, antivirus software, firewalls, and encryption tools. Finally, SMEs should consider appointing dedicated information technology personnel to oversee security issues and improve their technological capabilities. This role ensures a comprehensive approach to information security, which is key to protecting sensitive data and recommending the latest and most relevant technologies to minimize supply chain vulnerabilities to SME owners and managers.

5.3. Implications for further research

The study contributes to theory and practice but has limitations related to methodology and data interpretation. This creates opportunities for future research on supply chain factors. One shortcoming is that the study focuses only on SMEs in the manufacturing sector of Harare, Zimbabwe, making it difficult to generalize the findings. Therefore, similar studies should be conducted in other sectors and geographical regions to ensure the generalizability and comparability of the findings. Additionally, the study introduced technological capabilities as moderators in the relationship between supply chain risk factors and firm performance. Future studies could explore other moderators and mediators to yield more interesting results.

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