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The effect of SCOR metrics on supply chain performance among SMEs in Mombasa County, Kenya: A focus on cycle time, cost, and flexibility

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Abstract: *Purpose:* This study examines how Supply Chain Operations Reference (SCOR) metrics, specifically cycle time, cost, and flexibility metrics, influence the supply chain performance of Small and Medium Enterprises (SMEs) in Mombasa County, Kenya. *Methodology*: A descriptive research design was employed with data collected from 397 SMEs in Mombasa County using questionnaires. The Taro Yamane formula was used to determine the sample size. Data analysis involved both descriptive statistics and inferential analysis through correlation and regression. *Results:* The findings reveal statistically significant positive relationships between cycle time metrics (r=0.811), cost metrics (r=0.788), and flexibility metrics (r=0.848) with supply chain performance. Multiple regression analysis indicates that flexibility metrics substantially impact supply chain performance, followed by cost and cycle time metrics. *Theoretical contribution:* This study extends the application of SCOR model metrics to the context of Kenyan SMEs, addressing a significant research gap in supply chain performance measurement in developing economies. It validates the relevance of the SCOR framework in enhancing operational efficiency in resource-constrained environments. *Practical implications:* SMEs in Kenya should prioritize flexibility in their supply chain operations while optimizing cost structures and cycle times. The findings suggest that strategic allocation of limited resources should emphasize adaptability to market changes, which significantly impacts overall supply chain performance.

Keywords: supply chain performance, cycle time metrics, cost metrics, flexibility metrics

Sustainable Development Goals (SDGs): SDG 8: Decent Work and Economic Growth; **SDG 9:** Industry, Innovation, and Infrastructure

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1. Introduction

A supply chain can be described as an integrated process encompassing the acquisition of raw materials, their conversion into finished products, and the subsequent distribution to end customers (LeMay, Helms, Kimball & McMahon, 2017). Companies are increasingly implementing supply chain management to guarantee precise order fulfillment, adhere to product quality standards (Hugos, 2024), accelerate product/service delivery to customers, adeptly respond to external market fluctuations, minimize costs related to supply chain management and operations, and optimize the use of supply chain assets for fulfillment (Sanders, 2025). This signifies that a supply chain comprises several tiers, including numerous facilities and processes. The complexity of supply chains arises from the number of tiers within a chain and the number of facilities at each tier (Manavalan & Jayakrishna, 2019). Therefore, given the inherent complexity of a typical supply chain, it is crucial to identify and choose appropriate performance metrics to study and assess supply chains, as the system is generally wide and intricate (Blanchard, 2021).

In modern markets, competitive elements within the supply chain are rapidly evolving (Autry, Goldsby & Bell, 2013). These alterations make performance monitoring and process improvement imperative (Millar, 2015). The performance of a firm's supply chain currently depends on its ability to respond to client requests. Moreover, the increasing emphasis on client orientation and globalization requires a supply chain-responsive organization (Rajeev, Pati, Padhi & Govindan, 2017). As organizations recognize the potential of supply chain management, there is a necessity for insights to develop effective performance metrics and measurements to assess the viability of supply chain strategies, thereby enabling process enhancement and goal achievement (Al-Shboul, Barber, Garza-Reyes, Kumar & Abdi, 2017). Without measures, there can be no change; therefore, it is essential to evaluate the relevant metrics at the right time across the supply chain to enable timely interventions (Maestrini, Luzzini, Maccarrone & Caniato, 2017). Utilizing SCOR model metrics to evaluate supply chain performance enhances understanding of supply chain operations, hence promoting collaborative efforts to optimize supply chain excellence (Moharamkhani, Bozorgi-Amiri & Mina, 2017). Therefore, organizations must monitor and manage their supply chain operations daily to attain the desired performance. The SCOR framework was developed with these factors in mind (Dissanayake & Cross, 2018).

The SCOR architecture defines six essential processes: plan, source, make, deliver, return, and empower (Ayyildiz & Taskin Gumus, 2021). Planning procedures primarily illustrate the tasks involved in devising strategies for supply chain management (Saleheen, Habib & Hanafi, 2018). The processes encompass the gathering of requirements, data on available resources, the alignment of requirements with resources to determine intended capabilities and deficiencies in demand or resources, and the identification of measures to rectify these deficiencies (Prasetyaningsih, Muhamad & Amolina, 2020). Secondly, source procedures specify the order or schedule of deliveries and the procurement of products and services (Lemghari, Okar & Sarsri, 2018). These procedures include the issuance of purchase orders, scheduling of deliveries, reception, validation, and storage of commodities, along with the acceptance of bills from suppliers (Nguyen, 2024). With the exception of Sourcing Engineer-to-Order goods or services, the procedures for supplier identification, qualification, and contract negotiation are not delineated using Source process elements (Nguyen, Bekrar, Le & Abed, 2021). Third, outline the procedures that define the actions involved in resource transformation or content development for services (Ikasari, Sutopo & Zakaria, 2020). The phrase 'conversion of materials' is utilized in place of 'production' or 'manufacturing' because 'make' includes all types of material transformation. Assembly, chemical processing, maintenance, repair, overhaul, recycling, refurbishment, remanufacturing, and other common terms for material conversion processes (Ikatrinasari, Harianto & Yuslistyari, 2020). These processes are often defined by the input of one or more item numbers and the output of one or more unique item numbers. Fourth, establish processes that outline the operations related to the generation, maintenance, and fulfillment of customer orders (Saleheen & Habib, 2022). The delivery process encompasses the receipt, validation, and generation of client orders, the scheduling of order delivery, picking, packaging, shipment, and customer invoicing. The Deliver Retail process provides a condensed view of the Source and Deliver procedures employed only in a Make-to-Stock retail operation.

The return processes specify the facts concerning the reverse flow of products (Putri, Huda & Sinulingga, 2019). The return process includes acknowledging the need for a return, deciding on the disposition, organizing the return, and managing the shipping and receipt of the returned items (Kusrini, Caneca, Helia & Miranda, 2019). Return process elements do not specify the operations of repair, recycling, refurbishing, and remanufacturing. Sixth, it facilitates processes that define supply chain management (Kottala & Herbert, 2019). Enabling processes include contract administration, supply chain network administration, risk management, performance oversight, data governance, allocation of resources, facilities oversight, business rule administration, and regulatory compliance management. Every level-1 process comprises three or more separate categorizations at level-2. Each level-2 process consists of level-3 process components. These hierarchical connections enable the categorization of processes. To improve performance and gain a competitive edge, supply chain processes must be evaluated and improved using the metrics of the Supply Chain Operations Reference (SCOR) model (Rodríguez Mañay, Guaita-Pradas & Marques-Perez, 2022). The SCOR model metrics support the goals of supply chain management and provide a reliable framework for evaluating and improving supply chain performance in enterprises (El-Garaihy, 2021). As a criterion for evaluating the performance of supply chains for goods and services, the SCOR model metrics relate supply chain operations to achieve exceptional performance in meeting end-user demands and provide insights into customer requirements and supply chain capabilities (Sarjono *et al.,* 2021; Ozbiltekin-Pala, Koçak & Kazancoglu, 2023). The SCOR model metrics are essential for identifying supply chain performance measurement areas, evaluating possibilities for improvement and required resources, deciding the allocation of expert resources, and establishing the correct sequence (Kusrini, Helia & Maharani, 2019). Various obstacles exist in creating a supply chain performance assessment system (Estampe, Lamouri, Paris & Brahim-Djelloul, 2013). Assessing supply chain performance is intrinsically challenging to execute. Secondly, supply chain processes and operations are generally complex and demonstrate variability throughout the supply chain (Wagner & Kemmerling, 2014). Thirdly, supply chain participants who have been assessed are generally hesitant to provide accurate information. The categories of evaluated commodities vary among various participants in the supply chain (Chen, Liu & Oderanti, 2020). Furthermore, communication between partners or participants in the supply chain is generally protracted and ineffective (Saha & Goyal, 2017). Therefore, there is a requirement for well-defined metrics for supply network performance, together with a standardized nomenclature for assessing supply chain performance.

Practitioners must adopt a comprehensive view of the supply chain (Waters & Rinsler, 2014). Improving the efficiency of particular supply chain entities does not necessarily lead to optimizing the entire supply chain. The basic aim of supply chain management is to integrate processes and activities across the whole value-added supply chain to attain comprehensive optimization while preserving competitive advantages (Rai, Patnayakuni & Seth, 2006). Historically, a corporation must assess its organizational performance while emphasizing departmental procedures and operations (Gunasekaran, Lai & Cheng, 2008). Nevertheless, the industry has devised numerous methodologies or tactics in recent years to allow supply chain participants to substitute progressive planning or chronological optimisation with global optimization (Simchi-Levi & Zhao, 2003). In progressive planning, each member optimizes their profit with little consideration for the impact of their decisions on other players in the supply chain.

In contrast, global optimization aims to identify the optimal solution for the entire supply chain (Grossmann, 2004). Likewise, firms want a consistent framework to formulate performance metrics, evaluate indicator criteria, and improve supply chain efficiency. Furthermore, a shared language improves communication among all stakeholders in the supply chain.

Furthermore, the SCOR model (Stadtler, 2015) has emerged as a significant and promising tool for evaluating supply chains. It utilizes a process reference model that analyzes the present state of a company's activities and processes, assesses operational performance, and benchmarks against established KPIs (LeMay, Helms, Kimball & McMahon, 2017). The SCOR model has established extensive measures to assess supply chain performance across multiple dimensions, including responsiveness, reliability, cost, flexibility, cycle time, and asset management. These measures have been successfully applied across various sectors, including electronics, automotive, and manufacturing (APICS, 2015). Supply chains account for approximately 60% to 90% of overall enterprise expenses (SCC, 2013). A 2% improvement in supply chain process efficiency yields an impact of 3000% to 5000% relative to a 2%

improvement in efficiency for the firms (APICS, 2015). However, inadequacies in supply chain performance continue to be among the top five challenges businesses face, irrespective of their objectives to reduce inventory expenses, improve customer satisfaction, or increase responsiveness to market changes (Christopher, 2016). Sixty-eight percent of small and medium firms face challenges in identifying the appropriate allocation and sequencing of their expert resources (Seth & Seth, 2020). Moreover, they demonstrate a lack of fact-based prioritizing, with competencies restricted to a select few persons, especially in small and medium firms (Kulse, 2012).

Small and medium-sized enterprises face obstacles, including recurrent inaccuracies in order fulfillment (Muchaendepi, Mbohwa, Hamandishe & Kanyepe, 2019), inconsistent delivery speeds of products and services to customers, insufficient responsiveness to external market dynamics (Handayati et al., 2024), and heightened expenses associated with supply chain management and operations for fulfillment. This arises from the challenge of identifying the ideal distribution and arrangement of the company's specialized resources. The SCOR framework was developed to resolve these challenges (Cai, Liu, Xiao, & Liu, 2009). Over time, numerous practitioners have utilized SCOR metrics, methodologies, practices, and skills to assess supply chain performance and develop resilient networks and processes overseen by skilled professionals (Moazzam, Akhtar, Garnevska & Marr, 2018). Despite the extensive literature on SCOR indicators and supply chain performance, many studies predominantly focus on European and multinational enterprises, highlighting a considerable research gap. Research conducted within the Kenyan environment is exceedingly scarce. Moreover, SMEs in Mombasa County are increasingly implementing level 2 SCOR metrics in their operations. This study sought to examine how the SCOR metrics mitigated the challenges encountered by SMEs in Mombasa County, focusing on enhancing and assessing supply chain processes.

2. Literature review

2.1. Cycle time metrics

Cycle time metrics are quantifying the duration (in days or hours) from commencement to completion, together with the intervals between different stages within the supply chain (Kusrini & Miranda, 2021). Several cycle times are involved in improving and evaluating supply chain performance, including the manufacturing, purchase orders, replenishing inventory, cash-to-cash, and order fulfillment cycles (Gunasekaran, Patel, & Tirtiroglu, 2001). The cash-to-cash cycle time denotes the interval, quantified in days, between the disbursement for raw materials and the acquisition of payment for the product within the supply chain. Cycle time is a vital metric linking inbound supplier activities with outbound customer sales activities in small and medium enterprises, improving supply chain performance (Kaplan & Norton, 2015). Innovative business models that improve value chain strategies have significantly boosted the supply chain performance of companies by lowering inventory costs and accelerating the cash-to-cash cycle time of small and medium firms (Kottala & Herbert, 2019).

Users must understand small and medium enterprises' cash-to-cash cycle time metrics to employ these measures effectively (Muscettola, 2014). Moreover, users must acknowledge the various leverage points available for improving supply chain performance through analytics. The cash-to-cash cycle time metric is essential for organizations, particularly in accounting and supply chain management for small and medium firms (Hong, 2015). The indicator can be employed in accounting to evaluate liquidity, facilitating organizational valuation and assessing supply chain performance improvement. The indicator assesses the firm's operational liquidity and ability to fulfill obligations using cash flows from small and medium enterprises (Pavlis, Moschuris & Laios, 2018). In supply chain management, metrics serve as a measurement that links the activities of inbound and outbound logistics in small and medium enterprises. According to Awheda *et al.* (2016), the order delivery lead time is the fulfillment rate of the average percentage of orders delivered on time, in full, and undamaged. This helps small and medium enterprises meet customer demands for supply chain performance evaluation and improvement. Efforts must focus on reducing delays and continuously improving target timeframes for small and medium enterprises to evaluate and enhance supply chain performance (Perez-Canchanya, Urbina-Suarez & Flores-Perez, 2023).

The order fulfillment cycle time denotes the total time needed to fulfill a customer order at zero stock levels, determined by aggregating the maximum lead times for each cycle phase in small and medium enterprises, thereby indicating supply chain performance (Silvera, 2017). The order fulfillment cycle time focuses on improving delivery schedules, increasing customer satisfaction, and achieving rapid customer response across the supply chain to facilitate measurement and enhancement (Ambrosio-Flores et al., 2022). This metric evaluates the time taken from the client order to deliver the goods or service to the clients. It thus provides insight into internal efficiency and supply chain effectiveness (Bourlakis, Maglaras, Aktas, Gallear & Fotopoulos, 2014). Fulfilling orders is the most vital and demanding process within supply chain management, acting as a standard for improvement and assessment. Order fulfillment and replenishment in small and medium enterprises often represent 50-65 percent of warehouse labor expenses (Zelada-Muñoz et al., 2022). Evaluating and improving supply chain performance requires the capability to examine profitability and productivity via order fulfillment measures, offering a clear route to enhanced execution as well as outstanding planning in both automated and manual processes (Thakkar, Kanda & Deshmukh, 2009). Many companies are reestablishing their supply chain operations, requiring a more profound comprehension of supply chain performance for the in-house management of the order fulfillment process inside small and medium enterprises (Valéra, Lagacé & Bergeron, 2010). System utilization, on-time delivery, order fill rate, productivity, line accuracy, cost per order, inventory days on hand, order accuracy, and storage utilization are some of the metrics that can be used to analyze and optimize the order fulfillment system from an internal operational perspective in order to improve and evaluate supply chain performance (Abtahi, Farhana & Hasan, 2023). Consequently, the following hypothesis is put forward:

Hypothesis: **H_{01}:** *Cycle time metrics have no statistically significant effect on the supply chain performance of SMEs in Mombasa County, Kenya*

2.2. Cost metrics

A vital supply chain performance parameter is cost. Supply chain costs include all expenditures associated with supply chain operations, encompassing item costs and overall supply chain management expenses (Kusrini, Rifai & Miranda, 2019). In order to evaluate and improve supply chain performance, small and medium-sized businesses must include supply chain expenses related to forecasting, administration, transportation, inventory, manufacturing, customer service, and supplier relationship management (Kusrini & Miranda, 2021). Cost performance is crucial; thus, it is scrutinized more rigorously and comprehensively than any other competitive supply chain performance (Ramadheena, Zhafari & Aini, 2020). To survive and operate well in the supply chain, small and medium-sized businesses must build cost management and reduction capabilities into their organizational structure, processes, culture, and technology foundation (Fauzi, Ridwan & Juliani, 2019). Minimizing expenses internally as well as externally within the supply chain is crucial for improving the efficiency of small and medium enterprises. Many companies neglect to concentrate on the portion of the supply chain that generates the most significant expenses (Mumtaz, Sisilia & Karo-Karo, 2022). They concentrate on reducing direct labor expenses. Gunasekaran, Patel, and McGaughey (2004) provided examples of what is commonly known as indirect purchasing costs for small and medium enterprises. These expenditures can be classified as: procurement costs, logistical costs, warehousing costs, financial expenses, supplier management costs, administrative costs, and development expenditures. Cost is intricately associated with price-performance parameters in the supply chains of small and medium enterprises (Nguyen, 2024).

Alam, Thakur, and Islam (2024) state that pricing is an increasingly crucial order-winning factor, especially during the product life cycle's growth, maturity, and saturation phases for small and medium enterprises. According to Saleh, Mubiena, Immawan, and Hassan (2016), manufacturing aims to achieve the low costs necessary for price sensitivity in the marketplace of small and medium businesses focused on supply chains. This indicator is intricately associated with suppliers, particularly procured goods, and the organization's personnel. Organizations strive to achieve cost leadership in their supply chain management operations (Maulana, Febrianti & Fariza, 2024). According to Lemghari, Okar, and Sarsri (2018), cost leadership not only cuts costs below those of rivals but also creates a cost structure that complements an organization's value proposition, supply chain effectiveness, financial performance, and competitive environment. These outcomes may appear in different forms, including decreased product costs due to competitive pressures from low-cost entrants, or the development of cost strategies to sustain products at various lifecycle stages, leading to a high inventory turnover rate, which signifies improved supply chain performance (Llivisaca *et al.,* 2020). There is an intrinsic connection between these. It will be difficult for the company to achieve optimal supply chain performance if it is not aware of its expenses, alignment with organizational objectives, and strategic management (Miharja, Kaltum, Primiana & Sarasi, 2020). The ideal approach to cost management and efficient leadership necessitates a meticulous analysis of expenditures across the supply chain, guaranteeing complete awareness at every level. Organizations should utilize tools, methods, benchmarks, and specialist experience, sourced from diverse products and consulting services, to assess and understand before recommending changes to improve supply chain performance (Saeed, Waseek & Kersten, 2017).

With this enhanced understanding, firms must function pragmatically to create an ideal atmosphere for commercial success and enhance supply chain performance (Saleheen, Habib & Hanafi, 2018). The strategy for cost leadership differs owing to the distinctiveness of each company. Using knowledge and experience in supply chain analytics, strategic sourcing, and cost modeling, all components are tailored to match the needs of the business (Thilakarathna, Dharmawardana & Rupasinghe, 2015). To improve supply chain performance metrics and improvements, businesses should implement a focused cost reduction program that tackles both short-term and long-term solutions, identifying opportunities for cost and risk mitigation right away while implementing long-term strategies meant to radically alter the cost structure (Estampe, Lamouri, Paris & Brahim-Djelloul, 2013). Establishing core values and guaranteeing team cohesion are the main goals of building a strong, strategically sound basis for attaining supply chain performance success on a business level. Consequently, the following hypothesis is put forward:

Hypothesis: **H_{02}:** *Cost metrics have no statistically significant effect on the supply chain performance of SMEs in Mombasa County, Kenya*

2.3. Flexibility metrics

The ability to quickly adjust to unanticipated market changes to gain or maintain a competitive advantage in supply chain performance is known as flexibility (Kusrini, Rifai & Miranda, 2019). Flexibility is an element of supply chain performance that assesses the responsiveness of small and medium enterprises to the particular demands of consumers (Kusrini, Caneca, Helia & Miranda, 2019). Flexibility has become increasingly vital in the innovation of new products. Small and medium enterprises improve supply chain performance by expediting new product development compared to their competition (Ramadheena, Zhafari & Aini, 2020). According to Aem-on, Setamanit, Chandrachai, and Sinthupinyo (2024), this calls for supply chain partners who are flexible and ready to work closely with designers, engineers, and marketing specialists. According to Mumtaz, Sisilia, and Karo-Karo (2022), two indicators that indicate flexibility in small and medium-sized businesses are production flexibility and response time in the supply chain. The supply chain response time measures the number of days needed for a supply chain to adapt to market changes without facing cost penalties (Nguyen, 2024). Flexibility is the extent to which a small or medium-sized enterprise seeks to adjust to market variations, including significant demand increases. Flexibility involves managing responses to demand changes by preserving resources such as time, capital, materials, personnel, facilities, and suppliers until their explicit necessity arises, thereby assessing and enhancing supply chain performance (Divsalar, Ahmadi & Nemati, 2020). Both definitions characterize flexibility as the capacity to adjust to particular client requirements across the supply chain. According to Qurtubi, Yanti, and Maghfiroh (2022), this thorough performance statistic includes order processing time, order magnitude, product assortment, and demand variations (volume).

In certain markets, a firm's ability to respond to increasing demand is vital in obtaining orders from small and medium enterprises to enhance supply chain operations and performance (Lemghari, Okar & Sarsri, 2018). Japanese automobile manufacturers demonstrate adaptability by developing and continuously refining a system that efficiently meets individual client needs (Fuchs, Beck, Lienland & Kellner, 2018). Delivery flexibility (the ability to change scheduled delivery dates), mix flexibility (the ability to change the assortment of products manufactured), volume flexibility (the ability to modify production output levels), and new product flexibility (the ability to launch and produce new products) are the four categories of system flexibility within supply chains that Kouvelis, Chambers, and Wang (2006) identified. Each category can be measured by range and response. Multiple factors have converged to prioritize supply chain flexibility in evaluating and improving supply chain performance

(Ferrer & Santa, 2017). Developing countries are witnessing double-digit growth rates, leading to a global shift in demand patterns. These oscillations include changes in physical footprints and material flows and a heightened demand for personalized products with accelerated order-to-delivery timings across the supply chain (Chan, Ngai & Moon, 2017). Concurrently, competitive factors related to cost, delivery speed, and customer experience are exacerbating the complexity of supply chain management. Supply chains are vulnerable to disruptions caused by natural disasters, political instability, and strikes that can hinder their efficiency (Maulana, Febrianti & Fariza, 2024). Companies encounter intensified scrutiny from regulatory bodies, the media, and socially aware consumers to uphold labor standards and environmental practices across increasingly complex, regionally diverse supply chains (Rajaratnam & Sunmola, 2021).

Thus, a flexible and transparent supply chain has become crucial in the modern environment of small and medium enterprises concentrating on supply chain management (Mohamadi Janaki et al., 2022). To accomplish this, companies must prioritize supply chain operations and closely integrate them with other business functions to facilitate performance assessment and improvement (Tegbar, Klaus & Haile, 2024). Some firms have elevated their supply chain leaders to C-suite roles to underscore the strategic significance. According to Harsoyo, Wibowo, Hatmoko, and Fitria (2023), a flexible supply chain organization requires assistance from managers who handle traditional supply chain functions, including planning, procurement, production, logistics, and sales and marketing, in addition to a strategic leader. The term "upside supply chain adaptability" describes the highest sustainable percentage rise in the amount an organization can obtain in three months. Organizations regard 30 days as a standard benchmark metric for computing this indicator. In specific enterprises and institutions, a 30-day period may be impractical in some cases or too cautious in others. Component metrics like Flexibility and Upside can be improved simultaneously; hence, this calculation requires that the result indicate the smallest viable increment in quantity throughout a 30-day timeframe. The negative supply chain adaptability refers to the maximum percentage reduction in requested quantities that your firm can sustain 30 days before delivery without facing inventory or cost penalties. In computing this measure, forms recognize that 30 days is an arbitrary amount established for benchmarking purposes. In specific enterprises and institutions, a 30-day period may be unfeasible in some instances or overly cautious in others. Small and medium enterprises may exhibit short average lead times; however, these lead times may vary considerably along the supply chain. Extended yet more consistent lead times are occasionally advantageous for enterprises in assessing supply chain efficacy. The lead times indicate an efficient supply network. Consequently, the following hypothesis is put forward:

Hypothesis: **H_{03}:** *Flexibility metrics have no statistically significant effect on the supply chain performance of SMEs in Mombasa County, Kenya*

2.4. Supply chain performance

Assessing the execution of order-related tasks is often the initial step in evaluating supply chain performance. To do this, the supply chain must consider essential aspects such as the order-entry technique, order lead-time, and order traversal path (Afonso & do Rosário Cabrita, 2015). Supplementary measures may include non-conformities and the time required to perform additional operations within the function, such as sub-processes. The manufacturing process substantially affects production costs, quality, and delivery time in supply chain performance (Kot, Haque & Baloch, 2020). Therefore, the supply chain process requires evaluation, management, and improvement, with relevant metrics established in the following three categories (Vu, Nguyen, Luong, Nguyen & Doan, 2022): product and service assortment, capacity utilization, and scheduling method effectiveness. These measures are termed functional measures. Supply chain delivery reliability refers to the effectiveness of the supply chain in delivering the correct product to the specified location at the designated time, in suitable condition and packaging, in the precise quantity, along with the necessary documentation, to the intended recipient (Tanco, Jurburg & Escuder, 2015). Reliability typically signifies the ability to deliver goods as planned inside the supply chain (Cerchione, Centobelli & Shabani, 2018). A corporation may encounter prolonged lead times despite maintaining high reliability. Three criteria for evaluating supply chain delivery reliability are delivery performance, fill rates, and perfect order fulfillment.

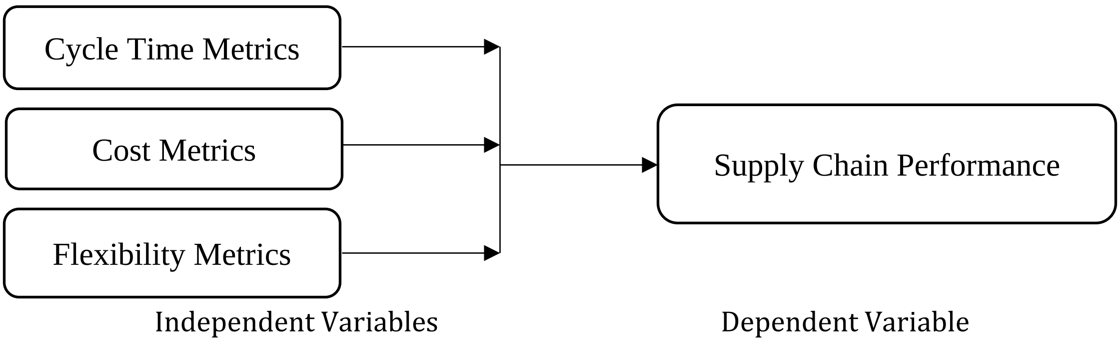
Organizations must prioritize their competitive advantage inside the supply chain (Kumar & Kumar Singh, 2017). The modern marketplace is shifting from prioritizing individual company performance to highlighting supply chain performance: the aggregate ability of the entire chain to meet end-customer demands through product availability and prompt, responsive delivery (Ali, Gongbing & Mehreen, 2020). Supply chain performance surpasses functional divides and organizational boundaries. Functional groups (engineering/R&D /R&D, manufacturing, and sales/marketing) are crucial for enhancing product design, production, and distribution throughout the supply chain. Conventional corporate borders are transforming as firms investigate collaborative strategies to achieve the fundamental goal of the supply chain: to fulfill client orders more rapidly and efficiently than their competitors (Khalil, Khalil & Khan, 2019). Companies need performance metrics to improve global supply chain performance to achieve that goal. The company's success indicators must reflect client satisfaction and corporate operations' administration. Given the cross-functional nature of many supply chain improvements, corporate metrics must prevent organizational silo behavior that could hinder supply chain effectiveness (Pooe & Mahlangu, 2017).

Every CEO must remain continually attentive to the competition (Quynh & Huy, 2018). The emphasis in the contemporary economy is shifting from the performance of individual companies to Supply Chain Performance (Chin, Hamid, Rasli & Baharun, 2012). Supply Chain Performance refers to the operations of the extended supply chain in meeting end-customer demands, including product availability, prompt delivery, and the necessary inventory and capacity for responsive performance (Wilujeng, Sarwoko & Nikmah, 2022). Supply Chain Performance extends beyond organizational boundaries, incorporating raw materials, components, subassemblies, finished items, and distribution through various channels to the ultimate consumer (Saunila, Ukko & Jääskeläinen, 2024). Furthermore, it goes beyond the usual divisions between functions within a company, such as purchasing, production, distribution, marketing, sales, and research and development. To thrive in a changing environment, supply chains necessitate continuous improvement. Consequently, the following hypothesis is put forward:

Hypothesis: **H_{04}:** *Cycle time metrics, cost metrics, and flexibility metrics have no statistically significant effect on the supply chain performance of SMEs in Mombasa County, Kenya*

2.5. Conceptual framework

Figure 1: Conceptual framework



3. Methodology

The study utilized a descriptive design to clarify the relationship between the independent and dependent variables. The study's target population comprised 54,245 SMEs in Mombasa County, Kenya. A sample of 397 organizations was utilized, from which one employee involved in the supply chain was selected to complete a questionnaire. The sample size was calculated using the Taro Yamane formula from 1967. The data was analyzed using both descriptive and inferential methods. A regression model was developed using linear and multiple regression analysis to determine the effect of cycle time, cost, and flexibility metrics on the supply chain performance of SMEs in Mombasa County, Kenya. Data was also analyzed by correlation.

4. Results

4.1. Correlation findings

The Pearson product-moment correlation was employed to evaluate the relationship between cycle time, cost, and flexibility metrics concerning supply chain performance. The results indicated a significant positive relationship between the independent and dependent variables. The analysis revealed cycle time metrics (r = 0.811), cost metrics (r = 0.788), and flexibility metrics (r = 0.848) at a significance level of 0.01. A robust positive correlation (r > 0.811) indicates that enhancements in cycle time metrics, such as reduced production or delivery times, are significantly associated with improvements in supply chain performance. Consequently, optimizing cycle times can improve responsiveness and operational efficiency, resulting in enhanced overall performance. Additionally, a correlation (r > 0.788) indicates a strong positive relationship, albeit slightly lower than that of cycle time metrics, suggesting that effective cost management significantly enhances supply chain performance. Reducing operational costs, optimizing resource utilization, and minimizing wastage will likely improve financial and operational results. The most significant correlation (r > 0.848) among the three metrics highlights the essential impact of flexibility on supply chain performance. Being flexible helps businesses adjust to shifts in the market, variations in demand, and interruptions, all of which are becoming increasingly important in dynamic supply chain settings. The results are presented in Table 1.

Table 1: Correlation analysis results

		Supply Chain Performance	Cycle Time Metrics	Cost Metrics	Flexibility Metrics
Supply Chain Performance	Pearson Correlation	1	.811**	.788**	.848**
	Sig. (2-tailed)		.000	.000	.000
	N	256	256	256	256
Cycle Time Metrics	Pearson Correlation	.811**	1	.305**	.326**
	Sig. (2-tailed)	.000		.000	.000
	N	256	256	256	256
Cost Metrics	Pearson Correlation	.788**	.305**	1	.205**
	Sig. (2-tailed)	.000	.000		.000
	N	256	256	256	256
Flexibility Metrics	Pearson Correlation	.848**	.326**	.205**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	256	256	256	256

**. Correlation is significant at the 0.01 level (2-tailed).

4.2. Cycle time metrics

The results presented in Table 2 indicate that a significant proportion of SMEs in Mombasa County, Kenya, successfully monitored and assessed cycle time for their essential processes, evidenced by a Likert scale mean of 3.58 along with a standard deviation of 0.812. Furthermore, most SMEs in Mombasa County, Kenya, clearly understood how cycle time affects customer satisfaction levels, as indicated by a Likert mean of 3.41 and a standard deviation of 0.712. Most SMEs in Mombasa County, Kenya, have set explicit goals and targets to reduce their cycle time, as evidenced by a Likert scale mean of 4.01 and a standard deviation of 0.826. Furthermore, a significant proportion of employees in SMEs located in Mombasa County, Kenya, demonstrated a strong understanding of the importance of cycle time reduction within their organizations, as indicated by a Likert scale mean of 3.84 and a standard deviation of 0.741. Nonetheless, most SMEs in Mombasa County, Kenya, exhibited a culture of continuous improvement focused on minimizing cycle time within their operations, as indicated by a Likert scale mean of 1.74 and a standard deviation of 0.743. The findings indicated that most SMEs in Mombasa County, Kenya, had insufficiently invested in technology and tools to streamline their operations and minimize cycle time, as evidenced by a Likert scale mean of 1.02 and a standard deviation of 0.525. In contrast, most SMEs in Mombasa County, Kenya, have implemented systems to identify and eliminate bottlenecks in their production processes, evidenced by a Likert scale mean of 3.49 and a standard deviation of 0.902. Last but not least, a Likert scale mean of 3.07 and a standard deviation of 0.721 revealed that most SMEs in Mombasa County, Kenya, neither routinely examine nor evaluate cycle time data to identify areas for development.

Table 2: Cycle time metrics descriptive findings

Statements on Cycle Time Metrics	Mean	Std. Deviation
Our company effectively tracks and measures cycle time for key processes.	3.58	.812
Our company has a clear understanding of the impact of cycle time on customer satisfaction.	3.41	.712
Our company has established clear goals and targets for reducing cycle time.	4.01	.826
Our employees are well-trained in understanding the importance of cycle time reduction.	3.84	.741
We have a culture of continuous improvement that prioritizes reducing cycle time.	1.74	.743
We have invested in technology and tools to streamline operations and reduce cycle time.	1.02	.525
We have implemented systems to identify and eliminate bottlenecks in our production processes.	3.49	.902
We regularly review and analyze cycle time data to identify areas for improvement.	3.07	.721

Hypothesis: **H_{01}:** *Cycle time metrics have no statistically significant effect on the supply chain performance of SMEs in Mombasa County, Kenya*

According to Table 3's findings, there is a significant positive correlation between Mombasa County, Kenyan SMEs' supply chain performance, and cycle time indicators ($R = 0.811$, $R^2 = .658$). The number ($R = 0.811$) signifies a strong, significant positive linear correlation between cycle time indicators and the supply chain performance of SMEs in Mombasa County, Kenya. This indicates that upgrades in cycle time measures, such as decreased production lead time, shorter delivery durations, or expedited order processing, correlate with substantial improvements in the supply chain performance of SMEs in Mombasa County, Kenya. The results suggest that cycle time measures may explain 65.8 percent of the variance in the supply chain performance of small and medium firms in Mombasa County, Kenya, as evidenced by an R^2 of .658. The other 34.2% could be due to other things, like how cost-effective, flexible, or relevant the external market is, or to other operating parameters.

Table 3: Cycle time metrics model summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.811a	.658	.657	.47224	.658	489.306	1	254	.000

a. Predictors: (Constant), Cycle Time Metrics

Table 4 displays an F-ratio of 489.306 and a P value of0.000 below 0.05 in Model 1. The regression model utilized in the study has a strong goodness of fit. Furthermore, the F-ratio quantifies the variation accounted for by the model's independent variable(s) in relation to the residual variance (error term). A strong F-ratio of 489.306 signifies that the model accounts for considerable variance in the dependent variable compared to random noise. Thus, it indicates that the model is statistically sound. A p-value of $P < 0.001$ signifies that the observed results possess a high statistical significance. Given that the p-value is below the conventional threshold of 0.05, we reject the null hypothesis, which asserts that the model lacks significance, and accept the alternative hypothesis. This indicates that the independent variable of cycle time measurements in Model 1 significantly influences the dependent variable of supply chain performance. The null hypothesis, asserting that cycle time measures did not positively and significantly influence the supply chain performance of small and medium firms in Mombasa County, Kenya, was rejected at the 95 percent significance level.

Table 4: cycle time metrics ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	109.120	1	109.120	489.306	.000[b]
	Residual	56.645	254	.223		
	Total	**165.765**	**255**			

a. Dependent Variable: Supply Chain Performance
b. Predictors: (Constant), Cycle Time Metrics

Table 5 below illustrates the significance of test results concerning cycle time measurements and the supply chain performance of small and medium firms in Mombasa County, Kenya. Model 1's findings revealed a substantial positive correlation between cycle time indicators and supply chain performance (b1 = 0.959, p = 0.000, β = 0.811). The unstandardized coefficient ($b1$ = 0.959) signifies that for each one-unit improvement in cycle time measurements, the supply chain performance of SMEs in Mombasa County, Kenya, enhances by 0.959 units, provided other variables are held constant. The size of $b1$ indicates a significant and quantifiable impact of cycle time measures on supply chain performance, underscoring the operational significance of time efficiency. The significance level (p = 0.000) reveals a statistically significant association between cycle time indicators and the supply chain performance of SMEs in Mombasa County, Kenya. A β value of 0.811 indicates a robust positive correlation, demonstrating that cycle time measurements are among the most significant determinants of supply chain performance for SMEs in Mombasa County, Kenya.

Competitive Advantage = 0.042 + 0.959Cycle Time Metrics + 0.043……. *Equation i*

Table 5: Cycle Time Metrics Significance of Test Results (Coefficientsa)

	Model	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.042	.137		.304	.761
	Cycle Time Metrics	.959	.043	.811	22.120	.000

a. Dependent Variable: Supply Chain Performance

4.3. Cost metrics

The results in Table 6 show that most small businesses in Mombasa County, Kenya, did not have a good idea of their overall cost structure. This was shown by a Likert scale mean of 1.39 and a standard deviation of 0.904. A Likert scale mean of 1.60 and a standard deviation of 0.840 show that most small businesses in Mombasa County, Kenya, did not have effective methods to track and manage their costs. On top of that, a Likert scale mean of 1.80 and a standard deviation of 0.633 show that most small businesses in Mombasa County, Kenya, have started to spend money on technology and tools to make their operations more cost-effective. The study also found that most small businesses in Mombasa County, Kenya, regularly reviewed and studied their cost data to find places to save money. This was shown by a Likert scale mean of 1.98 and a standard deviation of 0.631. Still, the study found that most small businesses in Mombasa County, Kenya had a cost-conscious culture that pushed their workers to find ways to save money, as shown by a Likert scale mean of 3.54 and a standard deviation of 0.914. The study also found that most of the employees of small and medium-sized businesses in Mombasa County, Kenya, knew how important it was to control costs in their businesses. This was shown by a Likert scale mean of 3.74 and a standard deviation of 0.842. A Likert scale mean of 3.83 and a standard deviation of 0.734 show that most small businesses in Mombasa County, Kenya, agreed on good terms with their suppliers to cut costs. A Likert scale with a mean of 3.58 and a standard deviation of 0.923 shows that most small businesses in Mombasa County, Kenya, had clear cost-cutting goals. Finally, the study found that most small businesses in Mombasa County regularly checked how cost-effective their activities and methods were. This was shown by a Likert scale mean of 3.41 and a standard deviation of 0.712.

Table 6: Cost metrics descriptive findings

Statements on Cost Metrics	Mean	Std. Deviation
Our company has a clear understanding of our overall cost structure.	1.39	.904
We have implemented systems to track and control our expenses effectively.	1.60	.840
We have invested in technology and tools to improve our cost efficiency.	1.80	.633
We regularly review and analyze our cost data to identify areas for savings.	1.98	.631
Our company has a culture of cost-consciousness that encourages employees to identify savings opportunities.	3.54	.914
Our employees are aware of the importance of cost management in our business.	3.74	.842
We have negotiated favourable terms with our suppliers to reduce costs.	3.83	.734
We have set specific cost reduction targets and goals.	3.58	.923
We regularly evaluate the cost-effectiveness of our operations and processes.	3.41	.712

Hypothesis: $\mathbf{H_{02}}$: *Cost metrics have no statistically significant effect on the supply chain performance of SMEs in Mombasa County, Kenya*

The data in Table 7 indicates a significant positive correlation between cost metrics and the supply chain performance of SMEs in Mombasa County, Kenya (R = 0.788, R^2 = 0.620). The correlation coefficient (R = 0.788) demonstrates a robust positive linear relationship between cost metrics and supply chain performance. Improvements in cost metrics, such as cost efficiency, cost minimization, and cost predictability, lead to a notable enhancement in the supply chain performance of SMEs in Mombasa County, Kenya. The Coefficient of Determination (R^2 = 0.620) indicates that cost metrics can explain 62.0 percent of the variation in the supply chain performance of small and medium enterprises in Mombasa County, Kenya, as reflected by an R^2 value of 0.620. In Mombasa County, Kenya, this suggests that cost control is a major driver of the supply chain performance of SMEs. The remaining 38.0% of the variation is probably due to other factors such as technology utilization, flexibility, cycle time, or external market conditions.

Table 7: Cost metrics model summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.788[a]	.620	.619	.49772	.620	415.157	1	254	.000

a. Predictors: (Constant), Cost Metrics

The findings shown in Table 8 reveal an F-ratio of 415.157, with a P value of 0.000, which is below the 0.05 threshold in Model 1. The high F-ratio of 415.157 indicates that the independent variable of cost metrics accounts for a significant portion of the variation in the dependent variable of supply chain performance among SMEs in Mombasa County, Kenya, while exhibiting minimal residual error. A p-value of $p < 0.001$ suggests that the results demonstrate a high level of statistical significance. The regression model utilized in the study exhibits a strong goodness of fit. Furthermore, given that the p-value falls below the standard significance level of 0.05, we can confidently reject the null hypothesis, which posits that the model lacks explanatory power. The null hypothesis, asserting that cost metrics did not exert a positive significant effect on the supply chain performance of small and medium enterprises in Mombasa County, Kenya, was rejected at the 95 percent significance level.

Table 8: Cost metrics ANOVAa

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	102.844	1	102.844	415.157	.000[b]
	Residual	62.921	254	.248		
	Total	165.765	255			

a. Dependent Variable: Supply Chain Performance
b. Predictors: (Constant), Cost Metrics

Table 9 below illustrates the importance of test results concerning cost metrics and the performance of the supply chain in small and medium enterprises located in Mombasa County, Kenya. The results from Model 1 demonstrated a notable positive correlation between cost metrics and supply chain performance (b1 = 0.914, p = .000, β = 0.788). The unstandardized Coefficient ($b1 = 0.914$) suggests that an increase of one unit in cost metrics is associated with an enhancement of 0.914 units in supply chain performance, assuming other variables remain unchanged. This indicates that cost management practices, such as cost reduction and efficient budgeting, significantly influence supply chain outcomes. This indicates that small and medium enterprises in Mombasa County, Kenya, attain improved supply chain performance by enhancing cost metrics. A p-value of 0.000 indicates a highly statistically significant relationship between cost metrics and supply chain performance. The significance level of $p < 0.001$ allows us to reject the null hypothesis with confidence, indicating that cost metrics are a substantial predictor of supply chain performance. The standardized coefficient ($\beta = 0.788$) underscores the significance of cost metrics in elucidating variations in supply chain performance. A value of 0.788 indicates that cost metrics significantly influence the variability in supply chain performance of SMEs in Mombasa County, Kenya, particularly when assessed against other predictors.

Competitive Advantage = 0.418 + 0.914Cost Metrics + 0.045……. *Equation ii*

Table 9: Cost metrics significance of test results coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients		
	Model	B	Std. Error	Beta	t	Sig.
1	(Constant)	.418	.130		3.206	.002
	Cost Metrics	.914	.045	.788	20.375	.000

a. Dependent Variable: Supply Chain Performance

4.4. Flexibility metrics

The findings regarding Flexibility Metrics indicate that most SMEs in Mombasa County, Kenya, demonstrate a capacity for rapid adaptation to market changes or customer demands, as evidenced by a Likert scale mean of 3.41 and a standard deviation of 0.721. The results indicated that many SMEs in Mombasa County had established processes for identifying and responding to emerging trends, as evidenced by a Likert scale mean of 3.61 and a standard deviation of 0.920. Furthermore, many SMEs in Mombasa County, Kenya, actively promote creativity and innovation among their employees, as evidenced by a Likert scale mean of 4.32 and a standard deviation of 0.914. The findings indicate that a significant portion of employees in SMEs in Mombasa County, Kenya, perceive themselves as empowered to take risks and explore new ideas, as evidenced by a Likert scale mean of 3.52 and a standard deviation of 0.940. The data indicates that many SMEs in Mombasa County, Kenya, exhibited a culture of continuous learning and development to enhance flexibility, as evidenced by a Likert scale mean of 4.02 and a standard deviation of 0.833. Furthermore, most SMEs in Mombasa County, Kenya, exhibited a flexible organizational structure that facilitated rapid decision-making, as evidenced by a Likert scale mean of 3.82 and a standard deviation of 0.952. The study indicated that certain SMEs in Mombasa County, Kenya, faced challenges adjusting their operations, whether to scale up or down as required. The findings indicated a Likert scale mean 3.20, accompanied by a standard deviation of 0.844. The study's findings revealed that most SMEs in Mombasa County, Kenya, had not invested in technology and tools to enhance flexibility and agility, as evidenced by a Likert scale mean of 1.80 and a standard deviation of 0.941. The study demonstrated that most SMEs struggled to adapt their products or services to meet specific customer needs, as evidenced by a Likert scale mean 1.20 and a standard deviation 0.919.

Table 10: Flexibility metrics descriptive findings

Statements on Flexibility Metrics	Mean	Std. Deviation
Our company can adapt quickly to changes in the market or customer demands.	3.41	.721
We have processes in place to identify and respond to emerging trends.	3.61	.920
Our employees are encouraged to be creative and innovative in their work.	4.32	.914
Our employees feel empowered to take risks and experiment with new ideas.	3.52	.940
We have a culture of continuous learning and development to foster flexibility.	4.02	.833
We have a flexible organizational structure that allows for quick decision-making.	3.82	.952
Our company can scale our operations up or down as needed.	3.20	.844
We have invested in technology and tools to support flexibility and agility.	1.80	.941
Our company can modify our products or services to meet specific customer needs.	1.20	.919

Hypothesis: **H_{03}:** *Flexibility metrics have no statistically significant effect on supply chain performance of SMEs in Mombasa County, Kenya*

The results shown in Table 11 indicate a significant positive correlation between flexibility metrics and the supply chain performance of SMEs in Mombasa County, Kenya (R = .848, R^2 = .718). The correlation coefficient (R = 0.848) indicates a robust positive linear relationship between flexibility metrics and the supply chain performance of SMEs in Mombasa County, Kenya. The findings suggest that increased flexibility, encompassing adaptability in operations and responsiveness to changes, correlates significantly with improved performance outcomes in the supply chains of SMEs in Mombasa County, Kenya. The coefficient of determination (R^2 = 0.718) indicates that flexibility metrics may explain 71.8 percent of the variation observed in the supply chain performance of small and medium enterprises in Mombasa County, Kenya. The findings indicate that flexibility plays a crucial role in shaping the supply chain performance of SMEs in Mombasa County, Kenya, while the remaining 28.2% of the variance can be linked to other elements such as cost efficiency, cycle time, or external factors.

Table 11: Flexibility metrics model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change
1	.848a	.718	.717	.42873	.718	647.818	1	254	.000

a. Predictors: (Constant), Flexibility Metrics

The findings shown in Table 12 reveal an F-ratio of 647.818, with a P value of 0.000, which is below the threshold of 0.05 in Model 1. A high F-ratio of 647.818 indicates that the flexibility metrics in Model 1 significantly account for a large portion of the variance in the supply chain performance of SMEs, while exhibiting minimal residual error. The regression model utilized in the study exhibits a strong goodness of fit. A p-value of 0.000, which falls below the conventional significance threshold of 0.05, suggests that the model demonstrates a high level of statistical significance in its explanatory power. The null hypothesis, which posits that the model lacks predictive power, is consequently rejected with a high degree of confidence. The null hypothesis, asserting that flexibility metrics did not exert a positive significant effect on the supply chain performance of small and medium enterprises in Mombasa County, Kenya, was rejected at the 95 percent significance level.

Table 12: Flexibility metrics ANOVAa

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	119.077	1	119.077	647.818	.000b
	Residual	46.688	254	.184		
	Total	165.765	255			

a. Dependent Variable: Supply Chain Performance
b. Predictors: (Constant), Flexibility Metrics

Table 13 below outlines the significance of test results concerning flexibility metrics and the performance of the supply chain in small and medium enterprises located in Mombasa County, Kenya. The results from Model 1 demonstrated a noteworthy positive correlation between flexibility metrics and the supply chain performance of SMEs in Mombasa County, Kenya (b1 = 1.039, p = 0.000, β = 0.848).

The unstandardized coefficient of $b1$ = 1.039 indicates that for each one-unit increase in flexibility metrics, such as the capacity to adjust production schedules, manage supply disruptions, or react to market changes; the supply chain performance of SMEs in Mombasa County, Kenya, enhances by 1.039 units. This suggests a clear, beneficial correlation between flexibility and performance, where increased flexibility in supply chain processes leads to enhanced performance outcomes. A statistically significant correlation between supply chain performance and flexibility measurements is indicated by a p-value of $p < 0.001$. In standard deviation units, the standardized coefficient of $\beta = 0.848$ shows how strongly supply chain performance and flexibility measures are related. This implies that the observed relationship is unlikely to result from chance, and we can safely rule out the null hypothesis that flexibility measurements have no bearing on the supply chain performance of SMEs in Kenya's Mombasa County. A standardized coefficient of 0.848 indicates a robust and positive correlation, implying that flexibility metrics significantly contribute to the variation observed in supply chain performance. This highlights the essential role of adaptability in improving supply chain effectiveness, particularly in the ever-changing contexts of small and medium-sized enterprises.

Competitive Advantage = 0.021 + 1.039Flexibility Metrics + 0.041……. *Equation iii*

Table 13: Cost metrics significance of test results coefficients [a]

	Model	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.021	.122		.170	.865
	Flexibility	1.039	.041	.848	25.452	.000

a. Dependent Variable: Supply Chain Performance

4.5. Supply chain performance

With a Likert scale mean of 3.80 and a standard deviation of 0.542, the results of supply chain performance showed that most SMEs in Mombasa County, Kenya, clearly understood their supply chain processes and interdependencies. With a Likert scale mean of 4.20 and a standard deviation of 0.822, most SMEs in Mombasa County, Kenya, also fairly recorded and measured their order fulfillment cycle time. Apart from that, a Likert scale mean of 3.77 and a standard deviation of 0.906 revealed that most SMEs in Mombasa County, Kenya, had implemented mechanismsto enhance their on-time delivery performance. Moreover, given a Likert scale mean of 4.05 and a standard deviation of 0.640, most SMEs in Mombasa County, Kenya had developed close ties with their suppliers and consumers. Furthermore, a Likert scale mean of 3.56 and a standard deviation of 0.801 show that most SMEs in Mombasa County, Kenya, had a consistent transportation system supporting their supply chain operations. Most SMEs in Mombasa County, Kenya, have applied inventory control techniques to maximize their stock levels based on a Likert scale mean of 3.73 and a standard deviation of 0.743. A Likert scale mean of 3.89 and a standard deviation of 0.913 also show that most SMEs in Mombasa County, Kenya, routinely examined and analyzed their supply chain expenses to find development opportunities. Apart from that, the results revealed that, based on a Likert scale mean of 4.00 and a standard deviation of 0.643, most SMEs in Mombasa County, Kenya had a culture of ongoing development that prioritized supply chain excellence. With a Likert scale mean of 3.42 and a standard deviation of 0.532, the survey finally showed that most SMEs in Mombasa County, Kenya, had invested fairly in technology and tools to improve their supply chain visibility and efficiency.

Table 14: Supply chain performance

Statements on Supply Chain Performance	Mean	Std. Deviation
Our company clearly understands our supply chain processes and their interdependencies.	3.80	.542
We effectively track and measure our order fulfillment cycle time.	4.20	.822
We have implemented systems to improve our on-time delivery performance.	3.77	.906
Our company has established strong relationships with our suppliers and customers.	4.05	.640
We have a reliable transportation network that supports our supply chain operations.	3.56	.801
We have implemented inventory management strategies to optimize our stock levels.	3.73	.743
We regularly review and analyze our supply chain costs to identify areas for improvement.	3.89	.913
Our company has a culture of continuous improvement that prioritizes supply chain excellence.	4.00	.643
We have invested in technology and tools to enhance our supply chain visibility and efficiency.	3.42	.523

4.5. Overall regression findings

Hypothesis: **H_{04}:** *Cycle time metrics, cost metrics, and flexibility metrics have no statistically significant effect on supply chain performance of SMEs in Mombasa County, Kenya*

Cycle time, cost, and flexibility metrics Vs supply chain performance of SMEs in Mombasa County, Kenya exhibited a positive relationship (R = 0.891 and R^2 = 0.794) per model 1 of the multiple regression. With supply chain performance, the correlation value $R = 0.891$ points to a strong positive linear relationship between the mix of cycle time, cost, and flexibility measurements. This suggests that the supply chain performance of SMEs in Mombasa County, Kenya usually rises in a well-correlated fashion when these independent variables, cycle time, cost, and flexibility, improve. Usually understood as a very high degree of relationship, a value of $R = 0.891$ emphasizes the relevance of these three measures in forecasting and improving supply chain outcomes. With a coefficient of determination ($R^2 = 0.794$), cycle time measurements, cost metrics, and flexibility measures together explain 79.4% of the variance in supply chain performance of SMEs in Mombasa County, Kenya. This is a significant explanatory power since it shows that the model fits the data well and that three indicators are fundamental determinants of supply chain success. Other elements not covered in the model could be responsible for the remaining 20.6% of variance, such as technology developments or outside market conditions.

Table 15: Overall model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change
1	.891a	.794	.791	.36854	.794	322.820	3	252	.000

a. Predictors: (Constant), Flexibility Metrics, Cost Metrics, Cycle Time Metrics

The F-ratio of 322.820 for model 1 means that the regression model used in the study has a high goodness of fit, as the p value is less than 0.05. With an F-ratio of 322.820 the residual variance and the model's explanatory power show a notable difference. These results show that the model's independent variables (predictors), flexibility, cost, and cycle time metrics, have a strong and meaningful connection with the model's dependent variable (outcome): supply chain performance of SMEs in Mombasa County, Kenya. The model also does a good job of explaining the collected data. The high F-ratio value indicates that the regression model explains a significant amount of the variability in the dependent variable of supply chain performance of SMEs in Mombasa County, Kenya, thereby reflecting statistical relevance and other aspects. To a large extent, this indicates a good fit.

Table 16: Overall ANOVA[a]

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	131.538	3	43.846	322.820	.000b
	Residual	34.227	252	.136		
	Total	165.765	255			

a. Dependent Variable: Supply Chain Performance
b. Predictors: (Constant), Flexibility Metrics, Cost Metrics, Cycle Time Metrics

Table 16 presents the results of the overall significance tests concerning flexibility, cost, and cycle time metrics as they relate to supply chain performance. At a 95% significance level, a positive and significant relationship was observed among flexibility metrics, cost metrics, cycle time metrics, and supply chain performance. The results were confirmed with a corresponding p-value of under 0.05. The unstandardized coefficient $b1$ = 0.634 suggests that a one-unit increase in flexibility metrics corresponds to an increase of 0.634 units in supply chain performance, assuming all other factors remain unchanged. This indicates a clear and beneficial correlation between flexibility and the performance of supply chains in SMEs located in Mombasa County, Kenya, with flexibility as a crucial factor in enhancing supply chain outcomes. The p-value of 0.000 is significantly lower than the conventional threshold of 0.05, suggesting a strong statistical significance in the relationship between flexibility metrics and supply chain performance. The null hypothesis can be confidently rejected, indicating that flexibility metrics influence supply chain performance. The standardized coefficient β = 0.518 indicates that flexibility exerts a moderate to strong influence on supply chain performance. The value of 0.518 indicates that flexibility plays a significant role in predicting supply chain performance, although it does not emerge as the most influential factor relative to other variables in the model. This suggests that enhancing flexibility can lead to notable performance improvements, although its effect is less significant than other specific metrics.

The unstandardized coefficient $b1$ = 0.375 suggests that a one-unit increase in cost metrics correlates with a 0.375-unit increase in the supply chain performance of SMEs in Mombasa County, Kenya when other factors are held constant. This indicates that cost efficiency positively influences supply chain performance, implying that optimizing costs enhances overall performance. A p-value of 0.000 demonstrates a strong level of statistical significance, suggesting that the association between cost metrics and supply chain performance is highly improbable to have arisen randomly. Consequently, it can be determined that effective management and reduction of costs positively influence supply chain performance. The standardized coefficient β = 0.323 suggests a moderate influence of cost metrics on the supply chain performance of SMEs in Mombasa County, Kenya. The effect observed is positive; however, it does not exhibit the same strength as the metrics related to flexibility. This indicates that although cost metrics hold significance, their influence is overshadowed by the role of flexibility in enhancing overall supply chain performance.

The unstandardized coefficient $b1$ = 0.146 indicates that a one-unit increase in cycle time metrics corresponds to an increase of 0.146 units in supply chain performance among SMEs in Mombasa County, Kenya while controlling for other variables. The relationship is positive; however, the effect size is relatively small, suggesting that cycle time is less significant than flexibility and cost in forecasting supply chain performance. The p-value of 0.045 falls beneath the 0.05 significance threshold, suggesting a statistically significant relationship between cycle time metrics and supply chain performance. The effect is positive but not as pronounced as the effects noted for flexibility and cost metrics. This indicates that, although significant, cycle time metrics exert a comparatively lesser impact on performance when evaluated alongside other factors. The standardized coefficient β = 0.123 suggests that the influence of cycle time metrics on the supply chain performance of SMEs in Mombasa County, Kenya, is minimal. This indicates that enhancing cycle time may lead to performance gains; however, its influence is less significant than optimizing flexibility or cost metrics.

Competitive Advantage = 0.354 + 0.146Cycle Time Metrics + 0.375Cost Metrics + 0.634Flexibility Metrics + 0.111……. *Equation iv*

Table 17: Cycle time metrics, cost metrics, and flexibility metrics significance of test results (Coefficients[a])

	Model	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.354	.111		3.187	.002
	Cycle Time Metrics	.146	.072	.123	2.018	.045
	Cost Metrics	.375	.056	.323	6.647	.000
	Flexibility Metrics	.634	.063	.518	10.121	.000

a. Dependent Variable: Supply Chain Performance

4.6. Findings on testing of hypotheses

The study's null hypotheses were tested, and the findings are presented in Table 18.

Table 18: Hypothesis testing results

Research Hypotheses	Decision Rule	P – Value	Inference
H_{01}: Cycle time metrics have no statistically significant effect on the supply chain performance of SMEs in Mombasa County, Kenya. **H_{a1}:** Cycle time metrics have a positive and statistically significant effect on supply chain performance of SMEs in Mombasa County, Kenya.	If the P ≤ 0.05, reject H_{01} and accept Ha_1	0.045	Rejected H_{01} **Accepted H_{a1}**
H_{02}: Cost metrics have no statistically significant effect on the supply chain performance of SMEs in Mombasa County, Kenya **H_{a2}:** Cost metrics have a positive and statistically significant effect on the supply chain performance of SMEs in Mombasa County, Kenya.	If the P ≤ 0.05, reject H_{02} and accept Ha_2	0.000	Rejected H_{02} **Accepted H_{a2}**
H_{03}: Flexibility metrics have no statistically significant effect on the supply chain performance of SMEs in Mombasa County, Kenya. **H_{a3}:** Flexibility metrics have a positive and statistically significant effect on the supply chain performance of SMEs in Mombasa County, Kenya.	If the P ≤ 0.05, reject H_{03} and accept Ha_3	0.000	Rejected H_{03} **Accepted H_{a3}**
H_{04}: Cycle time, cost, and flexibility metrics have no statistically significant effect on sustainable supply chain performance of SMEs in Mombasa County, Kenya. **H_{a4}:** Cycle time, cost, and flexibility metrics have a positive and statistically significant effect on sustainable supply chain performance of SMEs in Mombasa County, Kenya.	If the P ≤ 0.05, reject H_{04} and accept Ha_4	0.002	Rejected H_{04} **Accepted H_{a4}**

5. Conclusion

The regression analysis results indicate substantial positive correlations among flexibility, cost, and cycle time metrics with SMEs' supply chain performance in Mombasa County, Kenya. The study shows that flexibility is the primary driver, followed by cost and cycle time metrics for priority in SMEs in Mombasa County, Kenya. These findings underscore that, although enhancing cost efficiency and cycle time is significant, a flexible supply chain is crucial in achieving sustainable performance. Therefore, SMEs in Mombasa County, Kenya, should prioritize increasing flexibility while controlling costs and optimizing cycle times to attain exceptional and sustained supply chain performance.

6. Recommendations

This study investigated the impact of SCOR metrics- cycle time, cost, and flexibility on SMEs' supply chain performance in Mombasa County, Kenya. The findings reveal that all three metrics significantly influence supply chain performance, with flexibility metrics exhibiting the most substantial effect (β=0.848), followed by cost metrics (β=0.788) and cycle time metrics (β=0.811).

These results challenge the conventional emphasis on cost optimization as the primary driver of supply chain performance in resource-constrained environments. Instead, they highlight the importance of adaptability and responsiveness in today's volatile market conditions, even for small enterprises. The superior impact of flexibility metrics suggests that SMEs in developing economies must prioritize their ability to respond to market changes and customer demands to remain competitive.

The positive influence of cost metrics confirms that efficient resource utilization remains an important aspect of supply chain management, particularly in contexts where financial resources are limited. Similarly, the significance of cycle time metrics underscores the value of operational efficiency and timely delivery in meeting customer expectations.

From a theoretical perspective, this study extends the application of the SCOR model to SMEs in developing economies, demonstrating its utility beyond large multinational corporations. The findings contribute to the growing literature on supply chain performance measurement in diverse contexts.

From a practical standpoint, the research provides evidence-based guidance for SME managers in Kenya and similar economic environments. While traditional thinking might lead managers to focus primarily on cost reduction, this study suggests that investments in flexible systems and processes may yield greater returns regarding overall supply chain performance.

The study is not without limitations. The research's cross-sectional nature prevents examining how these relationships might evolve over time. Furthermore, the focus on Mombasa County may limit the generalizability of the findings to other regions with different economic conditions. Future research should consider longitudinal designs to capture the dynamic nature of supply chain performance and extend the investigation to different geographical contexts to validate the findings.

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Conflicts of interest

The authors declare no conflict of interest.

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