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Supply Chain Visibility Strategies and Performance of Manufacturing Firms in Nairobi City County, Kenya

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ABSTRACT

Purpose: The objective of the study was to examine the effect of real-time tracking strategies and data integration strategies on the performance of manufacturing firms in Nairobi City County, Kenya. This study was anchored on two theories, Information Processing Theory and Resource-Based View.

Methodology: The target population consisted of 189 registered manufacturing firms in Nairobi City County, as documented by the Kenya Association of Manufacturers. The study applied the Yamane (1967) sample size formula, yielding a sample size of 128 manufacturing firms, meaning data was collected from 128 knowledgeable managerial respondents, one per firm. A descriptive research design was used, supported by simple random sampling to select respondents. A structured questionnaire served as the primary data collection instrument. A pilot study involving 13 respondents (10% of the sample) was conducted to assess the validity and reliability of the research instrument. For the main study, data was analyzed using SPSS version 29, employing descriptive statistics (means, frequencies, standard deviations) and inferential techniques including Pearson correlation and multiple regression analysis to determine the effect of the four visibility strategies on firm performance.

Findings: The study concludes that real-time tracking strategies significantly enhance the performance of manufacturing firms in Nairobi City County. In addition, the study concludes that data integration strategies are the most influential supply chain visibility strategy affecting the performance of manufacturing firms.

Unique Contributions to Theory, Policy, and Practice: Manufacturing firms should increase investment in advanced real-time tracking technologies such as GPS systems, RFID technologies, IoT-enabled monitoring devices, and digital tracking platforms to improve visibility throughout supply chain operations

Keywords: *Supply Chain Visibility Strategies, Real-Time Tracking Strategies, Data Integration Strategies, Manufacturing Firms*

Background of the Study

The manufacturing sector is widely recognized as a cornerstone of economic development due to its substantial contributions to employment creation, export earnings, productivity enhancement, and technological advancement (Sirirat, Martine, & Wout, 2024). Its strong multiplier effect stimulates upstream and downstream sectors such as agriculture, logistics, and services, thereby supporting broader economic transformation (Charles, Acquah, & Ofori, 2020). In both developed and developing economies, manufacturing also drives innovation through the adoption of new technologies, automation, and data-driven processes, which enhance competitiveness and operational efficiency (Adegoke & Mark, 2020). A robust manufacturing sector therefore strengthens national resilience by reducing dependence on imports, supporting local production, and contributing to economic stability during global disruptions such as pandemics, supply chain shocks, and geopolitical tensions (Hsiao-Lan & Wang, 2020).

The rapid globalization and digitization of supply networks, however, have made manufacturing supply chains more complex and vulnerable to disruptions. Pandemic-related shutdowns, fluctuating demand patterns, transportation bottlenecks, and raw material shortages have shown that firms cannot operate effectively without timely and accurate information across the entire supply chain (KPMG International, 2022). This has elevated Supply Chain Visibility (SCV) from an operational convenience to a strategic necessity. SCV refers to a firm's ability to monitor, access, and interpret real-time data about materials, inventory, production, and product movement across multiple supply chain tiers (Tiwari, 2024; Kimwaki, 2023). Without visibility, firms resort to reactive, high-cost decision-making; with strong visibility, they can anticipate disruptions, coordinate more effectively, and optimize production and distribution processes.

Modern supply chain visibility is not incidental; it is the product of deliberate visibility strategies. These strategies integrate technologies such as IoT sensors, RFID, GPS tracking, ERP systems, blockchain, and cloud platforms with governance mechanisms including standardized data protocols, supplier mapping, and collaborative data-sharing agreements (Smith, 2024; KPMG International, 2022). Key components such as real-time tracking, ICT integration, customer visibility, and demand forecasting are central to these strategies. Real-time tracking improves transparency and responsiveness by allowing firms to pinpoint shipment locations and monitor conditions (Mose, Osoro, & Nyang'au, 2024). ICT integration enhances data flow across procurement, production, and logistics systems, ensuring that partners access accurate, synchronized information (Bichanga & Mwangi, 2020). Customer visibility strengthens trust and reduces information bottlenecks by allowing customers to follow the status of their orders (Ayorinde, 2024). Likewise, demand forecasting, enabled by analytics and historical data, supports inventory optimization, resource planning, and service-level improvements (Kimwaki, 2023).

Conceptually, supply chain visibility strategies influence performance through multiple mechanisms. Enhanced visibility reduces operational inefficiencies by lowering stock-outs, excess inventory, and lead times, thereby improving cost efficiency and service reliability (Smith, 2024; Zhao, 2025). Visibility also enhances agility and resilience, enabling firms to detect disruptions early and adjust plans in real time (Kalaiarasan, 2025; Saile & Noor, 2025). Strategic and financial performance is strengthened through improved forecasting accuracy, capacity utilization, and customer satisfaction (Mulweye et al., 2024; Tiwari, 2024). Furthermore, with growing requirements for sustainability and regulatory compliance, visibility supports environmental and social governance by ensuring traceability and accountability across supply chain partners (Zhao, 2025).

Although empirical evidence consistently demonstrates the value of visibility, the literature also highlights major gaps. Many firms, particularly in emerging economies, struggle with fragmented digital systems, limited cross-firm data sharing, weak multi-tier supply chain mapping, and uneven technological maturity among suppliers (Kalaiarasan, 2025; Singagerda, Fauzan, & Desfiandi, 2022). As a result, visibility remains partial, inconsistent, or reactive rather than strategically coordinated. Existing studies often examine isolated visibility elements, such as ICT integration or tracking systems, without capturing visibility as an integrated, multi-dimensional strategy. This creates a major conceptual gap regarding which combinations of visibility practices matter most, how they interact, and under what contextual conditions they enhance performance.

These gaps are particularly salient in Kenya. The manufacturing sector remains central to the country's industrialization agenda, yet firms face persistent challenges such as high production costs, logistical inefficiencies, unreliable transport systems, and import-heavy supply chains (KAM, 2025; Saile & Noor, 2025). Nairobi City County, which hosts the largest concentration of manufacturing firms, benefits from Kenya's advanced digital ecosystem, often described as the "Silicon Savannah", characterized by widespread mobile technology, digital platforms, and growing ICT infrastructure (U.S. International Trade Administration, 2024). Despite this, many manufacturers continue to operate with siloed information systems, limited real-time visibility, weak upstream traceability, and poor integration with suppliers and logistics partners (Muiruri, Shale, & Osoro, 2025). Existing Kenyan studies acknowledge the value of visibility but typically focus on specific components rather than comprehensive visibility strategies, and they rarely examine multi-dimensional performance outcomes or strategic configurations that could strengthen competitiveness. It is against this backdrop, the present study sought to examine how supply chain visibility strategies, conceptualized as an integrated set of technological, relational, and governance practices, influence the performance of manufacturing firms in Nairobi City County, Kenya.

Statement of the Problem

The manufacturing sector plays a central role in Kenya's economic development, contributing to industrialization, job creation, technological advancement, and regional trade competitiveness (Wambua & Noor, 2024). As a key pillar of the economy, manufacturing supports multiple dependent sectors, including logistics, retail, and services, creating a multiplier effect essential for sustained economic growth (Ogwang, Wachiuri, & Nyaberi, 2024). Nairobi City County, which hosts the country's largest concentration of industrial activity, is particularly critical, contributing nearly half of Kenya's manufacturing output and serving as a major hub for employment, innovation, and urban economic development (Bichanga & Mwangi, 2020). The performance of manufacturing firms in Nairobi therefore has direct implications for Kenya's national economic trajectory, industrial competitiveness, and resilience.

Despite its strategic importance, the manufacturing sector in Kenya continues to underperform. Manufacturing's contribution to GDP has stagnated at approximately 7.5% as of 2022, far below the national target of 15% set under Vision 2030 (Kimwaki, 2023). Industrial growth has also slowed significantly, declining from 4.3% in 2019 to 2.5% in 2021, reflecting reduced productivity and limited industrial expansion (Kimwaki, 2023). Nairobi's manufacturing firms face persistent operational challenges, including high electricity and production costs, utility expenses alone have increased by around 15% annually, alongside frequent power outages that disrupt production schedules and inflate operational costs (Kimwaki, 2023). These structural weaknesses continue to erode competitiveness and reduce the sector's contribution to employment and foreign exchange earnings.

Supply chain inefficiencies further compound this underperformance. The average time required to import goods through Kenyan ports stands at 11 days, while exporting takes approximately 10 days, significantly higher than the 6-day benchmark observed in more competitive regional economies (Bichanga & Mwangi, 2020). Congestion, inadequate road infrastructure, and bottlenecks within Nairobi's industrial corridors contribute to delayed deliveries and rising transportation costs (Kimwaki, 2023). A Kenya Association of Manufacturers (KAM) report indicates that nearly 40% of manufacturing firms in Nairobi experience operational delays linked to supply chain disruptions, resulting in annual revenue losses estimated at 10–15% (KAM, 2025). These issues were exacerbated during the COVID-19 pandemic, when over 60% of firms reported disruptions in supply availability, inventory management, and demand forecasting, leading to reduced productivity and diminished market responsiveness (Mose, Osoro, & Nyang'au, 2024).

While supply chain visibility (SCV) has been identified globally as a strategic lever for improving operational efficiency, risk management, and responsiveness, its conceptualization in Kenya remains limited. Existing local studies exploring SCV, such as those focusing on distribution firms, public corporations, retail supply chains, or general manufacturing contexts,

tend to examine isolated technological aspects such as ICT integration or tracking tools (Wambua & Noor, 2024; Ogwang et al., 2024; Bichanga & Mwangi, 2020; Kimwaki, 2023). These studies offer valuable insights but rarely address visibility as a holistic, multi-dimensional strategy integrating technological systems, relational coordination, multi-tier supplier mapping, and data governance. They also provide limited understanding of how comprehensive visibility strategies influence the multiple dimensions of performance, including efficiency, flexibility, reliability, and cost performance, within Nairobi's unique manufacturing ecosystem.

In light of persistent sectoral underperformance, significant supply chain inefficiencies, and the conceptual gaps in existing literature, this study sought to examine how supply chain visibility strategies influence the performance of manufacturing firms in Nairobi City County, Kenya. By focusing on visibility as an integrated strategic construct rather than a narrow technological intervention, the study aims to generate insights that can inform policy, strengthen managerial decision-making, and support the revitalization of Kenya's manufacturing sector.

Objectives of the Study

General Objective

To examine effect of supply chain visibility strategies and performance of manufacturing firms in Nairobi City County, Kenya.

Specific Objectives

The study was guided by the following specific objectives:

i. To determine the influence of real-time tracking strategies on the performance of manufacturing firms in Nairobi City County, Kenya.
ii. To examine the influence of data integration strategies on the performance of manufacturing firms in Nairobi City County, Kenya.

Theoretical Review

Information Processing Theory (IPT)

Information Processing Theory (IPT) was first introduced by Jay Galbraith (1973), who argued that organizations function in environments characterized by varying degrees of uncertainty, and their effectiveness depends on their capacity to acquire, interpret, and utilize information efficiently. According to Galbraith, when uncertainty increases, such as in complex supply chains, organizations must either reduce the need for information processing through the creation of slack resources or increase their information-processing capacity through mechanisms such as real-time communication, coordination structures, and technological systems. The core premise of IPT is that organizations must develop appropriate information systems and communication channels to align decision-making with environmental complexity.

Over the years, IPT has evolved and been extended within the fields of supply chain management, logistics, and operations. Researchers have emphasized that modern supply chains, characterized by globalization, rapid digitization, and heightened customer expectations, require firms to adopt advanced information-processing tools such as IoT-enabled tracking systems, cloud platforms, RFID technology, GPS-enabled logistics monitoring, and integrated communication systems (Tiwari, 2024). Contemporary scholars note that IPT has increasingly shifted from manual communication models toward sophisticated digital infrastructures that allow organizations to detect disruptions early, share data in real time, and synchronize activities across multiple supply chain tiers (KPMG, 2022). Moreover, recent studies apply IPT to explain how firms leverage digital visibility tools to reduce information asymmetry, improve forecasting accuracy, and enhance supply chain responsiveness (Smith, 2024).

IPT has been widely used by researchers to examine the role of information flow and digital tools in enhancing supply chain performance. For instance, Lee and Yoon (2023) applied IPT to analyze how integrated information systems in South Korea's manufacturing sector improved real-time coordination and reduced operational uncertainty. Similarly, Mose, Osoro, and Nyang'au (2024) used IPT to demonstrate how real-time tracking technologies enhanced responsiveness and reliability in Kenyan manufacturing supply chains. These studies affirm the theory's relevance in modern supply chain environments where tracking, transparency, and information-sharing systems are increasingly indispensable.

Despite its strengths, IPT has notable critiques. One limitation is its assumption that organizations can always increase information-processing capacity through technological investments, overlooking resource constraints faced by firms in developing economies. Critics also argue that IPT focuses primarily on internal information flows and may underestimate relational and behavioral factors influencing information exchange among supply chain partners (Kimwaki, 2023). Furthermore, some scholars note that IPT assumes rational decision-making and may not fully capture the complexities of dynamic, multi-tier supply chains where power imbalances and trust issues affect information sharing (Dyer & Singh, 1998).

Nevertheless, IPT remains highly relevant for the present study. Supply chain visibility, particularly real-time tracking strategies, is fundamentally an information-processing capability. Real-time tracking enhances the speed, accuracy, and completeness of information flows across the supply chain, enabling firms to reduce uncertainty, monitor movement of goods, detect disruptions early, and make timely decisions. The theory provides a robust foundation for understanding how real-time tracking systems support organizational performance by strengthening information-processing capacity in volatile environments such as Nairobi's manufacturing sector. Thus, Information Processing Theory supports the study's first independent variable, real-time tracking strategies, by explaining how enhanced information flow and visibility reduce operational uncertainty and ultimately improve firm performance.

Resource-Based View (RBV)

The Resource-Based View (RBV) was introduced by Wernerfelt (1984) and later advanced by Barney (1991), who argued that firms achieve and sustain competitive advantage through the possession and deployment of valuable, rare, inimitable, and non-substitutable (VRIN) resources. RBV posits that competitive advantage does not arise merely from industry structure or external forces but from internal organizational resources and capabilities, such as technology, knowledge, systems, and skills, that are strategically configured to create superior value. According to Barney (1991), if a firm possesses VRIN resources and deploys them effectively, it can outperform competitors over time.

Over the years, RBV has been significantly expanded to accommodate technological advancements and evolving organizational contexts. Scholars have argued that in digital environments, information systems, integrated data architectures, and technological capabilities constitute strategic resources that enhance coordination, decision-making, and operational efficiency (Wade & Hulland, 2004). As supply chains become interconnected and data-intensive, integrated information systems, such as Enterprise Resource Planning (ERP), Electronic Data Interchange (EDI), cloud databases, and real-time analytics platforms, are increasingly conceptualized as VRIN resources that enable firms to synchronize operations and reduce uncertainty (Teece, 2020). Modern extensions of RBV highlight that data, and the capability to manage and transform data into actionable insights, is now a central source of competitive advantage in supply chain environments (Sirmon, Hitt, & Ireland, 2020).

RBV has been widely applied in supply chain management research. For example, Dubey et al. (2020) used RBV to demonstrate how digital integration capabilities enhance supply chain visibility, agility, and performance. In manufacturing contexts, data integration technologies are shown to improve process synchronization, reduce delays, enhance inventory accuracy, and support predictive decision-making (Ivanov & Dolgui, 2020). In the African context, Mulweye et al. (2024) noted that integrated supply chain systems serve as strategic resources that improve information flow and coordination among manufacturing firms. Similarly, Ogwang, Wachiuri, and Nyaberi (2024) found that integrated ICT systems in Kenyan organizations enhanced transparency, reduced operational bottlenecks, and improved overall performance, supporting RBV's assertion that strategically deployed information systems strengthen competitiveness.

Although RBV is influential, it has been critiqued on several grounds. One critique is that RBV often lacks specificity regarding what constitutes a strategic resource, leading to ambiguity when identifying or measuring VRIN attributes (Priem & Butler, 2001). Additionally, critics argue that RBV assumes resource immobility and long-term stability, which may not apply in dynamic environments where technology evolves rapidly (Lin & Wu, 2014). Others contend that RBV underemphasizes environmental factors and interfirm relationships, which are crucial in modern supply chains characterized by collaboration and interdependence (Lavie, 2006). In developing

economies, RBV may also overlook constraints such as limited capital, weak technological infrastructure, and institutional barriers that restrict firms' ability to develop VRIN resources (Kimwaki, 2023).

Despite these limitations, RBV remains highly relevant to the present study. Data integration strategies, including the use of ERP systems, integrated databases, shared information platforms, and synchronized ICT systems, constitute strategic organizational resources that enhance supply chain visibility and performance. When effectively implemented, these systems become valuable and difficult to imitate, enabling firms to achieve operational efficiency, real-time decision-making, improved coordination, and enhanced competitiveness. For manufacturing firms in Nairobi City County, where supply chain fragmentation and information asymmetry are common, integrated data systems serve as critical resources that support visibility, reduce uncertainty, and strengthen performance outcomes. Thus, the Resource-Based View provides the theoretical foundation for the study's third independent variable, data integration strategies, by explaining how technology-based resources contribute to operational excellence and improved firm performance.

Conceptual Framework

A conceptual framework illustrates the relationships among the study variables and provides a structured representation of how the independent variables are expected to influence the dependent variable. The framework therefore illustrates the direct influence of each supply chain visibility strategy on the performance of manufacturing firms in Nairobi City County. Figure 1 presents the conceptual framework for the study.

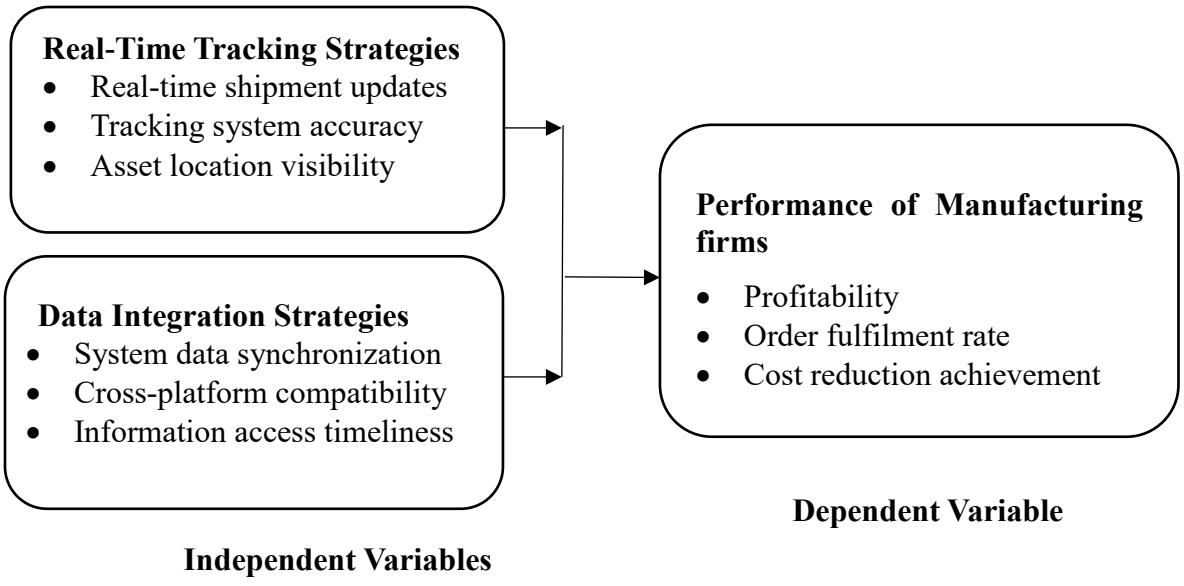

Figure 1: Conceptual Framework

Real-Time Tracking Strategies

Real-time tracking strategies are widely recognized as essential mechanisms for creating transparency and timely information flow throughout supply chains. Kalaiarasan (2025) explains that real-time monitoring capabilities enable firms to observe the movement of materials across multiple nodes, reducing uncertainty and enhancing their ability to anticipate disruptions. Through technologies such as IoT sensors, RFID, GPS devices, and telematics, firms gain immediate visibility into shipment status, asset location, and transit conditions, capabilities that strengthen oversight and improve operational reliability. According to Wyciślak (2024), these technologies provide continuous data feeds that make it possible to track goods dynamically, identify deviations early, and maintain situational awareness across logistics processes.

The strength of real-time tracking lies in its ability to enhance information accuracy and responsiveness. The analysis of supply chain visibility platforms shows that integrated tracking systems support granular monitoring of inventory positions, transport routes, and event occurrences in real time, thereby improving decision accuracy and the timeliness of managerial interventions (Supply Chain Visibility Platforms, 2025). Tracking tools generate actionable intelligence that reduces lead-time variability and minimizes risks of stock-outs or delayed deliveries by ensuring that managers have uninterrupted access to updated operational data. Kariuki (2025) emphasizes that improved supply chain transparency, achieved through real-time tracking, enables firms to respond more confidently to demand fluctuations, supplier delays, and transportation irregularities.

Real-time tracking strategies also contribute to enhanced coordination among supply chain partners. Wyciślak (2024) notes that when suppliers, manufacturers, and logistics providers share synchronized tracking information, they reduce information asymmetry and foster more reliable interfirm relationships. Such shared visibility supports upstream and downstream communication, enabling faster alignment of production schedules with actual material flows. Studies examining supply chain transparency further show that timely access to tracking information allows firms to better manage customer expectations by providing accurate delivery forecasts and performance updates (Supply Chain Transparency, 2025). These collaborative benefits make real-time tracking a foundational element in achieving high-performing and integrated supply chains.

The operational contribution of real-time tracking is reflected in its impact on core performance indicators within manufacturing environments. Technologies that supply real-time shipment updates, enhance tracking accuracy, and improve asset location visibility have been shown to reduce downtime, enhance order-fulfillment rates, and improve cost efficiency (Kalaiarasan, 2025; Kariuki, 2025). By strengthening visibility and enabling rapid managerial responses, real-time tracking strategies support smoother workflow execution and more consistent output levels. In manufacturing settings characterized by tight production schedules and complex logistics

flows, these capabilities are vital for maintaining operational continuity and elevating overall firm performance.

Data Integration Strategies

Data integration strategies refer to the technological and organizational mechanisms that enable seamless sharing, synchronization, and accessibility of information across supply chain partners. Harianto, Tarigan, Siagian, Basana, and Jie (2024) explain that effective data integration connects multiple systems, such as procurement, production, warehousing, and distribution, into a unified platform that supports real-time information exchange and coordinated operations. Integrated data environments reduce fragmentation by ensuring that information moves consistently across departments and between firms, thereby supporting more accurate planning and improved operational transparency. This integration is central to building digital supply chains that depend on continuous data flow.

The adoption of Enterprise Resource Planning (ERP), cloud-based platforms, and interoperable ICT systems enhances a firm's capacity to synchronize information across internal and external supply chain stakeholders. Atieh (2025) highlights that integration of digital technologies strengthens visibility by linking automation, analytics, and communication tools into coherent decision-support systems. These systems ensure that data are updated promptly, accessible to authorized users, and consistent across supply chain nodes. Balaha (2025) emphasizes that when data from IoT devices, ERP systems, and analytics engines converge, firms are able to detect inefficiencies quickly, align production with demand patterns, and optimize resource utilization. Such integrated infrastructures form the foundation for responsive and technology-enabled manufacturing operations.

Integrated data systems also promote collaboration and coordination between supply chain partners by enabling the exchange of structured, timely, and accurate information. Omar (2024) reports that supply chain technological integration in East African manufacturing firms enhances visibility and reduces operational errors by ensuring that partner firms access synchronized data regarding orders, inventory levels, and production schedules. This alignment supports more effective joint planning, minimizes duplication of efforts, and reduces variability in supply chain performance. Data integration therefore strengthens interorganizational relationships by enhancing transparency and reducing information asymmetry, critical factors in environments where supply chain fragmentation can impede performance.

Data integration strategies have measurable impacts on operational and business performance outcomes. Harianto et al. (2024) demonstrate that firms with high levels of digital integration achieve improved production efficiency, faster decision cycles, and higher service-level performance due to better coordination between functions. Balaha (2025) adds that real-time access to harmonized data enhances agility by enabling quick adjustments to production schedules and inventory strategies. In addition, Atieh (2025) shows that integrated data systems

reduce costs related to rework, redundancies, and delays, strengthening overall competitiveness. These findings underscore the importance of synchronized data systems, cross-platform compatibility, and timely information access as essential strategies for improving supply chain performance in modern manufacturing environments.

Empirical Review

Real-Time Tracking Strategies

Globally, Pethe, Sahu, and Kodarlikar (2024) examine how IoT-based real-time asset tracking reshapes logistics efficiency in large manufacturing supply chains in India. Their conference study on "IoT Research in Supply Chain Management and Logistics: Real-Time Asset Tracking and Inventory Management" focuses on technologies such as RFID, GPS, and IoT sensors as the core independent construct, and logistics efficiency (shipment delays, coordination quality, and order fulfilment accuracy) as key performance outcomes. According to the synthesis by Mwaura and Noor (2025), the authors employ a quantitative design and show that firms implementing real-time tracking systems achieve about a 30% reduction in shipment delays and roughly 25% improvement in supply chain coordination, because managers can continuously monitor product location, transit conditions, and estimated delivery times, and intervene proactively when disruptions arise. However, the study is heavily technology-centric, does not clearly articulate its sampling frame or analytical philosophy, and treats performance mainly as logistics efficiency. It therefore offers limited insight into how real-time tracking is embedded within broader visibility strategies, how it affects multi-dimensional firm performance (e.g., profitability, competitiveness), or how governance and collaborative practices condition its impact, gaps the present study addresses by framing real-time tracking as just one element of an integrated visibility strategy.

In the Kenyan context, Mwangi and Mutua (2022) provide one of the few studies that explicitly centre real-time tracking in relation to firm-level supply chain outcomes. Working with 90 Nairobi-based manufacturing firms in sectors such as food processing, pharmaceuticals and textiles, they use a cross-sectional survey to examine how adoption intensity of GPS and RFID tracking, together with AI-based monitoring tools, influences supply chain efficiency. As summarized by Mwaura and Noor (2025), firms using real-time tracking reported about 28% reduction in product loss during transit, 32% improvement in last-mile delivery efficiency, and roughly 20% improvement in customer satisfaction, owing to more accurate ETAs and faster disruption response. However, the study treats real-time tracking as a single composite construct, focuses narrowly on operational efficiency and customer-facing metrics, and does not explicitly theorise tracking as part of a broader visibility strategy that might also influence strategic and financial performance. It also offers limited discussion of organisational or governance enablers (e.g., data-sharing protocols, cross-functional coordination) that convert tracking data into sustained performance gains.

Finally, Mwaura and Noor (2025) analyse supply chain visibility and performance of manufacturing firms in Nairobi City County, with real-time tracking as one of the central visibility dimensions. Guided by Systems Theory and the Technology Acceptance Model (TAM), they employ a descriptive, positivist cross-sectional design targeting 714 managerial employees in 119 manufacturing firms; a sample of 256 respondents is selected using simple random sampling. Data are collected through structured Likert-scale questionnaires, pilot-tested for reliability, and analysed using descriptive statistics, Pearson correlation and multiple regression in SPSS. Their results show that real-time tracking (measured through adoption of GPS, RFID and IoT sensors, perceived impact on efficiency, disruption mitigation and customer satisfaction) has a strong, positive and statistically significant effect on firm performance ($B = 0.313$, $p < .001$), alongside ICT integration. Yet the study still operationalises tracking at a fairly generic level, provides limited differentiation between specific tracking strategies (e.g., multimodal tracking, exception management, predictive alerts), and does not consider how tracking interacts with risk management, data integration or supplier collaboration strategies in shaping multi-dimensional performance. These gaps justify the present study's focus on real-time tracking as a distinct, strategically configured visibility strategy, examined together with other visibility dimensions to explain the performance of manufacturing firms in Nairobi City County.

Data Integration Strategies

Atieh, Abu Hussein, Al-Jaghoub, Alheet, and Attiany (2025) examine how digital technology, automation, and data integration with upstream and downstream providers jointly influence supply chain performance in industrial manufacturing companies in Jordan. Grounded in digital transformation theory, the study conceptualizes data integration as the seamless sharing of information across ERP, cloud, and inter-organizational platforms, enabling real-time decision-making and coordination. Using a structured survey of 181 supply chain managers drawn from manufacturing firms and analyzed with SmartPLS (PLS-SEM), the authors find that automation has the strongest direct effect on supply chain performance, followed by data integration, while digital technologies alone yield weaker results unless embedded within broader digital transformation initiatives (Atieh et al., 2025). The study confirms that integrated data architectures are critical performance drivers, but it treats integration as one component in a broad digital bundle and does not disentangle specific data integration strategies (e.g., inter-firm interoperability, master-data governance) or examine sectoral nuances in resource-constrained manufacturing environments similar to Nairobi. MDPI

Chebet (2025) undertakook a critical literature review on supply chain digitalization and production lead time among African manufacturing firms, synthesizing evidence on ERP, IoT, cloud platforms, blockchain, AI and digital twins. The review shows that integrated digital systems improve information transparency, automate planning and replenishment, and support predictive maintenance, collectively reducing setup, processing and inspection times and cutting lead times by up to 30% in some cases (Gal et al., 2019; El-Shafie, Ibrahim, & Adeyemi, 2025).

It also highlights that effective performance gains occur when digital tools are tightly integrated with lean production and process redesign, rather than deployed as isolated applications (Chebet, 2025). However, because the study relies entirely on secondary sources and adopts a narrative synthesis rather than an empirical design, it does not quantify the relative contribution of specific data integration strategies (such as ERP–MES integration or cross-firm data sharing) to firm-level performance, nor does it provide primary evidence from individual African manufacturing hubs. ResearchGate

In Kenya, Omar, Egessa, and Ndolo (2024) investigate the influence of supply chain technological integration on the performance of formal manufacturing firms in Mombasa County, a construct that closely aligns with data integration strategies. Anchored in Innovation Diffusion Theory, the study conceptualizes technological integration as the extent to which firms connect internal systems (e.g., ERP, warehouse management systems) and external interfaces with suppliers and logistics partners into a cohesive digital architecture (Omar et al., 2024). The target population comprised 50 formal manufacturing firms, with 50 procurement managers, 100 warehouse managers and 100 operations managers (total 250 potential respondents). Using Yamane's formula, a sample of 152 respondents was drawn and data collected through structured questionnaires; analysis employed descriptive statistics and regression techniques. The findings show that process integration and information system interoperability are significantly and positively related to firm performance indicators such as delivery reliability, cost efficiency and capacity utilization. However, the study treats "technological integration" as a single construct, does not explicitly frame it as a visibility-oriented data integration strategy, and focuses on Mombasa rather than Nairobi City County, leaving contextual and configurational gaps for the present research.

RESEARCH METHODOLOGY

Research Design

A research design provides the structural blueprint that guides the collection, measurement, and analysis of data in a study. Creswell (2018) explains that a research design ensures methodological coherence by outlining the procedures necessary to obtain valid and reliable evidence. This study employed a descriptive research design, which Mugenda and Mugenda (2019) describe as a design used to systematically and accurately describe characteristics of a population, behaviors, or phenomena without manipulation of variables. Descriptive designs are particularly appropriate when the goal is to examine relationships among variables within their natural settings (Kumar, 2020).

Target Population

A target population refers to the entire group of individuals or entities that possess the characteristics relevant to a study's objectives. According to Kothari (2018), a target population

comprises all elements from which the researcher sought to draw conclusions. In this study, the target population consists of manufacturing firms operating within Nairobi City County. The Kenya Association of Manufacturers (KAM, 2025) reports that there are 189 registered manufacturing firms in the County (Appendix III), and these constitute the total population from which the study collected data.

The unit of analysis for this study was therefore the manufacturing firm, since the study aims to assess how supply chain visibility strategies are implemented at the organizational level and how they influence firm performance. The unit of observation was one knowledgeable respondent from each firm, specifically a senior supply chain manager who is directly involved in managing supply chain processes and visibility systems.

Sample and Sampling Techniques

A sample is a subset of the population selected for study, while sampling techniques determine how this sample is drawn. Samples are used to reflect the entire attributes of a given population under investigation such that the study's findings can be generalized to the entire population.

According to Mugenda and Mugenda (2018), a sample is a smaller group of individuals selected from the population. The Yamane formula was adopted to calculate the study sample size as follows;

$$n = \frac{N}{1+N(e^2)}$$

Where n is the sample size, and N is the population size, e- acceptable sampling error (0.05)

Substituting the values:

$$n = \frac{189}{1 + 189(0.05^2)} = \frac{189}{1 + 189(0.0025)} = \frac{189}{1 + 0.4725} = \frac{189}{1.4725} \approx 128.33$$

Thus, the calculated sample size was 128 manufacturing firms. Because data was collected from one knowledgeable respondent per firm, the final sample size consisted of 128 respondents.

Sampling technique deals with the procedure the researcher would adopt in obtaining items to be observed (sample) from a given population (Mugenda & Mugenda, 2018). The study used simple random sampling in selecting the sample from study population. The advantage of random sampling is that it ensures that the sampling error is minimal which increases precision of techniques of estimation in use (Cooper & Schindler, 2019).

Data Collection Instruments

This study utilized a structured questionnaire as the primary data collection instrument. Patton et al. (2016) note that questionnaires provide an efficient means of gathering standardized data from a large population, enabling direct alignment between research objectives and measurable

responses. Structured questionnaires ensure uniformity in the way questions are presented, which enhances the comparability and reliability of data across respondents. Dempsey (2019) further argues that questionnaires minimize interviewer influence and allow respondents the privacy to provide honest and unbiased answers. According to Kothari (2018), questionnaires are particularly suitable for studies requiring quantifiable analysis, as they enhance accuracy, reduce researcher interference, and provide a consistent framework for evaluating multiple variables.

Pilot Test

A pilot study is essential for testing and validating research instruments. According to Creswell and Creswell (2020), pilot testing helps refine questions, identify ambiguities, and improve instrument reliability before full-scale data collection. The pilot test involved 13 respondents (10% of the sample size), following recommendations by Mugenda and Mugenda (2018) that pilot tests should cover 5-10% of the total sample.

Data Analysis and Presentation

The objectives of the study guided data analysis. SPSS version 28 was used to analyze the data that was collected from the field. In order to allow data to be entered into the software, the questionnaires were referenced, and the data coded. Quantitative data collected was analyzed using descriptive statistics techniques. Through descriptive analyses, correlational as well as experimental studies emerge; and also, they provide clues on the issues that require more attention which leads to further research (Mugenda & Mugenda, 2018).

Descriptive statistics such as frequency distribution, mean (measure of dispersion), standard deviation, and percentages were used. Descriptive statistics therefore enables researchers to present the data in a more meaningful way, which allows simpler and easier interpretation (Singpurwalla, 2019). Inferential data analysis was conducted by use of Pearson correlation coefficient, and multiple regression analysis. Inferential statistic was used to make judgments about the probability that an observation is dependable or one that happened by chance in the study. The relationship between the study variables were tested using multivariate regression model.

The regression model was as shown below;

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$$

Whereby;

Y = performance of manufacturing firms in Nairobi City County, Kenya

β_0 = Constant

$\beta_1, \beta_2,$ = Coefficients of determination

X_1 = Real-Time Tracking Strategies

X_2 = Data Integration Strategies

ε = Error term

The findings were presented in tables and figures.

RESEARCH FINDINGS AND DISCUSSION

Descriptive Statistics

Real-Time Tracking Strategies

This subsection presents the descriptive statistics for real-time tracking strategies, and the findings are summarized in Table 1. The analysis sought to establish the extent to which manufacturing firms in Nairobi City County have adopted real-time tracking practices to enhance supply chain visibility, coordination, and responsiveness.

Table 1: Descriptive Statistics for Real-Time Tracking Strategies

Statement	Mean	Std. Dev.
Our firm uses GPS tracking to monitor the movement of goods in transit.	4.211	0.742
IoT-enabled devices are used to provide real-time updates on shipment conditions.	4.037	0.826
RFID technology is used to track inventory movement across the supply chain.	3.954	0.874
The firm receives timely alerts when disruptions occur during delivery.	4.165	0.761
Real-time tracking information is integrated into our daily operational decision-making.	4.220	0.718
Real-time tracking enhances accuracy in estimating delivery times.	4.248	0.695
Tracking systems are consistently updated to improve monitoring capabilities.	4.138	0.779
Aggregate Score	**4.139**	**0.771**

The findings presented in Table 1 indicate that respondents strongly agreed that real-time tracking enhances accuracy in estimating delivery times (M = 4.248, SD = 0.695), suggesting that real-time tracking technologies have improved the ability of manufacturing firms to accurately predict delivery schedules and enhance customer service. Respondents also strongly agreed that real-time tracking information is integrated into daily operational decision-making (M = 4.220, SD = 0.718), implying that information generated through tracking systems is routinely utilized in planning, logistics coordination, inventory management, and operational decision-making. Similarly, respondents strongly agreed that their firms use GPS tracking to

monitor the movement of goods in transit (M = 4.211, SD = 0.742), indicating widespread adoption of location-tracking technologies to improve visibility of goods throughout the transportation process.

The results further reveal that respondents agreed that the firm receives timely alerts when disruptions occur during delivery (M = 4.165, SD = 0.761), suggesting that tracking systems provide early warning mechanisms that enable firms to respond promptly to supply chain interruptions. Respondents also agreed that tracking systems are consistently updated to improve monitoring capabilities (M = 4.138, SD = 0.779), implying that manufacturing firms continuously invest in improving the effectiveness and reliability of their tracking technologies. In addition, respondents agreed that IoT-enabled devices are used to provide real-time updates on shipment conditions (M = 4.037, SD = 0.826), indicating growing adoption of advanced digital technologies that support continuous monitoring of supply chain activities. Respondents further agreed that RFID technology is used to track inventory movement across the supply chain (M = 3.954, SD = 0.874), suggesting that firms utilize automated identification technologies to improve inventory visibility, inventory accuracy, and movement control across supply chain networks.

The aggregate mean score for real-time tracking strategies was 4.139 with a standard deviation of 0.771, indicating a high level of implementation of real-time tracking strategies among manufacturing firms in Nairobi City County and relatively low variation in respondents' opinions. The findings suggest that manufacturing firms have substantially embraced technologies that facilitate real-time monitoring of goods, inventory, shipment conditions, and operational activities across the supply chain. Through enhanced visibility, firms are better positioned to improve responsiveness, strengthen operational coordination, minimize disruptions, and support informed decision-making. This finding concurs with Pethe et al. (2024), who established that real-time tracking technologies significantly enhance logistics visibility, operational efficiency, and supply chain responsiveness. The finding is also consistent with Wyciślak (2024), who found that real-time visibility technologies improve supply chain transparency and enable organizations to identify and address disruptions proactively. Furthermore, Zhao (2025) observed that real-time visibility capabilities strengthen supply chain performance by enhancing information accuracy, transportation visibility, and decision-making effectiveness.

Data Integration Strategies

This subsection presents the descriptive statistics for data integration strategies, and the findings are summarized in Table 2. The analysis sought to establish the extent to which manufacturing firms have integrated information systems and digital platforms to facilitate information sharing, coordination, and decision-making across supply chain activities.

Table 2: Descriptive Statistics for Data Integration Strategies

Statement	Mean	Std. Dev.
Our firm integrates ERP systems with supply chain partners for seamless information flow.	4.193	0.731
Data from suppliers and logistics partners is shared in real time.	4.110	0.789
Internal systems (procurement, inventory, production) are digitally interconnected.	4.275	0.682
The firm uses cloud-based platforms to support data accessibility across departments.	4.128	0.758
Data integration supports faster decision-making in supply chain operations.	4.321	0.651
The firm maintains consistent and accurate master data across all operations.	4.183	0.719
Integrated data platforms help reduce errors and inconsistencies across the supply chain.	4.266	0.676
Aggregate Score	**4.211**	**0.715**

The findings presented in Table 2 indicate that respondents strongly agreed that data integration supports faster decision-making in supply chain operations (M = 4.321, SD = 0.651), suggesting that integrated information systems enable managers to access timely and accurate information required for effective operational decisions. Respondents also strongly agreed that internal systems comprising procurement, inventory, and production functions are digitally interconnected (M = 4.275, SD = 0.682), implying that manufacturing firms have invested in technologies that facilitate seamless information exchange across organizational functions. Similarly, respondents strongly agreed that integrated data platforms help reduce errors and inconsistencies across the supply chain (M = 4.266, SD = 0.676), indicating that integrated systems enhance data quality and reliability, thereby improving operational efficiency and coordination.

The findings further reveal that respondents agreed that our firm integrates ERP systems with supply chain partners for seamless information flow (M = 4.193, SD = 0.731), suggesting that firms have adopted enterprise-wide systems that support collaboration and information sharing with supply chain partners. Respondents also agreed that the firm maintains consistent and accurate master data across all operations (M = 4.183, SD = 0.719), implying that organizations recognize the importance of data quality in supporting supply chain visibility and effective decision-making. In addition, respondents agreed that the firm uses cloud-based platforms to support data accessibility across departments (M = 4.128, SD = 0.758), indicating that cloud

technologies are increasingly being utilized to improve information accessibility and organizational coordination. Further, respondents agreed that data from suppliers and logistics partners is shared in real time (M = 4.110, SD = 0.789), suggesting that manufacturing firms have embraced collaborative information-sharing practices that improve responsiveness and operational synchronization across the supply chain.

The aggregate mean score for data integration strategies was 4.211 with a standard deviation of 0.715, indicating a very high level of implementation of data integration strategies among manufacturing firms in Nairobi City County and relatively low variation in respondents' opinions. The findings suggest that manufacturing firms have significantly embraced integrated information systems that facilitate real-time information sharing, cross-functional coordination, and data-driven decision-making. Effective integration of internal and external information systems enhances visibility, reduces information silos, improves operational efficiency, and supports strategic responsiveness. This finding is consistent with Harianto et al. (2024), who found that integrated information systems significantly improve supply chain visibility, collaboration, and organizational performance by facilitating seamless information flow among supply chain partners. The finding also concurs with Atieh (2025), who established that data integration capabilities improve decision-making quality, operational coordination, and responsiveness through enhanced access to reliable and timely information. Furthermore, Bichanga and Mwangi (2020) reported that information integration strengthens supply chain performance by improving communication, reducing information asymmetry, and enhancing synchronization of supply chain activities.

Performance of Manufacturing Firms in Nairobi City County, Kenya

This subsection presents the descriptive statistics for the performance of manufacturing firms, and the findings are summarized in Table 3. The analysis sought to establish the level of organizational performance achieved by manufacturing firms in Nairobi City County as reflected in delivery performance, operational efficiency, profitability, customer satisfaction, responsiveness, and competitive advantage.

Table 3: Descriptive Statistics for Performance of Manufacturing Firms

Statement	Mean	Std. Dev.
The firm consistently meets customer delivery timelines.	4.284	0.663
Operational costs have reduced due to improved supply chain practices.	4.156	0.739
Production efficiency has improved over the last three years.	4.248	0.692
The firm's market responsiveness has increased.	4.211	0.721
Customer satisfaction levels have improved.	4.330	0.637
Overall profitability has grown as a result of improved supply chain operations.	4.174	0.744
The firm has gained competitive advantage due to better supply chain visibility.	4.394	0.601
Aggregate Score	**4.257**	**0.685**

The findings presented in Table 3 indicate that respondents strongly agreed that the firm has gained competitive advantage due to better supply chain visibility (M = 4.394, SD = 0.601), suggesting that visibility-enhancing practices have enabled manufacturing firms to differentiate themselves from competitors through improved coordination, responsiveness, and operational effectiveness. Respondents also strongly agreed that customer satisfaction levels have improved (M = 4.330, SD = 0.637), implying that enhanced visibility across supply chain operations has contributed to improved service delivery and customer experiences. Similarly, respondents strongly agreed that the firm consistently meets customer delivery timelines (M = 4.284, SD = 0.663), indicating that firms have improved their ability to fulfil customer orders within expected schedules.

The findings further reveal that respondents strongly agreed that production efficiency has improved over the last three years (M = 4.248, SD = 0.692), suggesting that improvements in visibility and coordination have enhanced operational effectiveness and resource utilization. Respondents also strongly agreed that the firm's market responsiveness has increased (M = 4.211, SD = 0.721), implying that manufacturing firms are better positioned to respond quickly to changing customer needs and market conditions. In addition, respondents agreed that overall profitability has grown as a result of improved supply chain operations (M = 4.174, SD = 0.744), indicating that supply chain visibility contributes positively to financial performance. Further, respondents agreed that operational costs have reduced due to improved supply chain practices (M = 4.156, SD = 0.739), suggesting that enhanced coordination, planning, and visibility have enabled firms to reduce inefficiencies and optimize operational expenditures.

The aggregate mean score for performance of manufacturing firms was 4.257 with a standard deviation of 0.685, indicating a very high level of performance among manufacturing firms in Nairobi City County and a high degree of agreement among respondents regarding the performance outcomes achieved. The findings suggest that manufacturing firms have experienced substantial improvements in customer service, operational efficiency, profitability, market responsiveness, and competitive positioning. These results imply that firms that invest in supply chain visibility capabilities are better able to coordinate activities, reduce uncertainty, optimize resources, and achieve superior organizational outcomes. This finding is consistent with Zhao (2025), who established that supply chain visibility enhances organizational competitiveness through improved transparency, coordination, and decision-making effectiveness. The finding also concurs with Wambua and Noor (2024), who found that digitally enabled supply chain practices improve operational resilience, responsiveness, and organizational performance. Furthermore, Wyciślak (2024) observed that visibility-driven supply chain systems contribute significantly to operational efficiency, customer satisfaction, and overall firm performance.

Correlation Analysis

This section presents the results of Pearson correlation analysis conducted to determine the nature and strength of the relationship between supply chain visibility strategies and the performance of manufacturing firms in Nairobi City County, Kenya. The results are presented in Table 3.

Table 3: Correlation Analysis

Variable		Y	X1	X2
Performance of Manufacturing Firms (Y)	Pearson Correlation	1		
	Sig. (2-tailed)			
	N	109		
Real-Time Tracking Strategies (X1)	Pearson Correlation	.781**	1	
	Sig. (2-tailed)	.000		
	N	109	109	
Data Integration Strategies (X2)	Pearson Correlation	.814**	.467	1
	Sig. (2-tailed)	.000	.078	
	N	109	109	109

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

*** Correlation is significant at the 0.05 level (2-tailed).**

The findings presented in Table 3 indicate that real-time tracking strategies had a strong positive and statistically significant relationship with the performance of manufacturing firms ($r = 0.781$, $p = 0.000$). Since the significance value was less than 0.05, the relationship was statistically significant at the 5% significance level. The findings imply that increased adoption of GPS tracking, RFID technologies, IoT-enabled devices, and real-time operational monitoring systems is associated with improved organizational performance. The results suggest that enhanced visibility of goods, inventory, and logistics activities improves responsiveness, coordination, and decision-making within manufacturing firms. This finding supports Pethe et al. (2024), who found that real-time tracking technologies significantly improve supply chain visibility, logistics efficiency, and organizational performance through enhanced information accuracy and operational responsiveness.

The results also indicate that data integration strategies had the strongest positive and statistically significant relationship with the performance of manufacturing firms ($r = 0.814$, $p = 0.000$). Since the significance value was less than 0.05, the relationship was statistically significant at the 5% significance level. The findings imply that firms that effectively integrate ERP systems, cloud-based platforms, and real-time information-sharing systems are more likely to achieve superior organizational performance. Effective integration enhances information accessibility, coordination, visibility, and decision-making across supply chain activities. This finding concurs with Harianto et al. (2024), who found that integrated information systems significantly improve supply chain visibility, operational coordination, and organizational effectiveness. Similarly, Atieh (2025) established that data integration capabilities enhance responsiveness and decision quality, resulting in improved organizational performance.

Multiple Regression Analysis

This section presents the results of multiple regression analysis conducted to determine the combined influence of real-time tracking strategies and data integration strategies on the performance of manufacturing firms in Nairobi City County, Kenya. Multiple regression analysis was used to establish the extent to which variations in organizational performance could be explained by the study variables. The findings are presented through the model summary, analysis of variance (ANOVA), and regression coefficients.

Model Summary

This subsection presents the model summary results, which show the strength of the relationship between the independent variables and the dependent variable, as well as the proportion of variation in the performance of manufacturing firms explained by the study variables. The results are presented in Table 4.

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.891	.794	.786	.324

Predictors: (Constant), real-time tracking strategies and data integration strategies

The findings presented in Table 4 indicate that the correlation coefficient (R) was 0.891, implying a very strong positive relationship between the combined supply chain visibility strategies and the performance of manufacturing firms. The coefficient of determination (R^2) was 0.794, indicating that 79.4% of the variation in the performance of manufacturing firms could be explained by real-time tracking strategies and data integration strategies. The adjusted R^2 value of 0.786 further indicates that after adjusting for the number of predictors in the model, 78.6% of the variation in organizational performance remained explained by the study variables. The findings suggest that supply chain visibility strategies are important determinants of performance among manufacturing firms in Nairobi City County.

Analysis of Variance (ANOVA)

This subsection presents the ANOVA results, which were used to determine whether the overall regression model was statistically significant in explaining the relationship between supply chain visibility strategies and the performance of manufacturing firms. The results are presented in Table 5.

Table 5: ANOVA Results

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	41.362	2	20.681	200.786	.000
Residual	10.922	106	0.103		
Total	52.284	108			

The findings presented in Table 5 indicate that the regression model was statistically significant ($F = 200.786$, $p = 0.000$). Since the significance value was less than 0.05, the model was considered significant at the 5% level of significance. This implies that the combined influence of real-time tracking strategies and data integration strategies significantly explained variations in the performance of manufacturing firms. The results therefore demonstrate that supply chain visibility strategies collectively contribute significantly to organizational performance.

Regression Coefficients

This subsection presents the regression coefficients used to determine the individual contribution of each supply chain visibility strategy to the performance of manufacturing firms. The unstandardized coefficients (B) indicate the expected change in the performance of

manufacturing firms resulting from a one-unit change in each independent variable while holding the other variables constant. The results are presented in Table 6.

Table 6: Regression Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	0.584	0.181		3.227	0.002
Real-Time Tracking Strategies	0.241	0.058	0.256	4.155	0.000
Data Integration Strategies	0.318	0.061	0.347	5.213	0.000

Dependent Variable: Performance of Manufacturing Firms

The findings presented in Table 6 indicate that real-time tracking strategies had a positive and statistically significant influence on the performance of manufacturing firms (B = 0.241, t = 4.155, p = 0.000). This implies that a one-unit increase in real-time tracking strategies would result in a 0.241-unit increase in the performance of manufacturing firms while holding all other variables constant. The findings suggest that greater adoption of GPS technologies, RFID systems, IoT-enabled monitoring devices, and real-time tracking systems enhances visibility across supply chain operations, leading to improved organizational performance. This finding supports Pethe et al. (2024), who found that real-time tracking technologies significantly improve logistics efficiency, supply chain responsiveness, and organizational performance through enhanced visibility and information accuracy.

The results also indicate that data integration strategies had a positive and statistically significant influence on the performance of manufacturing firms (B = 0.318, t = 5.213, p = 0.000). This implies that a one-unit increase in data integration strategies would lead to a 0.318-unit increase in organizational performance while holding all other variables constant. Data integration strategies recorded the highest coefficient among the study variables, suggesting that they exerted the greatest influence on firm performance. The findings imply that integration of ERP systems, cloud-based platforms, real-time information sharing mechanisms, and interconnected organizational systems significantly enhances organizational effectiveness. This finding concurs with Harianto et al. (2024), who established that integrated information systems improve supply chain visibility, coordination, and organizational performance. Similarly, Atieh (2025) found that data integration capabilities enhance decision-making quality and operational responsiveness, resulting in improved firm performance.

Based on the regression coefficients, the estimated regression model was:

$$\mathbf{Y = 0.584 + 0.241X_1 + 0.318X_2}$$

Where:

Y = Performance of Manufacturing Firms

X_1 = Real-Time Tracking Strategies

X_2 = Data Integration Strategies

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The study concludes that real-time tracking strategies significantly enhance the performance of manufacturing firms in Nairobi City County. The adoption of technologies such as GPS, RFID, IoT-enabled monitoring systems, and real-time operational tracking improves visibility throughout the supply chain and enables firms to respond effectively to disruptions. Enhanced real-time visibility contributes to improved decision-making, operational efficiency, customer service, and organizational competitiveness.

The study concludes that data integration strategies are the most influential supply chain visibility strategy affecting the performance of manufacturing firms. Integration of ERP systems, cloud technologies, and interconnected organizational platforms enhances information accessibility, coordination, responsiveness, and decision-making effectiveness. Consequently, firms that invest in integrated information systems are likely to achieve superior operational and strategic performance.

Recommendations

Real-Time Tracking Strategies

Manufacturing firms should increase investment in advanced real-time tracking technologies such as GPS systems, RFID technologies, IoT-enabled monitoring devices, and digital tracking platforms to improve visibility throughout supply chain operations. Firms should also ensure that tracking information is integrated into operational and strategic decision-making processes to facilitate timely responses to disruptions and improve service delivery.

Data Integration Strategies

Manufacturing firms should prioritize investments in integrated information systems, particularly ERP platforms, cloud-based technologies, and real-time data-sharing infrastructures. Management should ensure seamless integration of procurement, inventory, production, logistics, and supplier information systems to facilitate timely information flow and support data-driven decision-making. Given that data integration emerged as the strongest predictor of performance, organizations should consider it a strategic priority for enhancing competitiveness and operational effectiveness.

REFERENCES

Adegoke, A., & Mark, O. (2020). Manufacturing innovation and industrial competitiveness. *Journal of Industrial Development, 12*(3), 45–58.

African Development Bank. (2024). *Industrialization and supply chain modernization in Africa*. AfDB Publications.

Atieh, M. A. (2025). Digital technologies integration and supply chain visibility. *Supply Chain Digital Transformation Journal, 14*(1), 44–59.

Avenyo, E. K. (2024). The performance effects of adopting digital technology in manufacturing firms in Africa. *Modern Economy, 12*(4), 123–142.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99–120.

Dubey, R., Gunasekaran, A., Childe, S. J., Fosso Wamba, S., Roubaud, D., & Foropon, C. (2020). Empirical investigation of data analytics capability and organizational flexibility as complements to supply chain resilience. *International Journal of Production Economics, 227*, 107663.

Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review, 23*(4), 660–679.

GIZ Nigeria. (2024). *Supply chain digitalization and industrial modernization in Nigeria*. Deutsche Gesellschaft für Internationale Zusammenarbeit.

Gölgeci, I., & Kuivalainen, O. (2020). Does environmental turbulence moderate the effects of organizational capabilities on performance? *Industrial Marketing Management, 84*, 116–129.

Harianto, Y., Tarigan, Z., Siagian, H., Basana, S. R., & Jie, F. (2024). The role of digital ERP implementation and supply chain integration to improve operational and business performance. *Mathematics, 12*(3), 492. https://doi.org/10.3390/math12030492

Kothari, C. R. (2016). *Research methodology: Methods and techniques* (2nd ed.). New Age International Publishers.

Kothari, C. R. (2018). *Research methodology: Methods and techniques* (3rd ed.). New Age International Publishers.

KPMG International. (2022). *Supply chain visibility in the digital age*. KPMG.

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement, 30*(3), 607–610.

Kultar, S. (2017). *Research methodology for social sciences*. SAGE Publications.

Lavie, D. (2006). The competitive advantage of interconnected firms: An extension of the resource-based view. *Academy of Management Review, 31*(3), 638–658.

Mose, S., Osoro, A., & Nyang'au, R. (2024). Real-time tracking technologies and supply chain responsiveness in manufacturing firms. *International Journal of Supply Chain Performance, 7*(1), 55–67.

Mugenda, O. M., & Mugenda, A. G. (2018). *Research methods: Quantitative and qualitative approaches*. Acts Press.

Mugenda, O. M., & Mugenda, A. G. (2019). *Research methods: Quantitative and qualitative approaches* (Rev. ed.). Acts Press.

Nketsiah, E., Asare, A., & Osei, A. (2022). Supplier collaboration and operational performance in developing economies. *Journal of African Business, 23*(1), 84–102.

Ofori Issah, K., Ackah, O., & Owusu-Asantewaah, S. (2025). Supply chain collaboration, organizational resources and firms' performance. *Research Journal of Logistics & Supply Chain Studies, 2*(1), 1–16.

Ogwang, G. O., Wachiuri, E., & Nyaberi, D. (2024). Supply chain visibility and performance of commercial state corporations in Kenya. *International Journal of Management and Business Research, 6*(1), 953–966.

Pethe, V., Sahu, A., & Kodarlikar, A. (2024). IoT-based real-time asset tracking and inventory management in supply chain logistics. In *Proceedings of the International Conference on IoT Research in Supply Chain Management and Logistics* (pp. 211–225).

Promoting logistics visibility in transportation. (2024). *International Journal of Supply Chain Development, 6*(2), 44–58.

PwC UK. (2024). *UK manufacturing outlook: Post-Brexit supply chain strategies*. PwC Research.

Singagerda, F., Fauzan, A., & Desfiandi, A. (2022). The role of supply chain visibility, supply chain flexibility, and supplier development on business performance of logistics companies. *Uncertain Supply Chain Management, 10*(2), 463–470.

Singpurwalla, N. D. (2013). *Reliability and risk: A Bayesian perspective*. John Wiley & Sons.

Sirirat, K., Martine, B., & Wout, L. (2024). Industrial growth and global value chain integration. *Journal of Manufacturing Economics, 14*(1), 1–15.

Smith, H. K. (2024). Impact of real-time data sharing on supply chain agility and performance [Working paper].

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal, 18*(7), 509–533.

Tiwari, M. K. (2024). Supply chain digitisation and management. *International Journal of Production Research*.

Wachiuiri, E., & Noor, N. (2025). ICT integration and operational stability in Kenya's manufacturing supply chains. *Journal of African Business & Technology, 11*(1), 67–82.

Wade, M., & Hulland, J. (2004). Review: The resource-based view and information systems research. *MIS Quarterly, 28*(1), 107–142.

Wambua, D., & Noor, N. (2024). Digital transformation and resilience of manufacturing firms during global crises. *East African Journal of Business and Economics, 3*(2), 45–61.

Zhao, Y. (2025). Supply chain transparency and firm performance: The role of visibility and traceability. *Journal of Global Operations and Analytics, 12*(1), 33–48.