



Effect of Integration of Supply Chain Practices on the Operational Efficiency of Distribution Firms in Rwanda: A Case of Sulfo Rwanda Industries

Benite Umuhire & Desire Nimpano
University of Kigali, Rwanda
Email: umuhirebenite@gmail.com

Abstract: This study assessed the effect of supply chain integration practices on the operational efficiency of distribution firms in Rwanda, focusing on Sulfo Rwanda Industries. Specifically, the study examined the effect of internal integration on operational efficiency. A mixed-methods approach and descriptive correlational research design were adopted. The target population comprised 567 employees involved in supply chain and operational activities, from which a sample of 235 respondents was determined using Yamane's formula. Stratified and simple random sampling techniques were used. Data were collected through structured questionnaires and interviews and analyzed using SPSS version 26. Descriptive statistics, Pearson correlation, and simple linear regression were employed. The findings revealed that internal integration positively contributes to operational efficiency. Respondents reported that sharing workflow systems, coordinating production, procurement and inventory schedules, conducting regular departmental meetings, improving information sharing, and reducing operational errors enhance organizational efficiency. Pearson correlation analysis showed a strong positive and statistically significant relationship between internal integration and operational efficiency ($r = 0.813, p < 0.001$). Regression analysis indicated that internal integration significantly predicted operational efficiency, explaining 77.4% of its variation ($R^2 = 0.774$). The study concluded that effective internal integration improves coordination, resource utilization, decision-making, and operational performance at Sulfo Rwanda Industries. The study recommends strengthening interdepartmental coordination, investing in integrated information systems, promoting collaborative planning, and improving communication mechanisms to enhance operational efficiency and competitiveness among distribution firms in Rwanda.

Keywords: Supply Chain Integration, Internal Integration, Operational Efficiency, Distribution Firms, Sulfo Rwanda Industries, Rwanda.

How to cite this work (APA):

Umuhire, B. & Nimpano, D. (2026). Effect of Integration of Supply Chain Practices on the Operational Efficiency of Distribution Firms in Rwanda: A Case of Sulfo Rwanda industries. *Journal of Research Innovation and Implications in Education*, 10(3), 1177 – 1189. <https://doi.org/10.59765/cvd42>

1. Introduction

Globally, Supply chain integration (SCI) has demonstrated its transformative impact on operational efficiency and competitiveness (Chen, 2023). In Asia, leading corporations have adopted advanced logistics networks,

automated warehousing systems, and real-time inventory tracking to manage complex supply chains. For instance, Chinese e-commerce giants like Alibaba and JD.com leverage integrated platforms that connect thousands of suppliers and distribution points, significantly reducing order processing times and operational costs while

improving customer satisfaction. Similarly, Japanese automotive manufacturers have implemented Just-In-Time (JIT) production systems that synchronize supplier deliveries with production schedules, minimizing waste and optimizing resource utilization. South Korean firms have embraced digital integration strategies that link suppliers, assembly plants, and distributors, illustrating SCI's role in managing complex operations and achieving operational excellence. These examples highlight how SCI enables firms to maintain flexibility, reduce inefficiencies, and achieve economies of scale in highly competitive global markets (Yassin, 2023).

In advanced economies, SCI adoption is facilitated by strong infrastructure, regulatory frameworks, and technological sophistication (Ariella, 2023). Organizations in the United States, Germany, and the United Kingdom employ Enterprise Resource Planning (ERP) systems, big data analytics, and Internet of Things (IoT) solutions to synchronize internal operations with external networks. Companies such as Amazon, DHL, and Tesco utilize these technologies to improve demand forecasting, optimize inventory management, and streamline logistics coordination. These integrated approaches enable firms to respond rapidly to market fluctuations, reduce operational costs, and maintain high service standards, reinforcing SCI's strategic importance in mature markets. Furthermore, these economies often integrate SCI with sustainability initiatives, lean manufacturing principles, and customer-centric service models, demonstrating its role in achieving long-term strategic objectives such as environmental responsibility, operational resilience, and enhanced customer loyalty (Müller, 2024).

Industrialized regions in West Asia have increasingly embraced SCI to address challenges associated with rapid urbanization, globalization, and growing consumer demand (Al-Farsi, 2024). Firms in the United Arab Emirates, Saudi Arabia, and Qatar have invested in advanced logistics platforms, real-time visibility systems, and collaborative planning tools to coordinate suppliers, transport providers, and distributors. These strategies have improved the efficiency of managing large volumes of imported goods, reduced lead times, and ensured product availability in highly dynamic markets. However, persistent challenges such as dependence on global imports, geopolitical uncertainties, and fluctuating oil prices highlight the need for resilient and adaptive SCI models in the region. The integration of digital technologies and risk management frameworks is becoming essential for firms operating in these markets to maintain continuity and competitiveness amid global disruptions (Khan & Rahman, 2024).

In Sub-Saharan Africa, SCI adoption is gaining traction as firms seek to overcome structural barriers, including

inadequate infrastructure, high logistics costs, and fragmented supply networks (Adeyemi, 2023). Manufacturing and distribution companies in Nigeria, Ghana, and South Africa have implemented supplier collaboration programs, technology-enabled tracking systems, and integrated planning processes to reduce stockouts and improve delivery reliability. South African retailers have invested in centralized inventory systems and regional distribution networks to enhance operational efficiency despite high transportation costs. In Ghana, supplier-customer integration initiatives have shown promising results in reducing inefficiencies, although challenges related to technology adoption and policy inconsistencies persist. These developments indicate that while SCI is gaining momentum in the region, significant investments in infrastructure, technology, and capacity building are required to unlock its full potential (Wallers, 2023).

Western economies have advanced SCI practices that emphasize end-to-end integration to achieve efficiency, competitiveness, and sustainability (Dupont, 2024). Organizations in France, the Netherlands, and Canada have adopted sophisticated IT systems and collaborative planning tools to link suppliers, logistics hubs, and retail outlets. These strategies enable firms to optimize inventory levels, improve forecasting accuracy, and reduce distribution costs. Furthermore, SCI in these markets is often aligned with broader operational strategies, including lean manufacturing, green logistics, and customer-centric service models, underscoring its role in achieving long-term strategic objectives. By integrating sustainability initiatives and advanced analytics into their supply chains, firms in these economies are not only improving operational performance but also meeting regulatory requirements and consumer expectations for environmentally responsible practices (Walker, 2024).

East African firms are progressively adopting SCI as governments and businesses invest in infrastructure development, trade facilitation, and digital transformation (Oriento, 2020). Kenya's horticultural export industry illustrates the benefits of SCI through its coordinated efforts among suppliers, logistics providers, and international distributors. This integration ensures timely delivery of fresh produce to European and Middle Eastern markets, reducing spoilage and maintaining quality standards. Similar trends are observed in Tanzania and Uganda, where firms are implementing integrated technologies and collaborative practices to improve operational efficiency. However, these efforts face significant constraints, including inconsistent policy frameworks, limited technological infrastructure, and shortages of skilled personnel, which hinder the full realization of SCI's potential in the region. Addressing these challenges requires targeted investments in capacity

building, policy harmonization, and technology adoption to create an enabling environment for SCI(Njoroge & Kamau, 2025).

In Rwanda, SCI has emerged as a critical enabler of operational efficiency within the manufacturing and distribution sectors (Mukasa, 2024). Leading firms have adopted integrated approaches that align procurement, production, and inventory management with external suppliers and retailers through collaborative planning, real-time information sharing, and coordinated logistics strategies. Sulfo Rwanda Industries, a major manufacturer and distributor of cleaning products, exemplifies this trend by leveraging integration to improve delivery reliability, reduce operational costs, and enhance customer satisfaction (Rwandan Ministry of Trade, 2025). Furthermore, innovative solutions such as Zipline's drone delivery platform for medical supplies highlight the potential of technology-driven integration to overcome logistical challenges in difficult terrains, ensuring timely access to essential goods. Despite these advancements, empirical research on the specific impact of SCI on operational efficiency in Rwandan distribution firms remains limited. This gap underscores the need for comprehensive studies that provide evidence-based insights to guide policymakers and industry practitioners in strengthening SCI practices and enhancing operational performance.

1.2 Statement of Problem

The integration of supply chain practices involves the strategic coordination and alignment of internal processes such as procurement, production, and inventory management with external partners including suppliers, distributors, and customers (Lola, 2023). Effective integration facilitates real-time information sharing, collaborative planning, synchronized logistics operations, and accurate demand forecasting. These capabilities enable firms to reduce operational costs, minimize lead times, optimize inventory levels, and enhance service reliability. Evidence from developed economies demonstrates that organizations with fully integrated supply chains achieve higher levels of operational efficiency and sustainable competitive advantage (Bunley, 2024).

However, despite these recognized benefits, many firms in developing regions continue to experience inefficiencies due to weak or fragmented supply chain integration (Gassy & Ray, 2024). Structural limitations such as inadequate technological infrastructure, poor coordination among supply chain partners, limited digital adoption, and unreliable logistics systems contribute to persistent operational challenges. In Sub-Saharan Africa, logistics costs account for approximately 30–40% of product value compared to 8–10% in developed economies (World Bank, 2024), reflecting significant inefficiencies. In Rwanda,

distribution firms similarly face coordination gaps between internal departments, suppliers, and customers, resulting in delayed deliveries, stock imbalances, and increased operational expenses (Passy, 2024).

Although several studies conducted in developed countries confirm that advanced supply chain integration practices supported by Enterprise Resource Planning systems and collaborative forecasting tools significantly improve operational performance (Ruth, 2024), empirical research within developing economies remains limited and fragmented. Existing studies in countries such as Nigeria, Ghana, and Kenya indicate that partial integration may improve delivery reliability and cost control (Mwangi, 2023), yet these studies often focus on manufacturing firms and fail to comprehensively examine distribution-sector dynamics. More importantly, in Rwanda, there is a scarcity of firm-level empirical evidence analyzing how internal integration, supplier integration, and customer integration collectively influence measurable operational efficiency indicators such as cost reduction, lead-time minimization, and service reliability (Terry, 2023).

Therefore, the key research gap lies in the limited empirical understanding of the relationship between supply chain integration practices and operational efficiency within Rwandan distribution firms, particularly at Sulfo Rwanda Industries. Without context-specific evidence, managerial decisions regarding integration strategies and technology adoption remain insufficiently informed. This study seeks to address this gap by empirically investigating how internal, supplier, and customer integration practices affect operational efficiency, thereby providing actionable insights for managers, policymakers, and stakeholders in Rwanda's distribution sector.

This study sought to achieve the following research objective:

- i. To examine the effect of internal integration on the operational efficiency of Sulfo Rwanda Industries.

2. Literature Review

This section presents a comprehensive review of existing literature related to the effect of internal integration on the operational efficiency of distribution firms in Rwanda. The review is organized to provide theoretical, conceptual, and empirical insights into the study variables, including internal integration, and their influence on operational efficiency. It examines global, regional, and local studies to identify trends, outcomes, and research gaps, providing a foundation for understanding how integration practices contribute to performance improvements in distribution operations

2.1 Internal integration and the operational efficiency of distribution firm

Internal integration refers to the coordination and alignment of activities, information, and decision-making processes among different functional units within an organization, including procurement, production, inventory management, warehousing, finance, marketing, and distribution (Ivanov & Dolgui, 2024). Effective internal integration enables departments to share accurate and timely information, synchronize operational activities, and work toward common organizational objectives. Such integration minimizes functional silos, enhances communication, and improves process visibility, leading to more efficient resource utilization and smoother workflow across the organization. As supply chains become increasingly complex, organizations have recognized internal integration as a strategic capability for improving operational efficiency and organizational responsiveness (Council of Supply Chain Management Professionals, 2024).

The increasing adoption of digital technologies has further strengthened the importance of internal integration in modern supply chain management (Queiroz et al., 2023). Organizations are increasingly implementing Enterprise Resource Planning (ERP) systems, cloud computing platforms, artificial intelligence, and real-time data-sharing technologies to connect internal departments and facilitate integrated decision-making. These technologies improve information accuracy, reduce communication delays, enhance inventory visibility, and support coordinated planning across business functions. Consequently, organizations are able to reduce operational costs, shorten order processing cycles, improve demand responsiveness, and increase overall operational efficiency while maintaining consistency in service delivery (Wamba et al., 2024).

Internal integration also contributes significantly to organizational agility and operational resilience by promoting cross-functional collaboration and coordinated problem-solving (Ivanov & Dolgui, 2024). When departments operate through integrated planning and information-sharing mechanisms, organizations are better positioned to respond quickly to unexpected disruptions such as supply shortages, demand fluctuations, or transportation delays. Cross-functional coordination enhances decision quality by ensuring that procurement, production, logistics, and sales departments work with consistent information and aligned objectives. This collaborative approach reduces process duplication, improves resource allocation, and supports continuous operational improvement, ultimately strengthening overall

organizational performance (World Economic Forum, 2024).

In developing economies such as Rwanda, internal integration has become increasingly important as organizations pursue greater operational efficiency amid growing competition and ongoing digital transformation (World Bank, 2024). Many distribution firms are investing in integrated information systems, standardized operational procedures, and collaborative planning mechanisms to strengthen coordination among internal departments. Despite these efforts, challenges including limited technological infrastructure, inadequate digital capabilities, and fragmented organizational processes continue to affect the effectiveness of internal integration. Strengthening cross-functional collaboration, investing in digital technologies, and promoting integrated organizational cultures are therefore considered essential for improving operational efficiency and sustaining competitiveness within Rwanda's distribution sector (Organisation for Economic Co-operation and Development, 2024).

Operational efficiency of distribution firm

Operational efficiency refers to the ability of an organization to maximize output while minimizing the use of resources such as time, labor, capital, and materials (Christopher, 2023). In distribution firms, operational efficiency is reflected in the effective management of procurement, inventory, warehousing, transportation, and order fulfillment processes to ensure that products reach customers accurately and on time. Efficient operations enable firms to reduce operational costs, improve inventory utilization, minimize delivery delays, and enhance customer satisfaction. As global supply chains become increasingly competitive and customer expectations continue to rise, operational efficiency has become a strategic priority for distribution firms seeking to achieve sustainable growth and maintain competitive advantage (Stevenson, 2024).

Technological innovation has significantly transformed operational efficiency in modern distribution systems. Organizations are increasingly adopting digital solutions such as warehouse automation, robotics, cloud computing, predictive analytics, and Internet of Things (IoT) technologies to improve visibility across logistics operations and facilitate real-time decision-making. These technologies enable firms to optimize inventory levels, improve warehouse productivity, reduce transportation costs, and enhance demand forecasting accuracy. Furthermore, standardized operational procedures, continuous process improvement initiatives, and quality management practices contribute to higher productivity

and improved service reliability across distribution networks (Heizer et al., 2023; Slack & Brandon-Jones, 2023).

In developing economies, improving operational efficiency remains essential for strengthening supply chain competitiveness and supporting economic development. Distribution firms continue to modernize their logistics operations through investments in digital infrastructure, workforce skills, and integrated operational processes. However, operational performance is often constrained by inadequate transport infrastructure, limited technological capacity, high logistics costs, and inefficient coordination among supply chain actors. Addressing these challenges through investment in modern logistics systems, process optimization, and digital transformation can significantly enhance operational efficiency, improve service delivery, and increase organizational competitiveness within emerging markets (United Nations Conference on Trade and Development, 2023; World Trade Organization, 2024).

2.2 Theoretical Review

The study was anchored on Supply Chain Management (SCM) Theory, which explains how the strategic integration and coordination of activities within and across an organization's supply chain improve organizational performance. The theory was popularized by Christopher (1992), who argued that organizations compete as supply chains rather than as individual firms. SCM Theory emphasizes the effective coordination of key business functions, including procurement, production, inventory management, warehousing, logistics, information sharing, and customer service, to create value for customers while improving operational efficiency. The theory suggests that organizations achieve superior performance when internal functions operate as an integrated system, allowing information, materials, and resources to flow seamlessly across departments. Such integration reduces operational inefficiencies, eliminates duplication of activities, minimizes waste, improves inventory management, shortens order processing time, and enhances service delivery, ultimately leading to improved operational efficiency (Christopher, 2023).

The theory is highly relevant to the present study because it provides a clear explanation of how internal integration, the independent variable, influences operational efficiency, the dependent variable, in distribution firms. SCM Theory argues that effective collaboration among departments such as procurement, finance, warehousing, production, sales, and logistics promotes synchronized planning, real-time information sharing, and coordinated decision-making. This enables organizations to optimize resource utilization, improve inventory control, reduce operational

costs, minimize lead times, and respond more effectively to customer demands. In the context of Sulfo Rwanda Industries, the theory supports the argument that strengthening internal integration can improve the firm's operational efficiency by enhancing coordination among internal functions and facilitating smooth distribution operations. Therefore, SCM Theory provides an appropriate theoretical foundation for examining the effect of internal integration on operational efficiency and guiding the interpretation of the study findings/

3. Methodology

The study adopted a descriptive and correlational research design using a mixed-methods approach. The descriptive design was considered appropriate because it enabled the researcher to describe the existing level of internal integration at Sulfo Rwanda Industries, including information sharing, interdepartmental coordination, and collaborative planning among functional units. The correlational design was employed to determine whether a significant relationship exists between internal integration (independent variable) and operational efficiency (dependent variable) without manipulating the variables. The mixed-methods approach combined quantitative data obtained through questionnaires with qualitative information collected through interviews to provide a comprehensive understanding of the study problem (Kothari, 2019).

The target population consisted of 567 employees of Sulfo Rwanda Industries who are directly involved in supply chain and operational activities, including top management, procurement staff, production staff, inventory officers, logistics personnel, and sales staff. Since studying the entire population was impractical, a representative sample was determined using Yamane's (1967) formula at a 5% margin of error, resulting in a sample size of 235 respondents. The study employed stratified sampling to categorize employees according to their departments and simple random sampling to select respondents within each category. This sampling approach ensured that every employee had an equal chance of participating while guaranteeing adequate representation of all relevant functional areas.

The study collected both primary and secondary data. Primary data were obtained using structured questionnaires administered to the sampled employees and semi-structured interviews conducted with selected managers responsible for procurement, production, logistics, and operations. The questionnaire contained closed-ended statements measured on a five-point Likert scale to assess internal integration and operational efficiency, while

interviews generated qualitative information on internal coordination practices and operational challenges. Secondary data were collected through documentary review of company reports, operational records, policy documents, and relevant academic literature to provide contextual information and support data triangulation.

The principal research instrument was a structured questionnaire developed according to the study objective and variables. The questionnaire comprised sections on respondents' demographic characteristics, internal integration, and operational efficiency. An interview guide was also developed to obtain detailed explanations from key informants regarding internal communication, departmental collaboration, information sharing, and operational performance. Before the main data collection exercise, a pilot study involving respondents who were not included in the final sample was conducted to identify ambiguous questions and improve the quality of the instruments. The Content Validity Index (CVI) was computed from expert assessments to establish content validity, while Cronbach's Alpha was used to determine internal consistency reliability. A CVI above 0.70 and a Cronbach's Alpha coefficient exceeding 0.70 confirmed that the instruments were valid and reliable for collecting data.

The collected data were analyzed using the Statistical Package for Social Sciences (SPSS) version 26. Quantitative data were summarized using descriptive statistics such as frequencies, percentages, means, and standard deviations. Inferential statistics were employed to determine the relationship between internal integration and operational efficiency. Specifically, Pearson correlation analysis was used to establish the strength and direction of the relationship between the variables, while simple linear regression analysis was conducted to determine the effect of internal integration on operational efficiency. Since the study examined only one independent variable, the analytical model adopted was:

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

Where:

- Y = Operational efficiency
- β_0 = Constant
- β_1 = Regression coefficient
- X_1 = Internal integration
- ε = Error term

Qualitative data obtained from interviews were analyzed using thematic analysis by organizing responses into meaningful themes related to internal integration and operational efficiency. Finally, the study observed ethical considerations throughout the research process by obtaining authorization from the University of Kigali and Sulfo Rwanda Industries before data collection. Participation was voluntary, informed consent was obtained from all respondents, confidentiality and anonymity were maintained, and all information collected was used strictly for academic purposes. These ethical principles enhanced the credibility of the study while protecting the rights, privacy, and dignity of all participants.

4. Results and Discussion

4.1 Results

This section presents the findings of the study in relation to the research objective. It also provides the analysis and interpretation of data collected from respondents regarding the effect of internal integration on the operational efficiency of Sulfo Rwanda Industries.

4.1.1 Response rate

The study targeted a sample size of 235 respondents drawn from different categories of employees at Sulfo Rwanda Industries. Among the selected respondents, 5 respondents comprising Top Management and Procurement Officers participated in interviews, while 230 respondents were issued with questionnaires. Out of the 230 questionnaires distributed, 211 questionnaires were successfully completed and returned, while 19 questionnaires were not returned. Therefore, a total of 216 respondents participated in the study, comprising 211 questionnaire respondents and 5 interview respondents.

Table 1: Response Rate of Respondents

Response Rate	Frequency	Percentage (%)
Questionnaires Returned	211	91.7
Questionnaires Not Returned	19	8.3
Total	230	100

Source: Field data, 2026

The findings presented in Table 1 indicate that out of the 230 questionnaires distributed to respondents, 211 questionnaires were successfully completed and returned, representing a response rate of 91.7%, while 19 questionnaires representing 8.3% were not returned. In addition, five key informants comprising Top Management and Procurement Officers participated in interviews. Consequently, the study obtained data from a total of 216 respondents. According to Mugenda and Mugenda (2003), a response rate of 70% and above is considered adequate for data analysis and generalization of study findings. Therefore, the response rate of 91.7% achieved in this study was considered excellent and sufficient for drawing valid conclusions regarding the effect of integration of

supply chain practices on the operational efficiency of Sulfo Rwanda Industries.

4.1.2 Descriptive Statistics of internal integration

The first objective of the study sought to examine the effect of internal integration on the operational efficiency of Sulfo Rwanda Industries. Respondents were requested to indicate their level of agreement with various statements relating to internal integration and its contribution to operational efficiency. A five-point Likert scale was used where 5 = Strongly Agree (SA), 4 = Agree (A), 3 = Neutral (N), 2 = Disagree (D), and 1 = Strongly Disagree (SD). The findings are presented in Table 2

Table 2: Level of agreement of Internal Integration and Operational Efficiency

Views of respondents	N	M	SD
Regular meetings are held between departments to coordinate operations.	211	4.03	.904
Workflow systems are shared across departments to ensure smooth operations.	211	4.32	.905
Production, procurement, and inventory schedules are coordinated effectively.	211	4.32	.936
Internal integration improves the speed of order fulfillment.	211	3.29	.579
Internal integration reduces operational errors and enhances efficiency.	211	4.29	.965
Aggregate Score		4.05	

Source: Field Data, 2026-**Key:** M=Mean, SD=Standard Deviation

The findings presented in Table 2 indicate that respondents generally agreed that internal integration contributes positively to operational efficiency at Sulfo Rwanda Industries, as reflected by the aggregate mean score of 4.05 and an aggregate standard deviation of 0.858. The high mean score demonstrates a favorable perception of internal integration practices within the organization, while the standard deviation indicates that respondents shared relatively similar views regarding the role of internal integration in enhancing operational performance. These findings imply that effective coordination among internal departments enables the organization to streamline its activities, improve communication, and achieve operational objectives more efficiently.

The results show that workflow systems are shared across departments to ensure smooth operations (M = 4.32, SD = 0.905) and that production, procurement, and inventory schedules are coordinated effectively (M = 4.32, SD = 0.936). These findings suggest that Sulfo Rwanda Industries has established mechanisms that facilitate collaboration and synchronization of activities across different functional units. The high mean scores indicate strong agreement among respondents, while the standard deviations below one demonstrate consistency in their

opinions. The implication of these findings is that integrated workflow systems and coordinated planning help reduce delays, prevent duplication of tasks, and enhance the efficient utilization of organizational resources. This enables the organization to respond more effectively to operational demands and customer requirements.

The findings further indicate that internal integration reduces operational errors and enhances efficiency (M = 4.29, SD = 0.965). This implies that effective coordination among departments contributes to minimizing mistakes, reducing duplication of activities, and improving the overall quality of operations. The relatively high mean score reflects strong agreement among respondents, whereas the standard deviation suggests only slight variations in their perceptions. The implication is that organizations that promote internal collaboration are better positioned to achieve operational excellence because employees are able to work towards common goals while sharing relevant information in a timely manner. As a result, operational processes become more reliable and productivity improves.

In addition, respondents agreed that regular meetings are held between departments to coordinate operations ($M = 4.03$, $SD = 0.904$). The mean score signifies that interdepartmental meetings are commonly practiced and play an important role in facilitating communication and decision-making processes within the organization. The corresponding standard deviation indicates that respondents expressed fairly similar views regarding this aspect of internal integration. The implication of this finding is that regular interaction among departments creates opportunities for problem-solving, knowledge sharing, and collective decision-making, which ultimately strengthen operational effectiveness and organizational performance.

The statement that internal integration improves the speed of order fulfillment recorded a mean score of 3.29 and a standard deviation of 0.579. Although this indicator received the lowest mean score among the statements, respondents still expressed moderate agreement regarding its contribution to operational efficiency. The relatively low standard deviation demonstrates a high level of consensus among respondents, suggesting that most participants held similar opinions concerning the influence of internal integration on order fulfillment speed. The implication is that while internal integration supports order processing activities, additional factors such as supplier responsiveness, inventory availability, transportation systems, and customer demand patterns may also influence the speed of fulfilling customer orders. Therefore, improvements in internal integration alone may not be sufficient to significantly accelerate order fulfillment unless supported by other supply chain functions.

Overall, the findings demonstrate that internal integration is an important component of operational efficiency at Sulfo Rwanda Industries. The combination of high mean scores and relatively low standard deviations across most indicators confirms that respondents consistently perceived communication, coordination, and information sharing among departments as essential practices for improving organizational efficiency and operational effectiveness. The findings imply that strengthening internal integration mechanisms can enhance operational performance by promoting teamwork, improving resource utilization, reducing operational errors, and supporting informed decision-making across the organization.

From the findings, the study revealed that internal integration positively influences operational efficiency at Sulfo Rwanda Industries. The results showed that departments share workflow systems, coordinate production, procurement, and inventory activities, and hold regular meetings to facilitate smooth organizational operations. The findings further indicated that effective internal integration helps reduce operational errors,

improves coordination among departments, and enhances overall efficiency. This implies that strong communication, collaboration, and information sharing within the organization contribute significantly to improved resource utilization, streamlined operations, and enhanced organizational performance.

The qualitative data gathered through interviews further supported the quantitative findings by revealing that internal integration plays a critical role in enhancing operational efficiency at Sulfo Rwanda Industries. Interview participants noted that effective communication and coordination among departments facilitate smooth workflow, improve information sharing, and reduce operational challenges. They emphasized that collaboration between procurement, production, inventory, and sales departments enables the organization to make timely decisions and respond effectively to operational demands. The interviewees further indicated that regular interaction among departments promotes teamwork, minimizes misunderstandings, and enhances the efficient utilization of organizational resources. These insights suggest that strong internal integration contributes significantly to improved operational performance and the achievement of organizational objectives.

These findings are consistent with those of Niyonsaba and Uwimana (2024), who found that internal integration positively influenced operational efficiency among distribution firms in Rwanda by reducing delivery delays, optimizing inventory management, and improving order accuracy. Similarly, Moshi and Kweka (2021), established that effective coordination between procurement, production, and logistics departments enhanced order fulfillment rates, reduced operational costs, and improved lead times among distribution companies in Tanzania. The findings also concur with Martin and Dupont (2021), who reported that strong internal integration significantly reduced delivery lead times and improved inventory turnover through enhanced communication and coordination among organizational departments. These studies support the view that internal integration strengthens organizational effectiveness by facilitating information sharing, reducing operational bottlenecks, and improving overall operational efficiency.

4.1.3 Correlation Analysis

To determine the strength and direction of the relationship between supply chain integration practices and operational efficiency at Sulfo Rwanda Industries, the study employed Pearson Product Moment Correlation Analysis. According to Cohen (1988), the Pearson correlation coefficient (r) ranges from -1 to +1, where values closer to +1 indicate a strong positive relationship, values closer to -1 indicate a strong negative relationship, and values near zero indicate

little or no relationship. The results are presented in Table 3:

Table 3: Correlation between independent variable and dependent variable

		Internal integration	Operational efficiency
Internal integration	Pearson	1	
	Correlation		
	Sig. (2-tailed)		
Operational efficiency	N	211	
	Pearson	.813**	1
	Correlation		
	Sig. (2-tailed)	.000	
	N	211	211

Source: Field data, 2026

Table 3 presents the results of the Pearson correlation analysis between internal integration and operational efficiency at Sulfo Rwanda Industries. The findings indicate a strong positive correlation between the two variables ($r = 0.813$, $p = 0.000$, $N = 211$). The correlation coefficient of 0.813 implies that improvements in internal integration are associated with corresponding improvements in operational efficiency. According to Cohen (1988), a correlation coefficient above 0.70 indicates a strong positive relationship between variables. The significance value ($p = 0.000$) is less than the conventional significance level of 0.05, indicating that the observed relationship is statistically significant. Therefore, the null hypothesis that there is no significant relationship between internal integration and operational efficiency is rejected. This finding suggests that effective internal coordination, information sharing, and collaboration among departments contribute significantly to improving operational efficiency at Sulfo Rwanda Industries.

Overall, the results demonstrate that strengthening internal integration practices is likely to enhance operational efficiency by improving coordination across functional departments, facilitating timely information flow, reducing operational delays, and optimizing resource utilization. The findings support the study objective of examining the effect of internal integration on operational efficiency and provide evidence that organizations with better internal integration tend to achieve higher operational performance

4.1.4 Regression analysis

Regression analysis was conducted to determine the extent to which youth involvement in planning watermelon agribusiness activities predicts the performance of youth-led watermelon farming enterprises. Multiple linear regression was used to assess the contribution of the independent variable to variations in enterprise performance. The results are presented using the model summary, ANOVA, and regression coefficients to show the explanatory power, significance, and effect of youth involvement in planning on enterprise performance.

Table 3. Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.880 ^a	.774	.770	.22367

a. Predictor: (Constant), Internal Integration (X_1)

Table 3 presents the model summary showing the effect of internal integration on operational efficiency at Sulfo Rwanda Industries. The results indicate a strong positive relationship between the variables, as shown by the correlation coefficient ($R = 0.880$). This implies that effective internal integration practices, including information sharing, departmental coordination, and collaborative decision-making, are strongly associated

with improved operational efficiency. The coefficient of determination ($R\text{ Square} = 0.774$) indicates that 77.4% of the variations in operational efficiency are explained by internal integration, while the remaining 22.6% are influenced by other factors outside the model.

The Adjusted R Square value of 0.770 confirms that the model maintains a high explanatory capacity after considering the sample size, demonstrating that internal integration is a significant predictor of operational efficiency. Furthermore, the standard error of the estimate (0.22367) indicates that the predicted values are relatively close to the actual observations, reflecting a good model fit.

Therefore, the findings suggest that strengthening internal integration at Sulfo Rwanda Industries can significantly contribute to improved operational efficiency through better coordination of internal processes, reduced operational delays, and effective utilization of organizational resources.

Table 4. ANOVA Results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	35.379	3	11.793	235.735	.000 ^b
	Residual	10.355	207	.050		
	Total	45.734	210			

a. Dependent Variable: Operational Efficiency (Y)

b. Predictors: (Constant), Internal Integration (X₁)

Table 4 presents the Analysis of Variance (ANOVA) results used to determine whether the regression model significantly explains the relationship between internal integration and operational efficiency at Sulfo Rwanda Industries. The results show that the regression model produced a F-value of 235.735 with a significance level of $p = 0.000$, which is below the 0.05 level of significance. This indicates that the regression model is statistically significant and that internal integration significantly predicts operational efficiency. Therefore, the model provides a good explanation of the variations observed in operational efficiency among the respondents.

The regression sum of squares (35.379) compared to the residual sum of squares (10.355) indicates that a larger proportion of the total variation in operational efficiency is explained by internal integration rather than by unexplained factors. Since the significance value is less than 0.05, the null hypothesis that internal integration has no significant effect on operational efficiency is rejected. The findings confirm that internal integration is an important factor influencing operational efficiency at Sulfo Rwanda Industries, emphasizing the importance of effective coordination, information sharing, and collaboration among internal departments.

Table 5. Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.683	.172		3.982	.000
	Internal Integration (X ₁)	.557	.056	.622	9.963	.000

a. Dependent Variable: Operational Efficiency (Y)

Table 5 presents the regression coefficients showing the effect of internal integration on operational efficiency at Sulfo Rwanda Industries. The results indicate that internal integration has a positive and statistically significant effect on operational efficiency, as shown by the standardized coefficient (Beta = 0.622) and significance level ($p = 0.000$). This means that an improvement in internal integration is associated with a corresponding increase in operational efficiency. The positive coefficient suggests that practices such as effective communication among departments, information sharing, coordinated planning, and collaboration between functional units contribute to improved operational performance.

The unstandardized coefficient (B = 0.557) indicates that a one-unit increase in internal integration results in a 0.557-

unit increase in operational efficiency, assuming other factors remain constant. The t-value of 9.963 further confirms that the contribution of internal integration to operational efficiency is statistically significant. Therefore, the null hypothesis stating that internal integration has no significant effect on operational efficiency is rejected. The findings demonstrate that internal integration is a significant predictor of operational efficiency at Sulfo Rwanda Industries, implying that strengthening coordination and integration among internal functions can enhance efficiency in distribution operations.

4.2 Discussion of Findings

The study examined the effect of internal integration on the operational efficiency of Sulfo Rwanda Industries. The findings revealed that internal integration plays an important role in improving operational efficiency through effective communication, information sharing, coordinated planning, and collaboration among internal departments. The study established that when procurement, production, inventory, logistics, and sales functions work together, organizational processes become more coordinated and efficient. Internal integration reduces departmental barriers, improves workflow management, and supports timely decision-making, which contributes to improved distribution operations.

The findings support the principles of Supply Chain Management Theory, which emphasizes that organizations achieve better performance when internal functions are integrated and coordinated toward common objectives. The theory explains that effective internal integration enables organizations to improve information flow, synchronize activities, minimize operational challenges, and enhance resource utilization. In the context of Sulfo Rwanda Industries, internal integration strengthens collaboration among departments, allowing the organization to respond effectively to operational requirements and customer expectations.

The findings are consistent with Ivanov and Dolgui (2024), who explained that internal integration enhances supply chain performance by improving coordination, information visibility, and organizational resilience. They argued that organizations with strong internal integration mechanisms are better positioned to manage complex operations and respond to changing business environments. Similarly, Queiroz et al. (2023) emphasized that the use of integrated information systems and collaborative practices improves internal communication, supports effective decision-making, and reduces inefficiencies within supply chain operations.

The findings also agree with Wamba et al. (2024), who highlighted that integrated operational processes improve inventory management, workflow coordination, and service reliability. According to their argument, organizations that promote collaboration among internal units are more capable of achieving operational excellence because employees share relevant information and coordinate activities effectively. This supports the observation that internal integration is essential for improving the performance of distribution firms.

However, the findings also indicate that continuous improvement of internal integration practices remains necessary, especially through strengthening digital systems, improving employee skills, and promoting a

culture of collaboration. Distribution firms operating in developing economies often face challenges related to technological limitations, communication gaps, and fragmented processes, which may affect operational effectiveness. Therefore, enhancing internal integration capabilities is important for sustaining competitiveness and improving long-term operational performance.

5. Conclusion and Recommendations

5.1 Conclusion

The study concluded that internal integration is an important factor influencing the operational efficiency of Sulfo Rwanda Industries. Effective coordination among internal departments, timely information sharing, collaborative planning, and integrated operational processes contribute to smoother business operations by reducing communication barriers, improving resource utilization, and supporting better decision-making. The study further established that strong collaboration among procurement, production, inventory, logistics, and sales departments enhances workflow efficiency and enables the organization to respond effectively to operational demands and customer expectations. Therefore, strengthening internal integration practices through improved communication mechanisms, coordinated planning, and integrated systems is essential for enhancing operational performance, maintaining competitiveness, and achieving sustainable growth within Sulfo Rwanda Industries.

5.2 Recommendations

Based on the study findings on the effect of internal integration on the operational efficiency of Sulfo Rwanda Industries, the study recommends the following:

1. The management of Sulfo Rwanda Industries should strengthen interdepartmental coordination through regular meetings, joint planning, and effective communication channels. This will enhance collaboration among procurement, production, inventory, logistics, and sales departments and support the smooth execution of supply chain activities.
2. The organization should continue improving integrated information systems that allow departments to access and exchange operational information efficiently. This will enhance decision-making, reduce delays, and improve coordination of supply chain processes.
3. Sulfo Rwanda Industries should develop continuous improvement programs that strengthen teamwork, process coordination, and collaboration among employees. This will help

minimize operational challenges, reduce errors, and improve the reliability of distribution activities.

4. Management should enhance collaborative planning mechanisms among procurement, production, and inventory departments. Better alignment of departmental schedules will support efficient resource utilization, improve workflow, and reduce operational disruptions.

Public Interest Statement

This study is of public interest because it highlights the importance of internal integration in improving operational efficiency within distribution firms. The findings demonstrate that effective coordination among departments, timely information sharing, collaborative planning, and integrated operational processes contribute to smoother business operations and improved service delivery. Strengthening internal integration practices can enable organizations to reduce operational challenges, improve resource utilization, and ensure the reliable availability of products to consumers.

The study provides valuable insights for managers, policymakers, and supply chain practitioners on the importance of improving internal coordination mechanisms within manufacturing and distribution organizations. Enhanced operational efficiency contributes to business sustainability, competitiveness, job creation, and economic development in Rwanda's industrial sector. Therefore, promoting effective supply chain integration practices can support organizations in achieving better performance while contributing to improved market stability and consumer satisfaction.

References

- Adeyemi, O. (2023). Supply chain integration practices and operational performance of manufacturing firms in Sub-Saharan Africa. *Journal of African Business and Management*, 15(2), 45–62.
- Al-Farsi, M. (2024). Digital transformation and supply chain resilience in emerging economies: Evidence from Gulf countries. *International Journal of Supply Chain Management*, 13(1), 88–103.
- Ariella, K. (2023). Technology adoption and supply chain integration in global enterprises. *Journal of Operations and Logistics*, 8(3), 112–126.
- Bunley, J. (2024). Supply chain integration and competitive advantage in modern organizations. *International Journal of Business Performance Management*, 25(1), 75–91.
- Chen, H. (2023). Supply chain integration and operational excellence: Evidence from global manufacturing firms. *International Journal of Production Economics*, 258, 108812.
- Christopher, M. (2023). *Logistics and supply chain management* (6th ed.). Pearson Education.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.
- Council of Supply Chain Management Professionals. (2024). *CSCMP supply chain management definitions and glossary*. CSCMP.
- Dupont, L. (2024). Sustainable supply chain integration and operational performance in developed economies. *Journal of Cleaner Production*, 452, 141987.
- Gassy, R., & Ray, P. (2024). Barriers to supply chain integration in developing economies. *International Journal of Logistics Research and Applications*, 27(4), 523–540.
- Heizer, J., Render, B., & Munson, C. (2023). *Operations management: Sustainability and supply chain management* (14th ed.). Pearson.
- Ivanov, D., & Dolgui, A. (2024). Digital supply chain twins and resilience management in complex supply networks. *International Journal of Production Research*, 62(4), 1281–1298.
- Khan, S., & Rahman, M. (2024). Building resilient supply chains through digital integration and risk management. *Supply Chain Management: An International Journal*, 29(2), 215–230.
- Kothari, C. R. (2019). *Research methodology: Methods and techniques* (4th ed.). New Age International Publishers.
- Lola, M. (2023). Supply chain coordination and operational efficiency in distribution organizations. *Journal of Business Logistics Research*, 12(1), 33–49.
- Martin, P., & Dupont, L. (2021). Internal integration and logistics performance improvement in distribution firms. *International Journal of Logistics Management*, 32(3), 921–940.

- Moshi, J., & Kweka, R. (2021). Supply chain integration practices and performance of distribution companies in Tanzania. *African Journal of Business Management*, 15(6), 168–180.
- Mukasa, D. (2024). Supply chain digitalization and operational performance of manufacturing firms in Rwanda. *Rwanda Journal of Business and Economics*, 5(1), 25–41.
- Mugenda, O. M., & Mugenda, A. G. (2003). *Research methods: Quantitative and qualitative approaches*. Acts Press.
- Mwangi, P. (2023). Supply chain integration and service delivery performance among firms in East Africa. *East African Business Review*, 9(2), 55–70.
- Niyonsaba, E., & Uwimana, J. (2024). Internal supply chain integration and operational efficiency among manufacturing firms in Rwanda. *Journal of African Supply Chain Studies*, 6(1), 14–29.
- Njoroge, P., & Kamau, J. (2025). Digital transformation and supply chain competitiveness in East African enterprises. *African Journal of Operations Management*, 11(1), 77–94.
- Organisation for Economic Co-operation and Development. (2024). *Digital transformation in emerging economies: Opportunities and challenges*. OECD Publishing.
- Queiroz, M. M., Fosso Wamba, S., Pereira, S. C. F., & Ladeira, M. B. (2023). The impact of digital technologies on supply chain integration and performance. *Technological Forecasting and Social Change*, 186, 122146.
- Slack, N., & Brandon-Jones, A. (2023). *Operations management* (10th ed.). Pearson.
- Stevenson, W. J. (2024). *Operations management* (15th ed.). McGraw-Hill Education.
- Terry, J. (2023). Supply chain integration challenges and operational performance in developing markets. *Journal of Supply Chain Management Research*, 18(2), 101–117.
- United Nations Conference on Trade and Development. (2023). *Review of maritime transport 2023*. United Nations.
- Wamba, S. F., Queiroz, M. M., & Trinchera, L. (2024). Artificial intelligence and supply chain analytics: Implications for operational performance. *International Journal of Information Management*, 74, 102703.
- Walker, H. (2024). Green supply chains and sustainable operational performance: Emerging trends and practices. *Business Strategy and the Environment*, 33(2), 845–861.
- Waller, K. (2023). Supply chain integration and operational challenges in Sub-Saharan African firms. *Journal of African Management Studies*, 10(3), 90–108.
- World Bank. (2024). *Connecting to compete: Trade logistics in an uncertain global economy*. World Bank Group.
- World Economic Forum. (2024). *Global supply chains transformation and resilience report*. World Economic Forum.
- World Trade Organization. (2024). *World trade report 2024*. World Trade Organization.
- Yassin, M. (2023). Global supply chain integration and competitiveness in emerging markets. *International Journal of Logistics Systems and Management*, 45(2), 201–219.