Effect of Supply Chain Integration on Performance of Metal and Allied Sector Manufacturing Firms in Nairobi City County, Kenya

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Abstract

Metal manufacturers in Kenya have been experiencing stagnating profitability, production, and operations management which is directly attributed to supply chain inefficiencies. This paper sought to determine the effect of supply chain integration on the performance of metal and allied sector manufacturing firms in Nairobi City County, Kenya. The study was guided by the systems theory. The study adopted a cross-sectional survey design and a target of 46 companies. Census technique was used involving 92 respondents from the procurement and stores departments. A questionnaire was used to collect primary data from the study respondents. The findings indicated that supply chain integration has a positive and significant influence on the performance of metal and allied sector manufacturing firms. The study concluded that supply chain integration positively and significantly contributes to the improved performance of metal and allied sector manufacturing firms. The study recommends that more linkage with the suppliers be enhanced since much of the delays and inefficiencies emanate from the upstream as it tickles down. Automatic ordering should be permitted to avoid chances of running short of the stock leading to production stoppages. Information security systems should also be beefed up with necessary cyber security measures to avoid unauthorized access to information.

Keywords: *Supply Chain Integration, Firm Performance, Metal, and Allied Sector Manufacturing Firms*

1.0 Introduction

Steelmakers are facing pressure on raw materials and their pricing as a result of the rapid development of worldwide steel demand. According to the steel industry's unique characteristics, the primary problem today is not only to enhance manufacturing procedures, but also to deal with supply chain unpredictability, which could lead to uncertainty in raw materials, marketing demand, and product pricing. A flurry of global events heralded the new millennium, all of which hurt global economic growth. From the horrific terrorist attacks of September 11, 2001, to the global financial crisis that began with real estate in the US economy. We discovered that the worldwide market did not create a suitable environment for the metal business in several situations. In recent years, there have been several steel prices cycles, and many steel factories have encountered crises when the cost of steel was higher than the selling price.

The supply chain management of large steel businesses typically entails scheduling raw material orders four to six months in advance. In a market crisis, this latency could cause serious problems for steel producers, since steel prices could plummet substantially. This bullwhip effect generally hurts big steel producers significantly more than small mini-mill producers (Wu, D-Y., & Katok, 2017). Because the steel industry is sensitive to the impact of raw materials on its total manufacturing costs, the increased demand for steel products is placing pressure on the availability and pricing of raw materials in the supply chain in the world steel industry. In Europe, Coke prices fell by roughly 20% in 2021, scrap prices remained stable, while iron ore, coking coal, and thermal coal prices climbed up. According to AIECE (Association of European Conjuncture Institutes) experts, most commodity prices are predicted to fall in 2021 as demand decreases and supply rises.

Limited access to finance, electricity, transportation infrastructure (some are landlocked), resource problems, and ICT networks are only a few of the structural and policy obstacles that the sector faces. East Africa, on the other hand, has been Africa's fastest-growing region for the past decade, with many of the world's fastest-growing economies (Gigineishvili et al., 2014). Despite this, the basic metal and engineering sectors' contributions to the region's economy are still minimal. As a result, as compared to other industrial sectors, the basic metal industry sector contributes significantly less to GDP (Abtew, 2016).

Furthermore, traditional production and management processes may be on the decline in these industries. While a new strategy could have a nascent impact on the basic metal sectors. Companies began to pursue a strategy of long-term system improvement rather than the traditional management paradigm of short-term profit maximization to respond to a rapidly changing business environment. Eastern Africa's basic metal industry must reform itself to compete in a worldwide changing landscape and improve regional performance. As a result, organizations are now focusing on safeguarding cost, quality, technology, resource, systems, and other competitive advantages as a means of ensuring global competitiveness and long-term growth.

Even though installing supply chain systems is not a guarantee of organizational improvement and long-term success, they are strategies for improving a company's performance and gaining a competitive edge in a variety of systems (Kitaw & Goshu, 2017). Rather, supply chain systems must operate in the context of nations, with individual organizations focusing their policies, firm size, geographic location, culture, and resources in a coordinated manner for competitive advantage (Gregory & Simiyu, 2015).

Steel and iron production in Kenya stretches back to the colonial period, albeit most steels were imported from European nations at the moment. During the construction of the Kenya-Uganda railway in 1902, the highest investment in steel and iron products was made (Parrenas, 2012). Steel manufacturing firms and supplies are the bedrock of today's contemporary economy, supporting the building industry and economic growth. The rise of the construction sector, as well as the creation of substantial government major projects targeted at the middle class, are predicted to increase demands for steel commodities by 2030 (Mwangi, 2015).

Steel supplies will be used in the construction of Lamu port, standard gauge railway and road projects, housing, industrial parks, and industrial zones. Kenya's iron and steel industry employs about 13 percent of the country's workforce and contributes significantly to the country's economic growth. Kenya Manufacturers Association, Kenya Manufacturers Association, Kenya Manufacturers Association, Kenya Manufacturers Association Kenya Manufacturers Due to a shortage of steel raw materials in Kenya and the lack of commercial

iron ore mining, the sector is heavily dependent on imported steel raw materials from Asia. The Kenyan government, on the other hand, has created a policy to control the steel industry and solve issues relating to low-quality goods that have wreaked havoc on construction and buildings.

Steel manufacturing industries are performing well, as shown by rising product demand and supply; this is sufficient for a firm's use its ensure that the items generate income above and beyond its operational costs (Mills, 2008). According to Parrenas (2005), performance measurement ensures that the firm's resources are employed in perhaps the most effective and efficient manner possible. The primary goal is to maximize shareholder wealth by providing the firm with the highest possible return on invested capital. The financial performance of a company is regarded as one of the most important factors in developing an efficient and effective strategy (Richard, 2011).

The goal of financial performance is to determine if the company is optimizing the return on its invested capital. The financial performance of a company can be described as one of the most significant aspects of an efficient and effective management strategy (Richard, 2011). Firm financial performance assessment is crucial in allowing policymakers and owners to assess the precise measures to be taken with respect to competition, internal actions, and the firm's response to change through time by embracing available technologies. Interestingly, the financial effectiveness of various companies is not a one-dimensional phenomenon in terms of strategy and measurement, with varying magnitudes of impact.

1.1 Statement of the Problem

Most countries' economies are based on steel. As Kenya starts the development activities envisioned in Vision 2030, direct and indirect use of steel is expected to increase (Winkler & Kuss, 2020). Lamu port development, railway and road projects, residential, and industrial estates, and the establishment of special economic zones are among the major Vision 2030 projects, all of which make use of steel goods (KAM, 2020). Kenya's iron and steel industry accounts for over 13% of the country's manufacturing industries, which makes a significant contribution to the country's GDP. Production of basic metals grew by 3.9% in 2019 due to a 1.5% increase in the production of corrugated iron sheets. During the same period, production of iron bars and rods increased by 5.7% while the fabricated metal products -sub-sector declined by 4.1 % in 2019. Nonetheless, it is predicted that the total costs of around 60 billion shillings (almost 750 million dollars) per year on steel imports (KAM, 2020).

With the advent of the Covid-19 pandemic, metal and allied sector manufacturing firms in Kenya have been experiencing a lot of turbulence including a drop in the revenues, stock shortages, and an inability to manage the fluctuating customer demand; resulting in an increasing imbalance of trade due to competition from multinational firms which provide imported cheap and subsidized iron and steel products (Sinha & Sarmah, 2021). In addition to that, metal manufacturers in Kenya have been experiencing stagnating profitability, production, and operations management which is directly attributed to supply chain inefficiencies (KAM Directory, 2019). Furthermore, Jia et al. (2020) pointed out that in times of economic uncertainty, the most successful manufacturers appear to be those who have closely linked their internal operations to external suppliers and customers in unique supply chains.

Jia et al. (2020) fixated on the need for businesses to incorporate integration, demonstrating that supply chain integration is a tool for enhancing corporate success in highly competitive settings. Motivated by the above challenges, the current study sought to establish the effect of

supply chain integration on the performance of metal and allied sector manufacturing firms in Nairobi City County.

2.0 Theoretical Framework

The systems theory was developed by Ludwig von Bertalanffy, in the 1930s. The idea focuses on the relationships and subsequent order of the various constituent parts of a system, (Hautus & Heymann, 1991). Interconnections such as these are crucial to the concept of a system, as they are what makes up the total, and they are in place to help the system achieve a single, overarching purpose.

Systems Theory is described as a group of exciting applications that preserve integrity through synergistic interaction, (Hautus & Heymann, 1991). Ludwig von Bertalanffy was aware of the peculiarities that distinguished operating systems, but he also felt that there was a universal set of laws that governed the system as a concept, regardless of the various individual components. Instead of dissecting a system into its constituent bits, the core principle of Systems Theory is to focus on the interaction between the parts. The relevance of a system is not restricted to the instantaneous aggregate of its components, as the concentration on interconnections advances to the next discovery. It's the extra value that comes from the interactions, and what occurs as a result, that's important (Memon et al., 2015).

System approach theory explains supply chain integration by showing how firms can share information within the firm`s logistic system. This system has enabled the shipping line to use their websites to log in and trace the exact position of the vessel. Transporters have automated their freight activities whereby shipments are tracked while the onboard vessel, this enables advise the expected time of arrival which helps in the preparation for receiving and storage (Memon et al., 2015). This information is also passed on to the customers to keep them updated. By so doing, delays in logistics are eliminated and lead times met thus improving customer efficiency.

2.1 Empirical Review

Supply chain integration is recognized as a tool for enhancing corporate success in highly competitive settings. As a result, manufacturing businesses have begun to use a variety of supply chain management techniques (Kouty, 2021). Manufacturers frequently adopt two associated forms of integration. The forward physical flow of supplies between suppliers, producers, and customers is coordinated and integrated into the first type of integration.

The second method of integration is anomalies associated. Reverse integration enables the manufacturer to more correctly predict the input price, resulting in a more profitable investment decision (Radanliev, 2019). By combining their interactions, activities, roles, procedures, and places, supply chain integration connects a company with its consumers, suppliers, and other channel members. According to supply chain management literature, incorporation is linked to doing duties in a variety of sectors, each with a different level of intensity. Commodity flow, planning, and control, organization, and information flow are just a few of the domains where integrative activities might be formed (Musau, 2021).

According to Radanliev (2019), supplier and customer integration should be the first step in the supply chain process. Externally and internally, continuous standardization of each internal logistic function, as well as good information transmission and strategic relationships with suppliers and consumers, can assist in achieving convergence. Supply chain coordination between businesses has grown strategically important as new types of organizations emerge,

such as virtual firms, global manufacturing and networks manufacturing, and various corporation collaborations (Baig & Akhtar, 2020).

In this situation, the importance of time as a competitive weapon and the capacity to meet consumer and market demand with shorter delivery times has been recognized. To respond to the specific needs of customers and marketplaces, several companies emphasize flexibility and agility. Providing the right product to the right customer at the right time is critical not only for competitive success but also for existence. When seeking to build a new supply chain strategy, these are critical factors to consider. The competitiveness in this dynamic industry requires having the right products at the right place at the right time.

Information exchange is one of SCI's most important organizational procedures. This refers to suppliers and customers sharing technological, marketing, production, and inventory information (Fang & Chen, 2021). The majority of the authors have emphasized the importance of information exchange in successful supplier development operations. Information exchange, according to Yan & Kull (2015), is the transmission of business-related information in a manner that allows the receiver to act. They emphasized the importance of knowledge transfer in the supply chain in gaining a competitive advantage in a variety of ways, including gaining a better understanding of trends and consumer needs, acquiring new product ideas, and identifying recommendations to better production methods and reduce total cycle time.

Collaboration between customers and suppliers, joint product creation, common systems, and shared information are all examples of supply chain business process integration. To manage an integrated supply chain, constant data flows are essential, which contribute to the formulation of optimal product flows (Lanez-Aguirre & Puigjaner, 2014). However, many businesses have discovered that optimizing product flows is impossible without taking a process-oriented approach to business. Lanez-Aguirre and Puigjaner (2014) classified the essential supply chain processes as customer relationship management, customer service management, demand management, order fulfillment, service flow management, supplier relationship management, product development and commercialization, and returns management.

2.2 Conceptual Framework

Figure 1 shows the study's conceptual framework. The independent variable comprises supply chain integration and the dependent variable is firm performance.

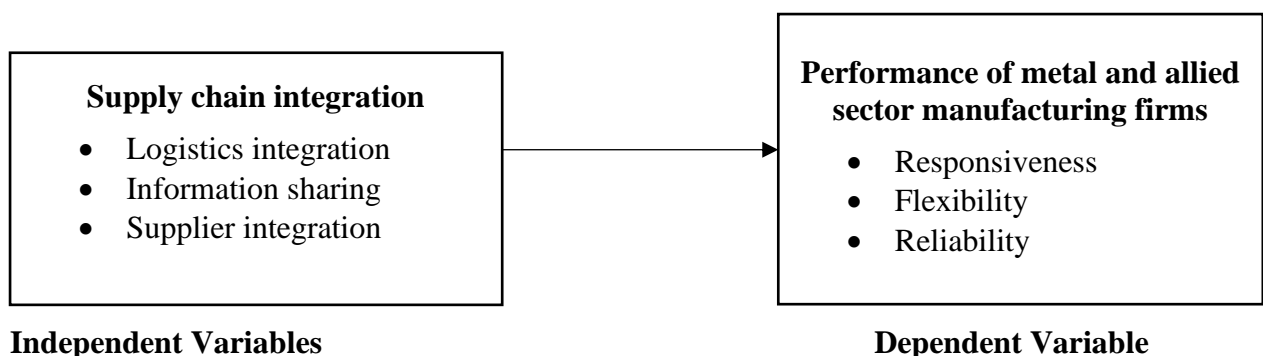**Independent Variables**   **Dependent Variable**

Figure 1: Conceptual Framework

3.0 Methodology

The study adopted a cross-sectional survey design and a target of 46 companies were involved. Census technique was used involving 92 respondents from the procurement and stores

departments. A questionnaire was used to collect primary data from the study respondents. Data processing and analysis were done using descriptive and inferential statistics. The findings were presented in tables.

4.0 Results and Discussion

This section presents results on descriptive statistics, correlation, and regression analysis.

4.1 Supply Chain Integration

The variable reported responses as tabulated below. As to whether logistics providers meet the firm's strict logistics operation requirements, the majority of the firms agreed as indicated by a mean of 4.0000. Similarly, a strong agreement was reported on the statement that firms strategically coordinate their supply chain operations with those of other companies in the same sector, that is, a mean of 4.0746 and a standard deviation of 0.47076. Furthermore, most firms' demand system is linked with that of their supplier for automatic ordering as proved by a mean of 3.9701 and standard deviation of 0.62692. The majority of the firms also indicated having a fully synchronized communication system with their suppliers as provided by a mean of 4.2537 and rated high the trust for the security of their shared information as evidenced by a mean of 4.0597 and a standard deviation of 0.54719. The findings agree with Lanez-Aguirre and Puigjaner (2014), that to manage a supply chain, constant data flows are essential, which contribute to the formulation of optimal product flows. Results are shown in Table 1.

Table 1: Supply Chain Integration

Statement	N	Mean	Std. Deviation
Our logistics providers meet our strict logistics operation requirements.	67	4.0000	.52223
We strategically coordinate our supply chain operations with those of other companies in the same sector.	67	4.0746	.47076
Our demand system is linked with that of our supplier for automatic ordering.	67	3.9701	.62692
We have a fully synchronized communication system with our suppliers	67	4.2537	.58629
We trust the security of our shared information.	67	4.0597	.54719

Table 2 shows that the stores/warehousing function was the most integrated function of the supply chain among the firms with a representation of 47.76% followed by finance/accounting at 38.81% while information communication was at 13.43%.

Table 21: Integrated Functions

Integrated Functions	Frequency	Percentage
Stores/warehousing	32	47.76
Finance/accounting	26	38.81
Information Communication	9	13.43
Total	**67**	**100**

4.2 Performance of metal and allied sector manufacturing firms

Majority of the firms strongly agreed that supply chain technologies have boosted their responsiveness as denoted by a mean of 4.1343 and a standard deviation of 0.34358. It was also noted that through supplier integration, the firm is flexible enough to handle demand

changes as denoted by a mean of 4.1791 and a standard deviation of 0.38633. Additionally, customers consider their firm reliable enough in product and service delivery as evidenced by a mean of 4.3433 and a standard deviation of 0.47839. Finally, on the statements that the firms respond promptly to customer needs and that the cost of the general operation has reduced as a result of embracing an agile supply chain, means of 4.0149 and 4.0299 were respectively realized.

Table 3: Performance of metal and allied sector manufacturing firms

	N	Mean	Std. Deviation
Supply chain technologies have boosted our responsiveness.	67	4.1343	.34358
Through supplier integration, the firm is flexible enough to handle demand changes.	67	4.1791	.38633
Our customers consider our firm reliable enough in product and service delivery.	67	4.3433	.47839
We can respond promptly to customer needs.	67	4.0149	.36897
Our general operations cost has been reduced as a result of embracing an agile supply chain.	67	4.0299	.38809

4.3 Correlation Analysis

Correlation shows the relationship among a set of variables. When values are not close to 1 or -1, it is an indication that the factors are sufficiently different measures of separate variables. It is also an indication of non-multicollinearity thus justifying the utilization of all the independent variables of the study. Results in Table 4 showed that supply chain integration ($r = .648**$, $P < .05$), had a positive and significant correlation with firm performance. This implied that an increase in supply chain integration is accompanied by an increase in the performance of metal and allied sector manufacturing firms.

Table 4: Correlation results

		Firm performance	Supply chain integration
Firm performance	Pearson Correlation	1	
	Sig. (2-tailed)		
Supply chain integration	Pearson Correlation	.648**	1
	Sig. (2-tailed)	.000	
	N	67	67

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

4.4 Regression analysis

A linear regression analysis was conducted to determine the effect of supply chain integration on the performance of metal and allied sector manufacturing firms. Table 5 indicates that the supply chain integration explains 42% percent of overall changes in firm performance ($R^2 = 0.419$). The remaining 58% of the variations are attributed to other factors not covered in this paper.

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Journal of Procurement and Supply Chain
Vol. 2, No. 1, pp. 1-10: ISSN 2789-3405
Email: info@edinburgjournals.org

Table 5: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.648a	0.419	0.41	0.14149

a Predictors: (Constant), integration

Table 6 shows an F statistic of 46.951 and a P-value of 0.000. The proposed model is statistically significant in predicting the dependent variable due to the P-value being less than the traditional value (P<0.05). This implies that supply chain integration is a good predictor of the performance of metal and allied sector manufacturing firms.

Table 6: Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0.94	1	0.94	46.951	.000b
	Residual	1.301	65	0.02		
	Total	2.241	66			

a Dependent Variable: firm performance

b Predictors: (Constant), supply chain integration

Results in Table 7 showed that supply chain integration (β=0.459, p<0.05) had a positive and significant effect on firm performance. This implied that a unit increase in supply chain integration would result in 0.459 unit increase in performance of metal and allied sector manufacturing firms.

Regression Equation

Y= 2.27+0.459X

Where;

Y = Performance of metal and allied sector manufacturing firms

X= Supply chain integration

Table 7: Regression coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.27	0.273		8.302	0.000
	Supply chain integration	0.459	0.067	0.648	6.852	0.000

a Dependent Variable: firm performance

5.0 Conclusion

The study concludes that supply chain integration has a positive influence on the performance of metal and allied sector manufacturers. Through strategic coordination in the supply chain operations between metal manufacturing firms and other companies in related sectors, logistics providers have been tasked to meet the strict logistics operation requirements. Moreover, the full synchrony of communication systems with those of strategic suppliers has necessitated ease of information sharing and its security.

6.0 Recommendations

The study recommends that more linkage with the suppliers be enhanced since many of the delays and inefficiencies emanate from the upstream as it tickles down. Automatic ordering should be permitted to avoid chances of running short of the stock leading to production stoppages. Information security systems should also be beefed up with necessary cyber security measures to avoid unauthorized access to information.

References

Abtew, A. (2016). *Ethiopia's Industrial development Fundamentals of Ethiopia's Industrialization*. Ethiopian Ministry of Industry

Baig, V. A., & Akhtar, J. (2020). Supply chain process efficiency (SCPE) and firm's financial efficiency (FFE). *Supply Chain and Logistics Management*, 651-672.

Fang, X., & Chen, H. (2021). Using vendor management inventory system for goods inventory management in IoT manufacturing. *Enterprise Information Systems*, 1-27.

Gigineishvili, M. N., Mauro, M. P., & Wang, K. (2014). *How solid is economic growth in the East African Community?* International Monetary Fund.

Gregory, P., & Simiyu, N. (2015). The impact of supply chain collaboration practice on the performance of steel manufacturing companies in Kenya. *European Journal of Logistics Purchasing and Supply Chain Management*, 3(2), 28–39.

Hautus, M. L., & Heymann, M. (1991). Module theory and linear system theory. *Mathematical System Theory*, 267-278.

Jia, F., Blome, C., Sun, H., Yang, Y. and Zhi, B. (2020), "Towards an integrated conceptual framework of supply chain finance: an information processing perspective", *International Journal of Production Economics*, Vol. 219, pp. 18-30.

Kitaw, D., & Goshu, Y. Y. (2017). Performance measurement and its recent challenge: a literature review. *International Journal of Business Performance Management*, *18*(4), 381-402.

Kouty, M. (2021). Green supply chain management practices and firm characteristics: Evidence from Cameroon. *Green Supply Chain [Working Title]*.

Laínez-Aguirre, J. M., & Puigjaner, L. (2014). Capturing dynamics in integrated supply chain planning. *Advances in Integrated and Sustainable Supply Chain Planning*, 159-195

Memon, M. S., Lee, Y. H., & Mari, S. I. (2015). A combined grey system theory and uncertainty theory-based approach for supplier selection in supply chain management. *Toward Sustainable Operations of Supply Chain and Logistics Systems*, 461-473.

Musau, E. G. (2021). Antecedents and consequences of the integration of supply chain information systems into the textile supply chain. A Kenyan textile supply chain perspective. *Journal of Transport and Supply Chain Management*, *15*.

Parrenas, R. J. S. (2012). Producing effect: Transnational volunteerism in a Malaysian orangutan rehabilitation center. *American Ethnologist*, *39*(4), 673-687.

Radanliev, P. (2019). Architectures for green-field supply chain integration - Supply chain integration design.

Richard, W. P. (2011). Performance measurement systems in supply chains: A framework for contextual analysis. *International Journal of Productivity and Performance Management*, 60(6), 583–602.

Sinha, S., & Sarmah, S. P. (2011). Price and warranty competition in a duopoly supply chain. *Supply Chain Coordination under Uncertainty*, 281-314.

Von Bertalanffy, L. (1950). An outline of general system theory. *British Journal for the Philosophy of science*.

Winkler, H., & Kuss, C. (2020). Using a supply chain improvement system (SCIS) to increase supply chain efficiency. *Supply Chain and Logistics Management*, 1404-1424.