

Role of Inventory Visibility on Performance of Manufacturing Sector in Sub-Saharan Africa: A Study in Kenya

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Abstract:

Inventory visibility is the ability of an organization to streamline its inventory tracking methods so as to ensure the right amount inventory is stocked based on the customers' needs and the supply rates of the suppliers. Having a high degree of inventory visibility is increasingly seen as a competitive advantage in modern supply chain management, as it allows for greater agility and responsiveness to market changes. One of the compelling issues that have been facing the manufacturing industry in Kenya is the inability to meet customer demands and high waiting times. Previous literature has shown that with a visible inventory, manufacturing firms could enhance their delivery effectiveness and significantly reduce waiting time. This however lacks empirical backing from a Kenyan perspective, hence the subject of the study. The study was anchored on the transaction cost theory. Descriptive research design was adopted, and the large manufacturing firms in Kenya were targeted. A sample of 160 firms was selected. Through a structured questionnaire, primary data was collected from the heads of supply chain in the 160 companies. The findings revealed that inventory visibility is an instrumental determinant of the performance of the manufacturing industry in Kenya. It was established that inventory visibility enabled manufacturing companies to have real-time or near-real-time information about the quantity, location, and status of its products or goods throughout the supply chain. This allowed for accurate tracking and management of inventory levels, which is crucial for efficient operations and customer satisfaction.

Keywords:

inventory visibility; supply chain; manufacturing sector; Sub-Saharan Africa

I. Introduction

1.1 Background of the Study

Inventory visibility is the process of tracking down the inventory to ensure that the available inventory is known and accounted for, and that the company is aware of the amount to inventory required to meet customers' orders (Gattorna, 2017). Through inventory visibility, companies are able to trace their inventory and manage the inventory for efficiency and enhanced customer satisfaction (Tenorio, Pascucci, Verkerk, Dekker, & van Boekel, 2021). According to Bolton and Dwyer (2017), through embrace of inventory visibility, it is easier to understand the best approach to avail the required inventory on time as well as ensuring the customers are satisfied through reduced waiting times. As an aspect of supply chain alignment, inventory visibility serves to ensure that as the company is aligning its supply chain process with the key stakeholders (customers, suppliers and employees), it is capable of ensuring the available inventory is known and properly tracked. This ensures that the customers do not have to wait long before their orders are fulfilled, while ensuring that the employees are working smoothly to manage inventory without having to be inconvenienced by delays or late arrivals. Inventory visibility also contributes to supply chain alignment by ensuring that the suppliers are notified on time on when to restock and deliver orders, thus

making their work easier and streamlining the relationship due to reduced unfulfilled orders (Sangari & Abbasi, 2017).

Inventory visibility is assessed using several aspects, among them the acquisition or restocking visibility. This is whereby the organization ensures that the available inventory is tracked to establish when the new inventory is required and when restocking should be done (Iranmanesh et al., 2023). This is informed by the current flow of inventory and the emerging customer orders (Chhetri, Hashemi, Lau, & Lim, 2022). When the inventory is visible, it implies that the organization is aware on when to restock and can engage the suppliers early enough to avoid any delays. Through acquisition visibility, the supplier can also identify the levels at which they are required to supply more materials, thus they can prepare early enough. Acquisition visibility as expounded by Gligor et al. (2020) ensures that not only the organization is able to track the levels which it has to track, but also the supply, who is able to smoothly identify when they are supposed to supply more inventory.

The other aspect of inventory visibility is maintenance visibility. This is the type of visibility where the organization through inventory management team is able to track the movement of inventory so as to ensure the maintenance costs of the inventory is low (Sheel & Nath, 2019). Through inventory maintenance visibility, the organization is able to establish which inventory to release first and which to release first. The customers also use inventory maintenance visibility to understand how they can best place their orders and the pricing for such inventory. According to Mahapatra, William, and Padhy (2019), inventory maintenance visibility helps to determining what is likely to be incurred while maintaining certain inventory so as to establish what to keep and what to leaves. Additionally, the customers are able to have better knowledge on cost of goods based on costs incurred in maintaining the inventory.

The manufacturing sector is the third biggest industrial sector after agriculture and transport and communication (KPMG, 2014). It is the third leading sector contributing to GDP in Kenya. Although Kenya is the most industrially developed country in East Africa, the manufacturing sector constitutes merely 10 per cent of the industrial sector contribution to GDP (RoK, 2014). The growth in manufacturing industry has declined to 3.3 per cent in 2011 as compared to 4.4 per cent in the year 2010 mainly due to a challenging operating environment (KNBS, 2012). Furthermore, the manufacturing sector has high yet untapped potential to contribute to employment and GDP growth.

After a long period of virtual stagnation, Kenyan economy went through a strong phase of performance over the period 2003-2007 since the rate of economic growth accelerated up to 7 per cent. During the same period Total Factor Productivity in manufacturing sector increased by as much as 20% (WB, 2013). As an important sector in the overall economic growth, manufacturing sector requires in depth analysis at industry as well as firm level. According to KPMG (2014), real growth in the manufacturing sector averaged 4.1% p.a. during 2006-2013 which is lower than the average annual growth in overall real GDP of 4.6%. As a result, the manufacturing sector's share in output has declined in recent years.

The increasing level of competition and globalization in the world economy has a major impact on the need for organizations to improve their supply chain performance. Many companies pay millions of dollars in order to improve their supply chain performance through process reengineering, new systems and training their employees (Dubey et al., 2018). A number of studies have been conducted on supply chain alignment globally. For instance, Doyle (2014) conducted a survey on 174 firms in the UK and found out that though 92%

claimed supply chain alignment seemed to have reduced transaction costs. In Malaysia, for instance, Rashid and Aslam (2012) conducted a study to assess the impact of supply chain alignment on business performance in Malaysia.

In Nigeria, the study conducted by Gattorna (2016) on supply chain practices identified supply chain alignment and a critical supply chain activity that every organization must engage in. Kakwezi and Nyeko (2010) associated procurement performance with supply chain alignment procurement operations. On the other hand, Gunasekaran, Patel and Tirtiroglu (2016) pointed out that supply chain alignment is associated with reduced procurement costs and improved achievement of procurement organizational goals respectively.

1.2 Large Manufacturing Firms in Kenya

Statistics from World Bank (2022) show that Kenyan manufacturers have registered stagnation and declining profits for the last five years amid the unpredictable operating environment. Further statistics from Kenya Association of Manufacturers have shown that certain firms announced plans to shut down their plants and shift operations to Egypt as a result of reduced profits (KAM, 2019). According to the World Bank (2021), sluggish growth in the manufacturing sector is pulling down economic growth in Kenya and is also losing grip on the East Africa Community market where it was dominant, due to inefficiencies and the unpredictable operating environment. The share of manufactured goods imported by EAC from Kenya declined from 9 per cent in 2009 to 7 per cent in 2013 (KAM, 2014). Kenya was the largest exporter of various manufactured goods to the EAC. Its market share has declined for a range of products including plastics, chemicals and paper (RoK, 2014). The report spelt out the main influence being uncertainties in the operating environment and lack of preparedness by these manufacturing firms to adjust and cope with the dynamic environment (RoK, 2014).

The manufacturing sector contributes on average 12% of Kenya's GDP. Its significance to Kenya's economy and growth cannot be overlooked (KIPPRA, 2013). Despite the complexity and length of manufacturing firms' supply chains, continuous improvement (kaizen) and alignment to the overall organizational goals is integral to the sustainability and overall performance of the firm in a competitive environment. However, this desired optimality in alignment and performance is seldom attained (World Bank, 2013). Supply chain alignment is therefore paramount to any organization since it leads to improved product design, quality and cost consciousness, which means an improvement in the performance of a firm.

Statistics from OECD show that large scale manufacturers operating in Kenya registered stagnation and declining profits for the last five years due to a turbulent operating environment as well as non-alignment of their respective supply chains (OECD, 2010). It is estimated that large manufacturing firms have lost 70% of their market share in East Africa largely attributed to non-alignment issues (RoK, 2014). In 2016, manufacturing sector in Kenya contributed barely 6% to the GDP which represented Sh.537 Billion indicating a decline from the previous year 2015 where it had reported a 10% due to disruptions in supply chains, a challenging operating environment and high operational costs (KNBS, 2014). In Kenya, there has been a rise in complaints by the public, professionals and other stakeholder's about the manufacturing firms' performance (Semchenkova et al., 2019). Several studies have been done, however these studies have used different methodological approaches, while others have focused on varied contexts (Skipworth & Julien, 2015; Attia, 2015; Mokadem, 2016).

1.3 Statement of the Problem

The Contribution of the manufacturing sector in Kenya's GDP has staged at an average of 10% over the years, despite the industry's potential to contribute to over 30% of the GDP (KNBS, 2021). In 2016, the sector contributed up to 11% of the GDP, but dropped to 9.2% in 2017, 9.0% in 2018, and 8.9% in 2019, and 7.1% in 2021 (Economic Survey, 2021). The overall value growth of the sector dropped from 2.7% in 2016 to 0.2% in 2017, and 0.1% in 2018 (Economic Survey, 2021). According to the Kenya Association of Manufacturers [KAM] (2022), in 2022, the Kenyan Manufacturing sector dropped over 7,000 jobs, despite benefiting from tax incentives from the government, where most of the firms cited unstable revenues and inability to meet the overhead costs. Additionally, most manufacturing firms have been recording losses while others downsizing their operations to minimize the cost of operation, while others have exited the market altogether (Gachanja, Nga'nga & Kiganane, 2020). Companies like Eveready, Athi River Mining, East African Portland Cement Plc, Mumias Sugar, and East African Cables have fallen from giants to loss-making within a span of less than 10 years, a situation that according to Kitainge, Bor and Wanza (2019), is worrying not only to the future of the manufacturing industry in the country but also on the continued growth of the country's economy. While there exists a number of studies on the performance of manufacturing industry in Kenya (Cheptum, 2019), the studies have failed to provide a conclusive elucidation on the waning performance in the sector.

Empirical evidence shows that inventory visibility is one of the fundamental drivers of effectiveness and efficiency in manufacturing industry, leading to enhanced performance of the sector (Mukhtar et al., 2021; Singha & Verma, 2018). Seshadri and Baja (2020) argued that inventory visibility plays an integral role in enhancing firm performance. Muhr (2020) argued that inventory visibility is integral in enabling the organization to align its inventory with the emerging demand and market conditions thus ensuring continued firm performance. While these studies have shown the essence of inventory visibility in enhancing on performance, they have focused on different contexts and conceptualized inventory visibility differently. The study therefore sought to fill these gaps by assessing the influence of inventory visibility on performance of manufacturing firms in Kenya.

II. Review of Literature

2.1 Theoretical Review

The study was anchored on transaction cost theory. The theory was introduced by Coase (1998) where he specified that in procurement these costs may include among others; life cycle related costs of inventory, equipment or property. Transaction cost theory tries to explain how companies compete cost-wise and why companies expand or source out activities to the external environment (Bharadwaj & Matsuno, 2012). Transaction cost theory supposes that a company will try to minimize the cost of exchange with the environment and the bureaucratic cost of exchange within the company. This may entail minimizing acquisition related costs (Carr & Smeltzer, 2012).

According to Castano and Mills (2013) transaction cost theory is one of the key motivator of supply chain alignment in any organization. The transaction cost economics focuses on the organization of transactions that occur whenever a good or service is transferred from a provider (seller) to a user (buyer) across separate interface. The theory sees sellers and buyers as different possible forms of organizing and coordinating economic transactions (Wever, Wognum & Omta, 2010).

When external transaction costs are higher than the company's internal costs then the company will grow because the company is able to perform its activities more cheaply than if the activities were performed in the market place (Luzzini, Caniato, Ronchi & Spina, 2012). This means keeping the maintenance and acquisition related costs at a minimum. According to Gonzalez-Benito and Spring (2010) transaction cost arises every time a product or service is being transferred from one stage to another where new sets of capabilities are needed to make the products or services.

Companies will therefore look at the inventory visibility of the entire process. Based on this theory, Fredikind (2014) argues that supply chain alignment lowers the cost of inventory ownership through looking at the total costs involved. Chae, Yen and Sheu (2015) says that transaction costs relating to procurement are those costs that enterprises incur in trying to acquire inventory and the overall procurement costs involved. This theory supports the variable inventory visibility by linking the acquisition of inventory visibility, visibility of inventory by the customers and visibility of the inventory by the suppliers to the need for efficiency and effectiveness in supply chain process for enhanced firm performance. The theory was therefore used to instigate the relationship between inventory visibility and performance of large manufacturing firms in Kenya.

2.2 Conceptual Framework

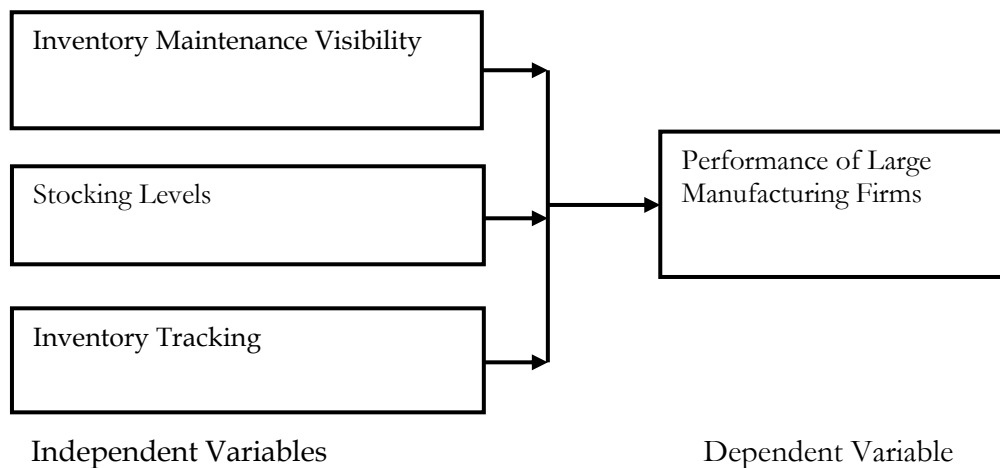


Figure 1. Conceptual Framework

2.3 Inventory Visibility and Performance of Manufacturing Firms

Inventory visibility as an inventory management practice has been found, by several studies, to have a favorable effect on firm's performance. This is supported by a study by Gattorna (2016) which shows that firms which outshine their counterparts execute a large standard of inventory visibility than those who did not apply it. As so, reduction of waste through some practices implemented such as preventive maintenance programs, setup time reduction and uniform workloads. From the findings, firms were steadily more profitable than the competitors due to the application of the inventory visibility. In lean production practice, inventory is considered to be a type of waste which should be reduced is seen to be equivalent to quality inventory management.

Hoang and Elgamal (2021) analysed the role of inventory visibility in supply chain and its role in firm performance. The findings revealed that inventory visibility was essential in enhancing firm performance. They however contended that overall firm's performance should

not be quantified with the inventory performance of the firm. Hoang and Elgamal (2021) showed that a bad impact on performance was experienced due to an improvement on turnover taking into account the effects of time. An interpretation of the evidence showed that some turnover improvement associated with increased performance while other turnover improvement associated with decreased performance, which varied transversely from one firm to another pertaining to the firms performance and turnover improvement.

According to Carr and Ittner (2012) in their study, they used a questionnaire to enumerate the major cost factors that affect the inventory visibility of the companies surveyed. Their study reported that the criteria for the selection of suppliers who are total cost of ownership compliant are divided into thirteen categories: operating costs, quality, customer-related costs, logistics, technological advantages, starting price, opportunity cost, capacity and reliability, maintenance, inventory costs, transaction costs, lifecycle costs, and others.

In another study by Ellram (2013) about 62% of firms he surveyed, it was reported that the inventory visibility is used in less than 40% of the purchases. These results are consistent with the work of Hines (2015) which states that the methodology is not widely publicized because its application is difficult. On the other hand, the results indicated that the main application of inventory visibility (28.8% of cases) is related to the purchase of capital goods, i.e. investments and equipment purchases.

According to Foster and Feitzinger (2011), it is particularly important to highlight that the inventory visibility is particularly relevant to support decision making in terms of purchasing materials and components for the production of a large quantity of products. Understanding and trading-off the various costs related to sourcing decisions is all the more relevant given the increased emphasis firms operating in business markets are placing on value-based market offerings, both from the supplier and the customer point of view.

Dumond and Siferd (2010) opine that inventory visibility facilitates companies in dealing with pressure in their own customer markets and making the purchasing function more value oriented. Such visibility also can be viewed as extending supply chain to a boundary-spanning context, where the firm is reliant on cooperation and information provided by suppliers, or inferences drawn from alternative prices quoted by suppliers for changes in their market offerings (e.g., changes in materials in the core offerings, changes in supplementary services, programs, and systems).

Messina (2019) studied the impact of inventory visibility on the effectiveness of supply chain processes and firm performance. They established that inventory visibility was one of the essential aspects of supply chain visibility that determined firm performance. According to Messina (2019), identifying the processes most impacted by visibility is a critical step for companies. This helps companies prioritize which information flows to share (Messina, 2019). The role of improved visibility in processes within procurement, manufacturing, planning, inventory management and transportation has been studied extensively in literature. Yet, as mentioned earlier, the purpose of this work is not to establish an exhaustive list of processes positively affected by inventory visibility and quantify the impact. Rather, it is to examine how some of the processes that are important for the company and organizational structure are improved once the inventory visibility is implemented.

III. Research Method

Descriptive research design was used in this study. The design helped to describe weather inventory visibility is related to performance of manufacturing firms in Kenya. The study targeted 461 large manufacturing firms in Kenya. A sampling formula was used to calculate the sample size as advanced by Cochran (1977).

$$n_0 = \frac{z^2 p(1-p)}{e^2}$$

Through the formula, a sample size of 160 respondents was obtained. The study selected the respondents through a purposive sampling method. The research utilized a structured questionnaire to collect data. The questionnaire was administered through drop and pick method to heads of procurement in charge of supply chain management or its equivalent in their respective manufacturing firms. This study adopted a descriptive data analysis and inferential data analysis. The study used SPSS version 26 in analysing the quantitative data. The regression model took the form of:

$$Y = \alpha + \beta X + \varepsilon$$

Where:

Y = Performance of Manufacturing Firms

α is the y-intercept or model coefficient;

β = the coefficients of the independent variable;

X = Inventory visibility

ε is the error term

IV. Discussion

4.1 Response Rate

A total of 127 questionnaires were properly filled and returned from the manufacturing firm's employees out of the total 160 questionnaires issued. This represented an overall successful response rate of 79.4%. According to Creswell (2014), a response rate of 50% or more is adequate. Babbie (2004) also asserted that return rates of 50% are acceptable to analyze and publish, 60% is good and 70% is very good.

4.2 Performance of Manufacturing Industry

The study sought to establish the performance of the manufacturing firms in Kenya. The respondents were asked to indicate their level of agreement on specific statements regarding the performance of their respective firms. This was based on a five-point Likert's scale. The findings as shown in Table 1 revealed that majority of the respondents disagreed that their company had been recording increased net profits in the past five years (Strongly disagree = 26%; disagree = 30.7%). Majority of the respondents (65.4%) disagreed that the lead time for their customers had been reduced continuously over the years in their respective firms, and a further majority disagreed that there had been a reduction in lead time which saw an increase in the number of customers in their respective companies (Mean = 2.51; standard deviation = 1.28). It was further established that most of the organizations recorded high returns from their customers, as a result of not meeting the needs and specifications of the customers (35.7%; disagree = 21.6%). The respondents further disagreed that that there their respective companies had been meeting the quantity of productions needed in the market for the past five years.

Table 1. Descriptive Results on Organizational Performance

Statement	Mean	Std. Dev.
Our company has been recording increased net profits in the past five years	2.61	1.35
The profit margins recorded by the company are sustainable to steer its expansion	2.41	1.46
The lead time for the customers has been reducing continuously over the years in our firm	2.46	1.35
The reduction in lead time has seen an increase in the number of customers in our company	2.51	1.28
There are fewer returns/rejections by our customers than it was in the past	2.39	1.47
There has been an increase in the volume of units produced by the company for the past five years	3.21	1.27
The company has been meeting the quantity of productions needed in the market for the past five years	2.18	1.29

4.3 Effect of Inventory Visibility on Firm Performance

The study sought to assess the relationship between inventory visibility and performance of manufacturing firms in Kenya. The main aspects of inventory visibility focused on the study were: inventory tracking, inventory maintenance visibility, and stocking levels. The respondents were asked to indicate their level of agreement with specific statements on inventory visibility. The findings are as shown in Table 2. The results revealed that majority of the respondent (3.76) agreed that their respective organizations had a framework for reducing the costs of acquiring inventory. The results further indicated that most of the companies had put measures to ensure any additional cost of acquiring inventory is justifiable as evidenced by a mean of 3.76 and a standard deviation of 0.84. According to Semchenkova, Chulkova, and Lukasheva (2019), putting the appropriate measures for controlling inventory ownership costs is essential for maintaining a proper flow of inventory and reducing costs. Tinkham et al. (2018) alludes that the inventory maintenance is essential for organizational performance but it is essential to minimize the costs of maintaining the inventory in order to reduce the entire cost of owning inventory. The findings are in line with those by Dobos and Vörösmarty (2019) who found out that through enhanced means of reducing the costs of inventory ownership, companies are able to save on the costs of operation and this significantly contributes to firm performance and competitiveness.

Table 2. Descriptive Results on Inventory visibility

Statement	N	Mean	Std. Dev.
Our organization tracks its inventory to ensure it has only the inventory required in given time	127	3.76	0.87
The company monitors its inventory stocking levels and costs to enhance the performance	127	3.54	0.99
Advance notices on inventories are given to enhance the performance of manufacturing firms in Kenya	127	3.76	0.84
Our organization has a framework for tracking its inventory as a way of controlling production	127	3.81	0.89
The management of our company's inventory has been upheld as a move to keep the inventory levels standard	127	3.69	0.94
Our organization has established stocking levels which guides on production levels	127	3.97	0.80
The stocking costs are minimized to steer cost-saving in our organization	127	3.83	0.81

There is a standard stocking levels that the company adheres to	127	3.83	0.92
There are allowed costs of stocking that should be upheld in our firm	127	4.09	0.88

4.4 Hypotheses Testing

H₀: Inventory visibility *has no significant relationship with performance of manufacturing firms in Kenya*

The study sought to examine the relationship between inventory visibility and performance of manufacturing firms in Kenya. The linear regression model analysis was carried out to establish the relationship between inventory visibility and performance of manufacturing firms in Kenya and the output included the model summary, the ANOVA results and the regression coefficients. The model summary results are as shown in Table 3.

$$Y = a + \beta X + \epsilon$$

As the findings portray, the R² for the variable was 0.412. This implies that inventory visibility influences up to 41.2% variation of the performance of manufacturing firms in Kenya. The ANOVA results revealed that the F-statistics for the model was 87.594 at a significant level of 0.000 < 0.05. This implies that inventory visibility significantly influences the performance of manufacturing firms in Kenya. From the regression coefficients obtained, the following model was derived:

$$Y = 1.089 + 0.657X$$

As the results portray, the Beta coefficient for inventory visibility was 0.657. This implies that a unit change in inventory visibility would lead up to 65.7% increase in the performance of manufacturing firms in Kenya. The p-value was 0.000 which is less than the standard p-value of 0.05. This means that there is a significant influence of inventory visibility on the performance of manufacturing firms hence the rejection of the null hypothesis that there is not significant influence of inventory visibility on the performance of manufacturing firms in Kenya. The findings are in line with those by Lambert and Croxton (2015) who indicate that inventory visibility is critical in enabling the company to establish how much inventory it owns, thus they are able to strategies for their management of the inventory for enhanced performance.

Table 3. Regression Results on Inventory Visibility and Firm Performance

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.642 ^a	.412	.407	.52326

a. Predictors: (Constant), Inventory visibility

ANOVA Results						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	23.983	1	23.983	87.594	.000 ^b
	Residual	34.225	125	.274		
	Total	58.208	126			

a. Dependent Variable: Performance of Manufacturing Firms

b. Predictors: (Constant), Inventory visibility

Regression Coefficients				
Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.
	B	Std. Error	Beta	

1 (Constant)	1.089	.244		4.459	.000
Inventory visibility	.657	.070	.642	9.359	.000

a. Dependent Variable: Performance of Manufacturing Firms

V. Conclusion

Supply chain alignment through inventory visibility has a significant influence on performance of the manufacturing industry. Through Continued focus on inventory tracking, inventory stocking levels and increased focus on inventory maintaining costs, the firms are likely to enhance their performance. The study also concluded that inventory visibility has a significant relationship with performance of manufacturing firms in Kenya. The sub-constructs of inventory visibility namely acquisition related costs, maintenance related costs, salvage related costs significantly influenced the performance of manufacturing firms in Kenya.

Inventory visibility being the ability to integrate, build and reconfigure internal and external expenses to address rapidly- changing customer needs, can also take the form of various ways apart from the ones discussed in the current study and hence the future scholars can seek to explore other measures of this factor

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