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EFFECT OF SUPPLY CHAIN VULNERABILITY ON SUPPLY CHAIN PERFORMANCE OF LOGISTICS FIRMS IN KENYA: A CASE OF MAERSK KENYA LIMITED

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ABSTRACT

The general objective of the study was to examine the effects of supply chain vulnerabilities on the supply chain performance in logistics firms in Kenya. The study adopted a descriptive research design. The total population of the study was one hundred and eighty nine (189) employees working at Maersk Kenya limited. The study sampled one hundred and seven (127) respondents who participated in the study. The research further used the simple random sampling method because it gave every member of the population equal chances of being selected. Structured questionnaire was used to collect the primary data from the sample size. Data was collected using structured questionnaire to ensure consistency. The raw data from the respondent was analyzed using statistical package for social science (SPSS version 24.0) analysis software. The research targeted 127 respondents to survey. All of them were supplied with questionnaires but 115 questionnaires administered were filled and returned. Therefore the response rate was 90.9%. The four independent variables that were studied, explained 81.14% of the Supply chain performance as represented by adjusted R square. This therefore meant that other variables not studied in this research contributed 18.6% of the Supply chain performance. The study recommended that there should be effective communication between all tiers in the supply chain should to create awareness of the end customer demand and not just of the orders placed by a single tier. The study recommended that managers must carefully measure and manage two conflicting objectives that is service and inventory. The firm should adopt a portfolio analysis technique which analyses the supply base according to supplier risk factors. The risk related to exposure to supply failure and supply market complexity should be used to as a proactive supply chain risk management process. The study recommended that more technology systems, such as point-of-sales product scanning and vendor-managed inventory should be adopted to improve the performance of the firm. Such systems would reduce risk exposures and the bullwhip effect as well.

Key Words: *Bullwhip Effects, Order Fulfillment, Supply Base Optimization, ICT Integration, Supply Chain*

INTRODUCTION

The concept of risk is multi-dimensional and not univocally defined, it is generally established the fact that it is linked to uncertainties associated with events. Managing risk in the supply chain has never been as challenging as it is today. As more companies have outsourced production to overseas locations, supply chains have been extended, the number of nodes increased, and the complexity of the networks have moved exponentially. In the past, supply chain managers were mainly concerned with reducing cost, reducing purchase price variance, and managing inventory (Oyatoye, 2011). Today, supply continuity is the single biggest business driver. Indeed, organizations now recognize that "preservation of shareholder value" is of paramount importance in supply chain management, and it has been assessed that disruptions can exert a tremendous impact on the company's overall performance of supply chain operations, if there are not suitable mechanisms or tools able to prevent or smooth their negative effects, as many real cases have showed in the past few years Sheffi, (2015).

According to Chopra and Sondhi *(*2014) risk in the concept of supply chains maybe associated with the production/ procurement process, the transportation/shipment of goods, and or the demand markets. In today's volatile era with businesses and, more specifically, supply chains becoming increasingly global, the industrial environment is heavily affected by uncertainty, which can potentially turn into unexpected disruptions. Economic and political turmoil, socio-cultural changes, highly fragmented and demanding behaviour of consumers, rapid development and changeover of products, have seriously modified the economic and industrial environment in which companies act, bringing out new issues related to assuring the continuity of the business against potential disruptive events.

Recent growth in globalization and digital business has created heightened complexities within supply chains, providing for greater vulnerabilities for firms. It is the examination of such vulnerabilities of a firm's supply chain network that may potentially be utilized to identify any inherent risks and weaknesses in the supply chain with the aim of developing mitigation strategies as well as corrective action plans that form part of the management of supply chain vulnerability within distribution (Wu & Blackhurst, 2009).

Mburu (2017) study on risk management strategy and supply chain performance among manufacturing companies in Kenya indicates that day's marketplace is shifting from individual company performance to supply chain performance: the entire chain's ability to meet end-customer needs through product availability and responsive, on-time delivery. Supply chain performance crosses both functional lines and company boundaries. Functional groups are all instrumental in designing, building, and selling products most efficiently for the supply chain, and traditional company boundaries are changing as companies discover new ways of working together to achieve the ultimate supply chain goal: the ability to fill customer orders faster and more efficiently than the competition (Mensah, 2014).

In Kenya, the importance of logistics management continued to grow with logistics firms. According to Njambi and Katuse (2013) then, in an era of shrinking product life cycles, proliferation of product lines, shifting distribution chains and rapidly changing technological advancement, use of logistics had become an essential ingredient for organizations in gaining competitive advantage. This was so since logistics management balances two basic objectives: Quality of Service and Low Cost of doing business as

every other firms objective lies on quality service and minimum production cost.

The Maersk Group is a worldwide conglomerate and operates in some 130 countries with a workforce of over 89,000 employees. In addition to owning one of the world's largest shipping companies, Maersk is involved in a wide range of activities in the shipping, logistics, and the oil and gas industries. Maersk Kenya Limited was established in 1994 following an upgrade of the East African Service. It trades as Maersk Line and Safmarine. Maersk line and Safmarine provide containerized sea freight from various ports of the world like the Americas, Europe, Middle and far-east and Australia. It has branches in Nairobi and Mombasa. Maritime customers care about service quality more than the delivery price

Statement of the Problem

According to Fazil & Masoumi (2012) disasters have increased in numbers and in intensity affecting the supply chain management in many organizations. The numbers of man-made hazards such as wars, terrorist attacks, and sabotage among others that affect supply chains are on the increase (Wagner & Neshat, 2010). Supply chain network has become prone to many risks and therefore the organizations have been forced to implement supply chain risk management strategies with the aim of reducing the negative impact. A study by Peck (2008), on supply chain vulnerability in the United Kingdom found that Supply chain vulnerability has a direct impact on the performance of the entire organization

Past studies showed that most supply chains fail within first three years of business operations (Bosman, 2006). According to World Bank report (2013),companies with poor supply chain performance experienced 33-40%, lower stock of returns and approximately 70% to 80% of these companies' supply chains fail within 1-3 years (WB, 2013). It's also evident that share price volatility in the year after the supply chain performance drop goes to 13.5% higher compared with volatility in the year before the disruption (Hendricks &Singhal, 2005). Several studies reveal that supply chains collapses at an alarming rate due to continuous risk disruptions in developing nations in the world (Singhal & Hendricks, 2005).

A study by Wagner and Bode (2006) found that supply chain disruptions cause a sales reduction of 7%, a down of an operating income of 42% and a decrease of return on assets of 35 % and an announcement of supply chain disruptions causes a shareholder return between 7 and 8 % (Hendricks & Singhal, 2005). According to a study by Sean and Kilcarr (2013) on Third-Party Logistics, economic losses due to poor supply chain performance among manufacturing companies increased by 465% over the last three years climbing from $62 billion in 2009 to well over $350 billion in 2011. Poor supply chain performance reduces company's revenue, cut into market share, inflate company's cost, increase budget and threaten production up to 60%, damage a company's credibility with investors and other stakeholders, thereby driving up its cost of capital; such firms experienced 7% lower sales, 11% higher costs and 14% increase in inventories (Ruud & Bosman, 2006).

Whilst risk has always been present in the process of reconciling supply with demand, there are a number of factors which have emerged in the last decade or so which might be considered to have increased the level of risk. These includes a focus on efficiency rather than effectiveness, the globalisation of supply chains, focussed factories and centralised distribution, the trend to outsourcing, reduction of the supplier base, volatility of demand and lack of

visibility and control procedures. Therefore, further study was necessary to examine the effects of supply chain vulnerabilities on the supply chain performance in Logistics firms in Kenya.

Study Objectives

The general objective of study was to examine the effects of supply chain vulnerabilities on the supply chain performance in Logistics firms in Kenya. The specific objectives were:-

- To evaluate the effect of bullwhip effects on supply chain performance in logistics firms in Kenya
- To determine the effect of order fulfilment on supply chain performance in logistics firms in Kenya
- To find out the effect of supply base optimization on supply chain performance in logistics firms in Kenya
- To assess the effect of ICT integration on supply chain performance in distribution firms in Kenya

LITERATURE REVIEW

Theoretical review

Theory of Industrial Dynamics

Theory of industrial dynamics explains the dynamic behaviour of a system connected by flows of information, materials, and finances through an understanding of how feedback structures and cause-effect delays create change over time (Omar*et al.* 2010). Systems in the organization are not static and they are affected by other factors and therefore result to changes. Organization is dynamic in nature and was affected by internal and external factors which will result to adjustments on how it is run.

Supply chain network is a structural system with interdependencies and the decision made by one firm will automatically impact another firm's performance (lee *et al.* 2010). the theory recognizes that the bullwhip effects are therefore experienced when organizations interdependency tendency is negatively affected by distorted information flow along the chain. The supply chain management should set out measures that identify, describe, analyse, optimize, and mitigate the impact of interconnected business systems (Lee, 2002). These business systems are often modelled as a simplified vertical or serial supply chain with one member per echelon. Demand variability resulting from supply chain vulnerabilities such as breakdown in flow of information will result to adjustment on the operations within the supply chain network.

Contingency Based Theory

The development of contingency approach was stimulated by managers, consultants and researchers argued that every challenge is unique and the solution is not universal to all similar challenges. Methods that were highly effective in one situation would not work in other situations. Williams *et al.*, (2002) argues that technique that works in one case may not necessarily work in all cases because of differences in their respective situations. Faisal (2009) indicates contingency approach need to be applied in dealing with any supply chain disruption that can negatively impact on the supply chain performance.

Institutional Theory

Institutional theory views organization as an institution that is dependent on external pressures. The organization operations are influenced by external pressures such as political pressures, economic pressures and environmental pressures (Walker, 2009). An organization doesn't have total freedom to act in a certain way but it has to highly rely on what is acceptable and permissible by the

environment in which it's operating from (Makau, 2014). Supply chain is greatly affected by many factors outside the individual members of the chain.

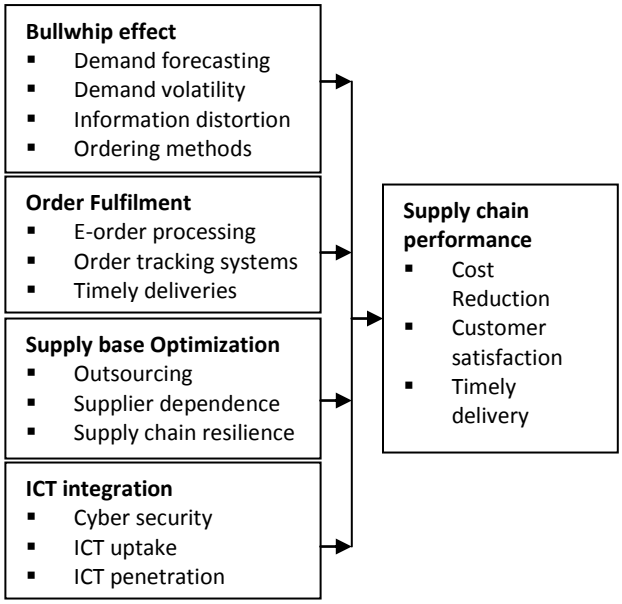
Institutions are composed of cultural-cognitive and regulative elements that together determine how an organization behave and operate (Scott, 2004). The institutions has actually three key pillars that include, regulatory, normative and cultural cognitive. The regulatory (policy) pillar emphasizes the use of rules, laws and sanctions as enforcement mechanism with emphasis on compliance. The organization must operate under the laid down rules and policy. The normative pillar refers to norms-how things should be done and the values preferred desired. The cultural pillar rests on shared understanding (common beliefs, symbols, shared understanding) especially between the organization and other players in the supply chain. According to Makau, (2014) the understand ability and awareness of the environment in which the organization is operating from is very important in order to reduce the supply chain disruptions.

Resource-Based View

Resource-based view suggests that firms compete using unique corporate resources that are valuable, rare, difficult to imitate and non-substitutable by other resources. A firm can consist of productive resources that can be used for competitive. The rarer the resources are the greater the advantage for the firm. However, while resources are important, it is more critical how the firm uses them to maximize its competitive potential (Walker, 2009).

Fawcett et al. (2011) study on application of IT in supply chain, three Resource-based view perspectives has been spelt out to impact on supply chain performance. The resource-heterogeneity perspective looks at resources and capabilities and their relationships to sustainable competitive advantage, which is connected to sustained performance. The organizing perspective suggests that in order to achieve competitive advantage, valuable resources should be properly organized and leveraged (Fawcett et al. 2011). Finally, the dynamic-capabilities perspective suggests a need to alter resources into a capability in order to achieve superior performance in a changing environment (Oyoteyo, 2011).

Conceptual framework



Independent Variables Dependent Variable

Figure: 1: Conceptual framework

Source: Author (2018)

Empirical Literature

Supply chain is a network that extends beyond the manufacturer and suppliers, but also includes the transporters, warehouses, retailers and customers themselves. According to Javaid et al (2012) the information flow in this system is very important and failure to accurately transmit information is likely to impact negatively to the entire cycle. Distortion of

information within the cycle leads to dissatisfaction of the stakeholders and eventually to customer dissatisfaction which is contrary to the organizational goals.

According to Tang (2006), as supply chains become more global, supply uncertainty becomes a more striking issue that requires high level of attention due to its possibility of hindering organization operation. Ravichandran (2006) argues that the uncertainties have become more inherent to every supply chain through factors such as variability in demand, lead times, breakdowns of machines and local politics, technological advancement and high level of information transfer in the industry. These kinds of uncertainties have resulted to companies having huge buffer stocks thereby increasing the operational costs within the organization. According to Patel and Jena (2009) the small variations in demand from customers result in increasingly large variations in demand as one move up the supply chain. This phenomenon is known as the bullwhip effect.

Cannella & Ciancimino (2010) notes that as the firms strive to successfully streamline their operations, there is a great need to concentrate on enhancing the coordination with suppliers and customers in order to receive or get their products to end users within the place, time and form of needed. Budiman (2004) notes that this depends on complex tasks that require several companies working together as a supply chain or network to eliminate all supply chain inefficiencies. In attempting to effectively coordinate the supply activities, firms are faced with intermittent supplies, changing consumer tastes and preferences, advancements in technology and a threatening competition.

The turbulent behaviour of supply chains is usually referred to industrial and business dynamics or the bullwhip effect i.e. the phenomenon, where a demand flowing upstream of a supply chain exhibits a greater variance, than that at its end (Micheliet al., 2009). The bullwhip effect has been observed in many industries, often resulting in excessive inventories, inadequate schedules, overproduction, poor customer service, tremendous inefficiencies, lost revenues and increased costs.

Further studies on supply chain vulnerability reduction regard the information sharing. In particular Sheffi (2005-a) and Suo and Jin (2004) states that one of the critical problems of the information sharing is the Bullwhip effect that is the amplification of the demand uncertainty moving back along the supply chain.

A typical global supply chain is a complex and spatially spread structure of collaborations, with many parallel cross-organizational business processes going on, including flows of materials, engineering, information, decisions, cash and finance, legal responsibilities, innovations etc. (Wagner et al. , 2009). All of them go on simultaneously with social processes, i.e. interactions of organizations, groups and individuals. Not surprisingly, the high level of complexity, enhanced by the global dimension of business, easily results in unpredictable and turbulent behaviours of supply chains, reflected by both, disturbances, disruptions, risks, perils, conflicts, tensions are just the few names, which are used to describe symptoms of volatility, vulnerability, unstableness, unpredictability and disharmony in supply chains (Thun and Hoenig, 2009).

Narasimhan and Talluri (2009) define business risk as a level of exposure to uncertainties that the enterprise must understand and effectively manage as it executes its strategies to achieve business objectives and create value. Szuster (2010) also express risk as, Risk= Probability (of the event) × Business Impact (severity).Due to the network

complexity caused by the global supply process, an enormous range of inherent risks, ranging from minor irritation of delays through to the destruction of an entire chain, are expected. If poorly handled, disruptions in supply chain (SC) could result in exorbitant delays causing poor service levels and high, Since every organization strives for success and uninterrupted operations, efficient supply chain risk management is crucial(Tang &Musa, 2011).

According to Sheffi (2009), the two basic elements of resilience are redundancy and flexibility. He says that some companies take a chance and hope that nothing bad will happen, whereas some others invest in building redundancy into the system and prepare a business continuity plan. Companies which are more flexible and resilient are able to tackle threats to supply chain disruption. This means that companies are prone to be more reactive even though they have built in a certain amount of flexibility to handle the disruption. This seems to suggest that there may be scenarios when the disruption is unavoidable and the flexibility helps to react and bring the situation to a normalcy.

Hendricks and Singhal (2008) established that not only can the failure to manage supply chain risks effectively lead to a sharp downturn in an organisation's share price, which can be slow to recover, but it can also generate conflict amongst the organisation's stakeholders. They found that, on average, major supply chain disruptions can reduce the stock market value of a company by 10%. Indeed, moving beyond supply chain risks and analysing the risks faced by organisations in general, Hood and Young (2009) maintained that many organisations may have gone out of business because of their failure to adopt effective risk management strategies.

Wagner (2009), argues that organization should always develop resiliency in the supply chain so as to be able to compete effectively in the market. Christopher and Rutherford (2006), study on Creating a Resilient Supply Chains, propose an accurate definition and description of the supply chain agility, velocity, visibility and redundancy. The authors define the agility as the company capability to quickly respond to unforeseen and unpredictable demand/supply markets changes. Note that the agility of a company also depends on the agility of all the actors involved in the supply chain. The velocity must be interpreted as time required for moving goods along the supply chain. The velocity is usually measured in terms of lead times. The visibility is the capability of the company to see all the information regarding the flow of products, information and finances both downstream and upstream along the supply chain. The redundancy is the augmentation of capacity and inventory in each node of the supply chain for facing supply chain disruption events.

Nagurney (2011) argues that the best criteria of selecting appropriate supplier base are to evaluate the risk assessment all potential suppliers. Suppliers are required to undertake their own supply chain risk profile which helps to identifies the organization weaknesses and supply chain resilience capabilities. Supplier's capability to monitor and mitigate risks is very critical in ensuring that the entire supply chain network is safeguarded from adverse effects emanating from a single supply chain partner. Nambirajan (2013) urges that it is appropriate for the company to adopt a pro-active strategy of supplier development to work closely with key suppliers to help them improve their supply chain risk management (SCRM) practices.

According to Mayo and Mark (2009) a supply chain is a combination of various players who eventually forms a network and therefore the operation within the supply chain should take a network-wide

structure. A high level of collaboration amongst the supply chain partners can significantly help mitigate risk and ensure resilience. The challenge is to create the conditions in which collaborative working becomes possible. Traditionally supply chains have been characterized by arms-length, even adversarial, relationships between the different players. There has not been a history of sharing information either with suppliers or customers. Opata (2015) indicates that organizations are becoming more willing to work in partnership with the aim of spreading and sharing risks.

Omar (2012) indicates that the underlying principle of collaborative working in the supply chain is to exchange of information with the aim of reducing supply chain uncertainty. Thus a key priority for supply chain risk reduction has to be the creation of a supply chain community to enable the exchange of information between members of that community. The creation of high level of 'supply chain intelligence' will ensure that there is greater visibility of upstream and downstream risk profiles which will ensure organization is more flexible in handling cases of disruption in the supply chain (Neureuther, 2012).

According to Murphy (2014) organizations have invested on Research and development initiatives aimed at developing ICT tools that supports companies in managing complex process in the supply chain. These tools are targeted on ensuring visibility of risks along the supply chain by enabling information collection through sensor technologies, sharing of data, and application of advanced business intelligence. The management of information sharing in supply chain is very critical in reducing and managing risks and disruptions in the supply chain and therefore negative impacts was reduced. Mizgier (2013) reveals that the application of information technology in supply chain is fundamental in reducing the administrative costs that cross-border supply chains as well as reducing supply chain vulnerability

METHODOLOGY

The study adopted descriptive survey design. The design enabled the researcher to come up with descriptive statistics that assisted in explaining the relationship that exists among variables. Descriptive design method also provides both quantitative and qualitative data from cross section of the chosen population (Cooper and Schindler, 2003). The study targeted the key players within the company in the determination of what the effects of supply chain vulnerabilities on supply chain performance of logistics firms in Kenya. The unit of analysis was for all the employees of Maersk Kenya Limited operating at the Nairobi offices. Therefore the target population was the one hundred and eighty six (186) employees working at Maersk Kenya Limited operating at the Nairobi offices. The primary data collection instrument used was the structured questionnaire. The questionnaire was designed using the variables identified as important for meeting the study objectives. Questionnaire was self-administered to the respondents and two research assistants was recruited and trained so that they can be able to get quality results. Secondary data was collected from published sources such as library, internet and research done by other scholars. The target participants were employees working at Maersk Kenya Limited operating at the Nairobi offices. Primary data obtained from the field was coded and fed into the Statistical package for social science computer software to enable the responses to be grouped into various categories. The data was analyzed through descriptive statistics and inferential statistics. The regression model used was;

$$Y= \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \sum$$

Whereby: β0 is the regression intercept;
B1-β4 are the regression coefficients;
Y is the dependent variable (supply chain performance);
X1 bullwhip effects;
X2 Order fulfilment;
X3 supply base optimization
X4 ICT integration

RESULTS

Bullwhip Effects on Supply Chain Performance

The respondents were asked to indicate the extent to which they agreed with how the Bull whip effects influence Supply chain performances in Kenya. According to the findings, the respondents agreed with a mean of 2.31 and a standard deviation of 0.21 that Poor demand forecasting results to supply chain disruption. Again the respondents agreed with a mean of 2.42 and a standard deviation of 0.22 that Uncertainties in the supply chain is a cause of disruption in supply chain.

Respondents agreed with a mean of 3.11 and a standard deviation of 0.23 that Information distortion in the supply chain results to supply chain disruption. Respondents agreed with a mean of 3.01 and a standard deviation of 0.24 that Customers demand volatility results to disruption in supply chain while Customers are encouraged to order on the before their product are out of stock by mean of 2.98 and std. deviation of 0.20. As shown in table 1 below

Table 1: Bullwhip Effects

Bullwhip Effects	N	Mean	Std. deviation
Poor demand forecasting results to supply chain disruption	115	2.31	0.21
Uncertainties in the supply chain is a cause of disruption in supply chain	115	2.42	0.22
Information distortion in the supply chain results to supply chain disruption	115	3.11	0.23
Customers demand volatility results to disruption in supply chain	115	3.01	0.24
Customers are encouraged to order on the before their product are out of stock	115	2.98	0.20

Order Fulfillment strategies

This study was interested in determining the extent to which the following risks have affected the supply chain performance in the organization. To answer this objective, the respondents were asked to indicate whether they agreed or disagreed with various statements on order fulfilment strategies. Table 2 showed the distribution of their responses.

Table 2: Order fulfilment strategies

Order fulfilment strategies	Very large extent		Small extent		Not at all	
	F	(%)	F	%	F	(%)
a) Before placing an order we must confirm with the user department on the need	30	30	60	60	10	10

b)	Orders must be approved by the head of the department	20	20	70	70	10	10
c)	We have system for receiving customers' orders.	50	50	30	30	20	20
D	The information on the order process can be accessed any time by all department.	60	60	30	30	10	10

According to the findings, the respondents agreed with small extent that 60 % that before placing an order the firm must confirm with the user department on the need. Again the respondents agreed with small extent that 70% that orders must be approved by the head of the department and 60% of the respondents agree with very large extent that the firm have system for receiving customers' orders, Again the respondents agreed with small extent that 70% that the information on the order process can be accessed any time by all department.

Optimization on Supply

This study was interested in determining the influence of Supply base Optimization on Supply chain performances in Kenya. To answer this objective, the respondents were asked to indicate whether they agreed or disagreed with various statements on Supply base Optimization on performance. Table 3 showed the distribution of their responses.

Table 3: Supply base Optimization

Supply base Optimization		**Agree**		**Disagree**		**Not sure**	
		F	**(%)**	**F**	**%**	**F**	**(%)**
a)	Reduction of supplier base increases supply chain vulnerability	61	61	28	28	11	11
b)	Single sourcing increases supply chain vulnerability	55	55	26	26	19	19
c)	Outsourcing helps the organization transfer risks to a third party therefore reducing organization vulnerability	42	42	48	48	10	10
d)	The organization is flexible /agile enough to be able to deal with any eventuality in the supply chain	62	62	33	33	5	5
e)	Close relationship and coordination with the suppliers has helped to enhance organization resilience	61	61	32	32	7	7
f)	Supplier concentration/dependence enhances the supply chain vulnerability to risks	46	46	43	43	11	11
g)	Large supply base reduces supply chain vulnerability	68	68	30	30	2	2

According to the findings, the respondents agreed with 61 %, that reduction of supplier base increases supply chain vulnerability. Again the respondents disagreed with the statement with 28% and 11% of the respondents were not sure about the statement. Respondents agreed with 55 % that Single sourcing increases supply chain vulnerability, 26% of the respondents disagreed with the statement.

Respondents agreed with 42 % that outsourcing helps the organization transfer risks to a third party therefore reducing organization vulnerability, 48% of the respondents disagreed with the statement. Respondents agreed with 62 % that the organization is flexible /agile enough to be able to deal with any eventuality in the supply chain, 33% of the respondents disagreed with the statement. Respondents agreed with 61 % that close relationship and coordination with the suppliers has helped to enhance organization resilience, 32% of the respondents disagreed with the statement. Respondents agreed with 46% that they electronically evaluate new supplier capabilities, 43% of the respondents disagreed with the statement. Respondents agreed with 68% that Supplier concentration/dependence enhances the supply chain vulnerability to risks, 30% of the respondents disagreed with the statement. Respondents agreed with 60% that they electronically purchase for their product and services, 36% of the respondents disagreed with the statement. Respondents agreed with 74% that Large supply base reduces supply chain vulnerability, 25% of the respondents disagreed with the statement while respondents agreed with 51% that they electronically process suppliers invoice, 41% of the respondents disagreed with the statement.

ICT integration

The respondents were asked to indicate the extent to which they agreed with statements on how ICT integration affects supply chain performance. According to the findings, the respondents agreed with a mean of 3.41 and a standard deviation of 0.31 that ICT integration has helped in information sharing therefore reducing supply chain exposure to risks. Again the respondents agreed with a mean of 3.42 and a standard deviation of 0.32 that ICT helps to evade major risk in the supply chain. Respondents agreed with a mean of 4.03 and a standard deviation of 0.33 that Just in Time Approach helps to manage Customer demand volatility. Respondents agreed with a mean of 4.01 and a standard deviation of 0.34 that Just in Time Approach helps to manage Customer demand volatility.

Respondents agreed with a mean of 4.98 and a standard deviation of 0.30 that ICT integration in supply chain has helped to reduce the bullwhip effects. Respondents agreed with a mean of 3.52 and a standard deviation of 0.35 that ICT security risks are prone and can result to supply chain disruption. As shown by the table 4 below.

Table 4: ICT integration

ICT integration	N	Mean	Std. deviation
ICT integration has helped in information sharing therefore reducing supply chain exposure to risks	115	3.41	0.31
ICT helps to evade major risk in the supply chain	115	3.42	0.32
Just in Time Approach helps to manage Customer demand volatility	115	4.03	0.33
ICT integration in supply chain has helped to reduce the bullwhip effects	115	4.01	0.34
ICT security risks are prone and can result to supply chain disruption	115	4.98	0.30

Inferential Test

The regression model was;

$$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \sum$$

Whereby: β_0 is the regression intercept; β_1-β_4 is the regression coefficients; Y is the dependent variable (Supply chain performance); X_1 is the Bull whip effects; X_2 is Order fulfilment ; X_3 is Supply base Optimization and X_4 is and ICT integration adoption . The researcher applied the statistical package for social sciences (SPSS) to code, enter and compute the measurements of the multiple regressions for the study.

Coefficient of determination explained the extent to which changes in the dependent variable can be explained by the change in the independent variables or the percentage of variation in the dependent variable. The four independent variables that were studied, explained 81.14% of the Supply chain performance as represented by adjusted R square. This therefore means that other variables not studied in this research contribute 18.6% of the Supply chain performance. Therefore, further research should be conducted to investigate the other variables and factors (18.6%) influence of Supply chain performance.

Table 5: Model Summary

Model	R	R Square	Adjusted R Square	Std Error of the Estimate
1	.949[a]	.823	.8114	.6885

a. Predictors: (constant), Bull whip effects, Order fulfilment, Supply base Optimization and ICT integration.

As per the SPSS generated coefficient, the equation (Y = β0 + β1X1 + β2X2 + β3X3 + β4X4 + ε) becomes:

Y= 0.162X1+ 0.423X2+ 0.208 X3+ 0.173 X4 +5.053

Where Y is the dependent variable i.e. supply chain performance, X1 is Bull whip effects, X2 is Order fulfilment, X3 was Supply base Optimization and X4 is ICT integration.

Table 6: Regression Coefficient

Model	Unstandardized Coefficients		Standardized T Coefficients		Sig.
	B	Std. Error	Beta		
(Constant)	6.072	3.061	1.652		.106
Bullwhip effects	0.362	0.073	0.204	2.221	0.001
Order fulfilment	0.423	0.079	0.623	5.344	0.000
Supply base Optimization	0.271	0.058	0.375	3.063	0.003
ICT integration adoption	0.123	0.039	0.472	5.328	0.002

a. **Dependent Variable: Supply chain performance**

The possible value of Y when all independent variables are equal to zero was 6.072. The data findings analyzed also showed that taking all other independent variables at zero, a unit increase in Bull whip effects would lead to a 0.362 increase in Supply chain performance; this means that there was a significant relationship between Bullwhip effects and Supply chain performance. The *P*-value was 0.001 and thus the relationship was significant. A unit increase in Order fulfilment would lead to a 0.423 increase in Supply chain performance; this means there is a significant relationship between Order fulfilment and Supply chain performance. The *P*-value was 0.000 and thus the relationship was significant.

A unit increase in Supply base Optimization would lead to a 0.271 increase in Supply chain performance; this means that there is a significant relationship between Supply base Optimization and Supply chain performance. The *P*-value was 0.003 and thus the relationship was significant. Lastly, a unit of ICT integration adoption to change will lead to a 0.123 increase in Supply chain performance; this means there is a significant relationship between ICT integration adoption and Supply chain performance. The *P*-value was 0.002 and thus the relationship was significant. This infers that Supply base Optimization influences the Supply chain performance most followed by Bull whip effects, ICT integration adoption and finally Supply base Optimization.

CONCLUSION

The study concluded that Bullwhip significantly affected supply chain performance. Poor demand forecasting and uncertainties a cause of disruption in supply chain. Information distortion and customers demand volatility in the supply chain as well results to supply chain disruption.

From the findings the study concluded that there was a significant relationship between order fulfillment and supply chain performance since a unit increase in order fulfilment would lead to a 0.423 increase in supply chain performance. The firms had system for receiving customers' orders which must be approved by the head of the department. The information on the order process can be accessed any time by all departments however before placing an order the firm must confirm with the user department on the need.

There was a significant relationship between supply base optimization and supply chain performance. Large supply base reduces supply chain vulnerability. The firm electronically run most of its processes such as purchase for their product and services, processing suppliers invoice and providing all tender notice to the public. The firm organization was flexible enough to be able to deal with any eventuality in the supply chain while close relationship and coordination with the suppliers has helped to enhance organization resilience.

The study concluded that there was a significant relationship between ICT integration adoption and Supply chain performance. ICT integration has helped in information sharing therefore reducing supply chain exposure to risks and reducing the bullwhip effects. It has also enabled just in time approach which helps to manage customer demand volatility. The firm is prone to ICT security risks and can result to supply chain disruption.

RECOMMENDATIONS

Bullwhip was found to have a significant effect on supply chain performance. This is caused by demand forecasting. The study recommends that there should be effective communication between all tiers in the supply chain should to create awareness of the end

customer demand and not just of the orders placed by a single tier.

Order fulfillment affects supply chain performance, the study hence recommends that managers must carefully measure and manage two conflicting objectives that is service and inventory. This would be aimed at improving customer delivery service and reducing inventories simultaneously.

The firm should adopt a portfolio analysis technique which analyses the supply base according to supplier risk factors. The risk relates to exposure to supply failure and supply market complexity should be used to as a proactive supply chain risk management process.

The study found a significant relationship between ICT integration adoption and Supply chain performance. The study therefore recommended that more technology systems, such as point-of-sales product scanning and vendor-managed inventory should be adopted to improve the performance of the firm. Such systems would reduce risk exposures and the bullwhip effect as well. The study also recommended that management must be commitment to implement supply chain vulnerabilities management strategy and encourage staff to accept the new system.

Areas for Further Research

This study focused on the effects of supply chain vulnerabilities on the supply chain performance in Logistics firms in Kenya. Future research may consider carrying out an extension of the study and focus on the effects of supply chain outsourcing on the performance of Logistics firms in Kenya.

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