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INFLUENCE OF SUPPLY CHAIN RE-ENGINEERING ON SUPPLY CHAIN RESILIENCE IN MANUFACTURING FIRMS IN KENYA

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Abstract: **Supply chain resilience is a relatively unexplored area in supply chain research in Kenya and it focuses on the firms' ability to absorb disruptions. Supply chain resilience can enable manufacturing firms to overcome disruptions and continually transform them to meet the changing needs and expectations of its customers, shareholders and other stakeholders. Thus, the objective of this study was to investigate the influence of supply chain re-engineering on supply chain resilience in manufacturing firms in Kenya. The study adopted cross-sectional survey design using both quantitative and qualitative approaches. The target population was 613 manufacturing firms in Nairobi and its surroundings, who were members of Kenya Association of Manufacturers (KAM) in 2015. The study used stratified random sampling to pick a sample size of 62 manufacturing firms which represented 14 industrial sectors in manufacturing firms. Data was collected using questionnaire. Descriptive statistics was used aided by Statistical Packages for Social Sciences version 24 to compute percentages of respondents' answers. Also, analysis was conducted using quantitative approach. The study found out that supply chain re-engineering was significant predictor of supply chain resilience. The study recommends that management of manufacturing firms to adopt and embrace supply chain re-engineering as a proactive way of creating resilience in manufacturing firms.**

Keywords: **Supply chain re-engineering, supply chain resilience, manufacturing firms.**

1. INTRODUCTION

Supply chain disruptions can be very severe to the productivity of manufacturing firms. This complicates working business environment and hence calling for lean and flexible global operations in any manufacturing firms. Skipper and Hanna (2009); Scholten and Fynes (2014) asserted that the growing complexity of managing global supply chains and meeting exacerbating customer requirements has made organizations more aware of their operational and economic vulnerability to threats from the macro environment. Supply chain resilience can help to reduce and overcome exposure to risks through developing strategies that enable the supply chain to recover to its original functional state following a disruption (Juttner & Maklan, 2011). Therefore, manufacturing firms can use supply chain resilience to prevent and overcome disruptions in case it occurs.

Resilience is defined as a process of mitigating disruptions that might occur and cause losses in the organizations. Fiksel (2006); Scholten and Fynes (2014) define resilience as capacity of a system to survive, adapt and grow in the face of turbulent change. Business systems face technological change, financial risk, political turbulence and mounting regulatory

pressures; industrial growth does not proceed smoothly. The traditional tool to manage uncertainty is risk management, which is especially challenging when threats are unpredictable. Deliberate threats such as theft or terrorism can even adapt to new security measures. At the same time, corporations are accepting broader responsibility for the social and environmental impacts of their supply chains. The entire enterprise has a role to play in creating and maintaining supply chain resilience (Pettit, Fiksel, & Croxton, 2010). A resilient supply chain has the capacity to overcome disruptions and continually transform itself to meet the changing needs and expectations of its customers, shareholders and other stakeholders. Supply chain resilience encompasses the ability to prepare for unforeseen disruptions and to respond and recover from them faster than competitors do (Jüttner & Maklan, 2011; Chopra & Sodhi, 2014). All firms rely on their suppliers to maintain smooth operations and their customers for continued revenue. Therefore, a resilient firm is truly only as resilient as its supply chain (Welch & Welch 2007).

Kenya's economic growth remains vulnerable to external shocks, especially developments in the global economy, regional stability and security, and weather-related supply shocks. On the domestic front, political stability and national cohesion are essential for improved business confidence and policy predictability. Kenyan authorities should develop mechanisms to respond flexibly to macroeconomic risks and shocks (Republic of Kenya, 2013). For example, in the Kenyan context oil and gas supply chains, many of the security threats identified are attacks perpetrated while oil and gas are transported by sea (for example sea piracy, hijacking), in pipelines (for example theft, sabotage and vandalism) or while it is being extracted from platforms or stored in facilities. For instance, the entire offshore areas of Yemen and Somalia extending to Oman and Kenya have been frequently associated with endemic piracy. Attacks on ships increased by 10 per cent in 2010, mostly by Somali based pirates (Luciani, 2011). This has increased vulnerability of Kenya's supply chain in various sectors.

Statement of the Problem:

The Government of Kenya considers manufacturing firms in particular a key pillar of its growth strategy. According to the Kenya Vision 2030 (Government of Kenya, 2007) the manufacturing sector is one of the pillars alongside tourism, agriculture, wholesaling and retail trade, business process outsourcing and financial services. The sector is expected to play a key role in the growth of the Kenyan economy by contributing 20 percent of Gross Domestic Product (GDP). Despite the accrued benefits from the manufacturing firms in Kenya, they are yet to account 20 percent of the GDP as stipulated in the Kenya Vision 2030 (Bolo & Wainaina, 2011; KAM, 2012; KNBS, 2013; Waiganjo, 2013). The manufacturing sector's contribution to GDP has remained at an average of 10 percent for more than ten years (KNBS, 2015). For example, KAM, (2012); KNBS, (2013) found out that the Kenya manufacturing sector contribution to GDP worsened from 9.6 per cent in 2011 to 9.2 per cent in 2012, while the growth rate deteriorated from 3.4 per cent in 2011 to 3.1 per cent in 2012. For instance, Transparency International (2013) asserts that developing countries are more vulnerable to particular supply chain threats such as political turmoil, including rebel activities and post-election violence, and to bribery, corruption and other unethical business practices.

Moreover, disruptions are not only affecting manufacturing firms in Kenya but also all businesses globally. For instance, the global business environment has changed and is currently subjected to a multitude of events from a variety of sources, such as natural disasters, social conflicts, economic crises and manufacturing failures (Giunipero *et al*., 2015). In the year 2013 alone, 75 per cent of companies experienced at least one disruption, of which 21 per cent suffered more than €1 million in costs for a single incident ranging from equipment malfunctions, unforeseen discontinuities in supply, and information technology breakdowns to natural hazards and disasters (Business Continuity Institute, 2013). To address these gaps, this study sought to investigate the influence of supply chain re-engineering on supply chain resilience in manufacturing firms in, Kenya.

Objective of the study:

The objective of this study was to determine the influence of supply chain re-engineering on supply chain resilience in manufacturing firms in Kenya.

Hypothesis:

H_0 Supply chain re-engineering has a positive significant influence on supply chain resilience in manufacturing firms in Kenya.

2. LITERATURE REVIEW

The study was supported by the following theory and reviewed literature:

Complex Adaptive System:

Complexity adaptive system consists of an interconnected network of multiple agents that respond adaptively to changes in both the environment and the system of agents within it. For instance, manufacturing firms in Kenya operates in a volatile environment which changes frequently due to disruptions and yet they need to adopt and survive within the same environment. Thus, the environment in which manufacturing firms in Kenya operates contain both chaos and order, complex non-linear systems strive to be neither overly stable nor unstable (Wycisk, McKelvey, & Hülsmann, 2008). Holland (1995); Choi, Dooley, and Rungtusanatham (2001) defined a CAS as a kind of system that, over a period of time, emerges into a coherent form through the aforementioned properties of adaptation and self-organization. In a CAS, adaptation implies that the system's agents or elements are responsive, flexible, reactive and often proactive in dealing with the inputs of other agents or elements that affect it. Hence, manufacturing firms need to be proactive, flexible, re-design their structures and make strategic decisions. The agents that constitute a CAS are guided by order-generating rules, also known as schemas (e.g. McCarthy 2003; Pathak *et al*. 2007; Hasgall, 2013), which determine how the CAS responds during the adaptation process. The CAS environment is rugged and dynamic; and CAS agents must adapt to maintain fit with the environment in a timely manner. During the adaptation process, new changes in the CAS and its environment may arise through a process of coevolution, which makes it necessary to learn, thereby making appropriate modifications to schemas to increase fitness. But, equally, a CAS acts on and modifies its environment, and entities within the environment learn from the system's responses.

Supply chain resilience is manifested through the process of self-organization – another property of a CAS – rather than as a result of being deliberately managed or controlled by a single firm. No single firm, however large it may be, can claim to manage and control the resilience of the entire supply chain. This is partly because a supply chain is complex to the extent that most of what happens therein is beyond the visibility and reach of a focal firm (Choi & Krause, 2006). Similarly, a survey by the Business Continuity Institute (2013) found that 75% of respondents lacked visibility of their supply chains. Managers in the Kenyan manufacturing firms should be aware that supply chain resilience is manifested through the process of self-organization rather than as result of being deliberately managed or controlled by a single firm. No single firm can claim to manage and control the resilience of the entire supply chain. This is partly because a supply chain is complex to the extent that most of what happens therein is beyond the visibility and reach of a focal firm. Therefore managers should learn to be flexible in order to collaborate with other manufacturing firms and other stakeholders like suppliers, customers and government in order to be able to create resilience in manufacturing firms in Kenya.

Supply Chain Re-engineering:

Supply chain re-engineering is the conceptualization, design, implementation and operational of supply chains (Naim *et al* 2000). When a disruption happens, it is already too late to try to develop preventative solutions (Tomasini & Van Wassenhove, 2009). Resilience must be built into a supply chain in advance of a disturbance and incorporate readiness to enable an efficient and effective response (Ponomarov & Holcomb, 2009). Robust supply chain strategies enhance a firm's capability to sustain its operations when a major disruption hits (Tang, 2006) by preventing risks from having negative effects and enabling resistance to change without adapting the chain's initial stable configuration (Wieland & Wallenburg, 2012). This requires all chain members to have an understanding of the network (Christopher & Peck, 2004; Ponomarov & Holcomb, 2009) to be aligned in the event of a disruption occurring (Juttner & Maklan, 2011).

Mapping the supply network involves understanding who owns what, as well as key measures that are currently in place. Such maps can then direct management attention and enable the prioritisation of planning (Sheffi & Rice, 2005) as processes and structures to absorb risks are already in place when the risk event occurs (Wieland & Wallenburg, 2012). This is especially relevant to balancing efficiency of operations (Pettit *et al*., 2010, 2013) with the need for redundant capacity (Sheffi & Rice, 2005; Sheffi, 2005) to provide a buffer that can buy time for a firm to recover from a disruption (Zsidisin & Wagner, 2010), for example safety stocks or multiple suppliers. Obtaining a holistic understanding of cost/benefit trade-offs when managing risks and understanding where inventory should be strategically placed, in what form it should be held, and how much is necessary, enables an effective handling of disruptions and increases resilience (Blackhurst *et al*., 2011). This can only be achieved through collaboration between the different members of the supply chain.

Supply chain Resilience:

Resilience is defined as the capacity of a system to survive, adapt and grow in the face of turbulent change (Fiksel 2006; Scholten *et al*., 2014). Business systems face technological change, financial risk, political turbulence and mounting regulatory pressures; industrial growth does not proceed smoothly. The traditional tool to manage uncertainty is risk management, which is especially challenging when threats are unpredictable. Deliberate threats such as theft or terrorism can even adapt to new security measures. At the same time, corporations are accepting broader responsibility for the social and environmental impacts of their supply chains. The entire enterprise has a role to play in creating and maintaining supply chain resilience (Pettit *et al*., 2010).

Supply chain resilience is based on the underlying assumption that not all risks can be prevented. Resilience is a proactive and holistic approach to managing supply chain risks enhancing traditional risk management strategies (i.e. risk assessment, vulnerability analysis, continuity planning): as it does not require risk identification and quantification, supply chain resilience can deal with unforeseeable disruptions and events (Pettit *et al*., 2010). The concept refers to an organization's capacity to survive, adapt and grow when confronted with change and uncertainty (Knemeyer *et al*., 2009) and has been defined in supply chain terms as "the adaptive capability of the supply chain to prepare for unexpected events, respond to disruption and recover from them by maintaining continuity of operations at the desired level of connectedness and control over structures and function" (Ponomarov & Holcomb, 2009).

Despite the increase in SCRES publications, few focus on assessing and measuring SCRES. Referring to the different SCRES phases, Sheffi and Rice (2005) outline a plot demonstrating that economic turbulences will have a fluctuating effect on performance measures such as sales, production levels, profits or customer service. Pettit *et al*. (2010) present an agent-based framework aiming to strengthen supply chain flexibility and SCRES by studying multi-product, multi-country supply chains subject to demand variability, production and distribution capacity constraints. The SCRES level is assessed by four measures: customer service level, production change over time, average inventory at each distribution center and total average network inventory across all distribution centers.

Wu *et al.* (2013) examine retail stock-outs quantitatively through an agent-based simulation model to enhance understanding of the effect of different stock-out lengths for different products. To evaluate the stock-out's impact, they used the market-share level as a measure of SCRES (the ability to respond to and recover from a stock-out disruption). By using a timeline to show the impact of a stock-out before, during and after it occurs, the authors demonstrate the SCRES magnitude of both the retailer and manufacturer.

Giunipero *et al*. (2015) used sand cone model to illustrate the different Supply Chain Resilience (SCRES) phases and their relative importance to performance. They came up with four SCRES phases namely; readiness, responsiveness, recovery and growth phases. Thus, they examined SCRES as the ability to avoid/reduce the probability of disruptions and to respond and recover quickly, they identified that SCRES can be quantified through three essential performance metrics that enable reporting on how severe a disruption impact is and how a firm's SCRES performs: (1) customer service (2) market share (3) financial performance. As shown by Wu *et al.* (2013), a timeline can illustrate the impact before, during and after a disruption to measure SCRES and display how quickly a firm has recovered. Therefore, this study adopted customer service, market share and profitability performance to operationalize SCRES in manufacturing firms.

3. RESEARCH METHODOLOGY

The study adopted cross-sectional survey design using both quantitative and qualitative approaches. The target population was 613 manufacturing firms in Nairobi and its surroundings, who were members of Kenya Association of Manufacturers (KAM) in 2015. The study used stratified random sampling to pick a sample size of 62 manufacturing firms which represented 14 industrial sectors in manufacturing firms. Data was collected using questionnaire. Descriptive statistics was used aided by Statistical Packages for Social Sciences version 24 to compute percentages of respondents' answers. Also, analysis was conducted using quantitative approach.

4. RESEARCH FINDINGS AND DISCUSSION

Response Rate:

The targeted respondents in the study were supply chain managers of the manufacturing firms in Kenya and which were registered members of Kenya Association of Manufacturers (KAM) in the year 2015. A total of 59 self-administered

questionnaires were filled out of the expected 62 yielding a response rate of 95%. This response rate was good and representative and confirms to Mugenda (2008) stipulation that a response rate of 50% is adequate for analysis; a rate of 60% is good and a response rate of 70% and over is excellent. This good response rate was attributed to the data collection procedure, where the researcher personally administered questionnaires to the respondents who filled them. The researcher collected the filled questionnaires later. This response rate demonstrated willingness to respond to study.

Supplier Chain Re-Engineering:

The study sought to examine the influence of supply chain re-engineering on supply chain resilience in manufacturing firms in Kenya. This objective was measured using the following indicators: supply chain knowledge, supply chain design and supply strategy in opinion statements given. Respondents were asked to indicate the extent to which they agreed with the opinion statements given in regard to the implementation of supply chain re-engineering issues for supply chain resilience in their manufacturing firms. This was on a likert scale of not at all, small extent, moderate, large extent and very large extent. Therefore, in this study the scale of not all and small extent meant disagree while large and very large extent meant agreed.

a) Supply chain knowledge:

The study showed that 45% of the respondents agreed that manufacturing firms used mapping tools to identify bottlenecks and critical path in supply chain, 49% of the respondents indicated moderate and 7% of the respondents disagreed. Also, 61% of the respondents agreed that manufacturing firms used prior knowledge acquired identifying high supply chain risk (demand process control and environment), 36% of the respondents indicated moderate and 4% of the respondents disagreed.

Measurement of supply chain knowledge:

Supply chain knowledge	Not at all (%)	Small Extent (%)	Moderate (%)	Large Extent (%)	Very Large Extent (%)	Mean	Std. deviation
We use mapping tools knowledge to identify bottlenecks and critical path in supply chain (long lead time)	5	2	49	31	14	3.46	0.93
We use knowledge to identify high supply chain risk (demand process control and environment)	2	2	36	42	19	3.75	0.84

From the study findings it was observed that few manufacturing firms in Kenya used mapping tools to identify bottlenecks and critical path in supply chain (long lead time). Mapping tools should be used in identifying bottleneck and critical items in the manufacturing firms. This is because mapping can enable the prioritization of planning process and structures to absorb risks in manufacturing firms (Sheffi & Rice 2005). Also, from the study it was noted that manufacturing firms in Kenya used prior knowledge acquired in identifying high supply chain risk. This finding agreed with Tang (2006) acknowledge that robust supply chain strategies enhance a firm's capability to sustain its operations when a major disruption hits and this requires all chain members to have an understanding of the network. Therefore, manufacturing firms in Kenya should have mapping knowledge of the supply network in order to understand on who owns what, as well as key measures that are currently in place. Supply chain knowledge can create supply chain resilience in manufacturing firms in Kenya.

b) Supply base strategy:

Majority of the respondents (88%) agreed that manufacturing firms adopted pro-active strategy of supplier developments i.e worked closely with their suppliers, 8% of the respondents indicated moderate and a small number of respondents (3%) disagreed. In addition, 48% of the respondents agreed that manufacturing firms used risk awareness as key criteria for selecting suppliers, 37% of respondents indicated moderate and 16% of the respondents disagreed. However, 40% of the respondents agreed that manufacturing firms used single sourcing by product in order to keep alternative source of supply available, 20% of the respondents indicated moderate and 39% of the respondents disagreed. Also, the study revealed that 32% of respondents agreed that manufacturing firms used single sourcing for multiple sites or branch outlets to gain advantages of single sourcing, 24% of the respondents indicated moderate and 44% of the respondents disagreed.

Measurement of supply base strategy:

Supply base strategy	Not at all (%)	Small Extent (%)	Moderate (%)	Large Extent (%)	Very Large Extent (%)	Mean	Std. Deviation
We adopt pro-active strategy of supplier developments (working closely with suppliers)	3	0	8	54	34	4.15	0.85
We use risk awareness as a key criteria for selecting suppliers	2	14	37	29	19	3.49	1.01
We use single sourcing by product in order to keep alternative source of supply available	12	27	20	32	8	2.98	1.20
We use single sourcing for multiple sites / branch outlets to gain advantages of single sourcing	15	29	24	25	7	2.80	1.19

Generally, it was noted from the study that manufacturing firms in Kenya adopted pro-active strategy of supplier developments such as working closely with their suppliers. Likewise the study found out that manufacturing firms in Kenya used risk awareness as key criteria for selecting suppliers. This is a good practice as supplier development would enable manufacturing firms to develop a good relationship with key suppliers. This would only be possible if manufacturing firms are able to maintain manageable supply base. Manageable supply base would enable manufacturing firms to assess risks from suppliers and hence creating supply chain resilience in manufacturing firms in Kenya.

However, from the study it was observed that few manufacturing firms in Kenya used single sourcing by product and single sourcing for multiple site or branch outlets. These findings were in agreement with Christopher and Peck (2004) who depicted that firms are in a move towards adopting single sourcing where a supplier is responsible for the supply of specific items or services and may be advantageous from the cost and quality management but dangerous in terms of resilience. But recommended that where firms have multiple sites it may be responsible to have single source item or service and if firm makes a range of products it may be possible to single source product thus keeping an alternative source of supply available. Therefore, manufacturing firms in Kenya should keep alternative source of supply as a way of creating resilience in manufacturing firms and use single sourcing for multiple sites to gain advantages of single sourcing.

c) Supply chain design principle:

The researcher observed that 81% of the respondents agreed that manufacturing firms chose supply chain strategies that keep lowest cost, reduce impact in disruptions, 17% of the respondents indicated moderate and 2% disagreed. Also, the study revealed that 62% of the respondents agreed that manufacturing firms maintained stakeholders to understand supply chain structures, 24% of the respondents indicated moderate and 13% of the respondents disagreed. Further, the study showed that 32% of the respondents agreed that their manufacturing firms trade-off between efficiency and redundancy stock, 49% of the respondents indicated moderate and 19% of the respondents disagreed.

Measurement of supply chain design principle:

Supply chain design principle	Not at all (%)	Small Extent (%)	Moderate (%)	Large Extent (%)	Very Large Extent (%)	Mean	Std. Deviation
We choose supply chain strategies that keep lowest cost , reduce impact in disruptions	0	2	17	47	34	4.14	0.75
We maintain stakeholders to understand supply chain structures	5	8	24	42	20	3.64	1.06
We trade-off between efficiency and redundancy stock	0	19	49	25	7	3.20	0.83

From the study findings it was found that manufacturing firms in Kenya chose supply chain strategies that keep lowest cost and reduce impact in disruptions. This is very important to the manufacturing firms because strategies would assist them to create resilience in supply chain. This finding concurred with Christopher and Peck (2004) that firms should choose supply chain strategies that keep several options open and these options should provide an opportunity to reduce the impact of disruption if and when it occurs. Equally, the study found out that manufacturing firms in Kenya maintained stakeholders to understand supply chain structures.

However, it was found that few manufacturing firms in Kenya trade-off between efficiency and redundancy stock. Manufacturing firms in Kenya should constantly trade-off between advantages of keeping buffer stock as a way of cautioning disruptions and thus creating resilience. Blackhurst *et al*. (2011) asserts that firms should re-examine the efficiency versus reducing trade off. Firms should have strategic disposition of additional inventory that can be extremely beneficial in the creation of resilience. Hence, manufacturing firms in Kenya should redesign their network to increase visibility and as a way of creating supply chain resilience.

Test of hypothesis:

The researcher conducted regression analysis so as to establish the influence of supply re-engineering on supply chain resilience in manufacturing firms in Kenya. The hypothesis tested was:

H_0 Supply chain re-engineering has a positive significant influence on supply chain resilience in manufacturing firms in Kenya.

The linear regression model shows R^2= 0.255 which means that 25.5% change of supply chian resilience can be explained by a unit change of supply chain re-engineering. The result is shown in table below. Out of the results there is an indication that one unit change in supply chain re-engineering translates to 25.5% change in supply chain resilience in manufacturing firms in Kenya therefore, supply chain re-engineering has a positive influence on supply chain resilience in manufacturing firms.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.517[a]	.267	.255	.83134

a. Predictors: (Constant), SCR

Further test on ANOVA shows that the significance of the F-statistic (20.809) is less than 0.05 since p value, p=0.00, as indicated in table below. This implies that there is a positive significant relationship between supply chain re-engineering and supply chain resilience. Thus, supply chain re-engineering creates supply chain resilience in the manufacturing firms in Kenya and managers should understand and have knowledge of supply chain processes to conceptualize, design and implement in order to improve resilience of firms. The finding of this study was in harmony with the study of Scholten, Scott and Fynes (2014) who noted that re-engineering capabilities had a positive influence in mitigating risk and hence building supply chain resilience. Re-engineering of supply chain channels during emergency enables processes that help to get aid to people or products to consumers effectively and efficiently while avoiding duplication efforts.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14.381	1	14.381	20.809	.000[b]
	Residual	39.394	57	.691		
	Total	53.775	58			

a. Dependent Variable: BSCR

b. Predictors: (Constant), SCR

Further test on the regression coefficient for supply chain re-engineering was positive and significant (β = 0.517) with a t-value=2.521 (p-value<0.001). As shown in table below.

This implies that for every 1 unit increase in supply chain re-engineering, supply chain resilience in manufacturing firms in Kenya is predicted to increase by 0.338 units and therefore H_0 is accepted.

Coefficients of supply chain re-engineering

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.154	.458		2.521	.015
	SCR	.799	.175	.517	4.562	.000

a. Dependent Variable: BSCR

5. CONCLUSION AND RECOMMENDATIONS

Based on the study findings, it could be concluded that supply chain re-engineering had a positive significant linear relationship with the supply chain resilience of manufacturing firms in Kenya using Pearson correlation coefficient. The study found out that supply chain re-engineering if adopted could increase supply chain resilience in manufacturing firms in Kenya. Basing on the indicators used to measure supply chain re-engineering, from the findings it could be concluded that manufacturing firms in Kenya had acquired prior knowledge in identifying high supply chain risk, maintained stakeholders to understand supply chain structures, chose supply chain strategies that kept lowest cost and reduced impact in disruptions but lacked mapping tools to identify bottlenecks and critical path in supply chain which is key element in supply chain re-engineering. Besides that, manufacturing firms in Kenya lacked risk awareness as key criteria for selecting suppliers, trade-off between efficiency and redundancy stock and use of single sourcing by product in order to keep alternative source of supply available.

Based on the study findings, it was noted that supply chain re-engineering had a positive influence in creating supply chain resilience in manufacturing firms in Kenya. But manufacturing firms in Kenya lacked mapping tools to identify bottlenecks and critical path in supply chain and risk awareness as key criteria for selecting suppliers, trade-off between efficiency and redundancy stock. Therefore, the study recommends that it would be appropriate for management of manufacturing firms in Kenya to embrace supply chain re-engineering as a way of building supply chain resilience.

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