

**EFFECT OF SUPPLY CHAIN STRATEGIES ON THE  
PERFORMANCE OF MANUFACTURING FIRMS IN  
KENYA**

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**Effect of Supply Chain Strategies on the Performance of  
Manufacturing Firms in Kenya**

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**A Thesis Submitted in Partial Fulfillment of the Requirement for the  
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## DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

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This thesis has been submitted for examination with our approval as University Supervisors.

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## **DEDICATION**

This thesis is dedicated to my loving wife, Ruth Wawira, our sons Jayden, Ryan and Adrian for their unending support and encouragement.

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## LIST OF ACRONYMS

<b>AEU</b>	Asean Economic Community
<b>AM</b>	Agile Manufacturing
<b>API</b>	Active Pharmaceutical Ingredient
<b>ASC</b>	Agile Supply Chain
<b>BK BK</b>	Buy Kenya Build Kenya
<b>CBA</b>	Case Based Approach
<b>CFA</b>	Confirmatory Factor Analysis
<b>Co<sub>2</sub></b>	Carbon Dioxide
<b>CODP</b>	Customer Order Decoupling Point
<b>CPPR</b>	Customer- Product- Processes-Resource
<b>DEA</b>	Data Envelopment Analysis
<b>ELCD</b>	European Lifecycle Database
<b>EO</b>	Entrepreneurial Orientation
<b>EOU</b>	Ease of Use
<b>EPLCA</b>	European Platform on Lifecycle Assessment
<b>EU</b>	European Union
<b>FAHP</b>	Fuzzy Analytic Hierarchy Process
<b>FP</b>	Form Postponement
<b>GDP</b>	Gross Domestic Product

<b>GOK</b>	Government of Kenya
<b>GSCN</b>	Green Supply Chain Network
<b>IS</b>	Information Systems
<b>JIT</b>	Just in Time
<b>KAM</b>	Kenya Association of Manufacturers
<b>KITP</b>	Kenya Industrial Transformation Programme
<b>KNBS</b>	Kenya National Bureau of Standards
<b>KSA</b>	Kingdom of Saudi Arabia
<b>LM</b>	Lean Manufacturing
<b>LSC</b>	Lean Supply Chain
<b>LSCM</b>	Lean Supply Chain Management
<b>MADM</b>	Multiple attribute decision making
<b>MAP</b>	Markov Arrival Process
<b>MAS</b>	Management Accounting Systems
<b>NSE</b>	Nairobi Securities Exchange
<b>NVA</b>	Non-value Adding Activities
<b>PEU</b>	Perceived Environmental Uncertainty
<b>PESTLE</b>	Political, Economic, Social, Technological, Legal, Ecological
<b>PLC</b>	Product Lifecycle
<b>PMS</b>	Performance Measurement Systems

<b>PVA</b>	Performance Value Analysis
<b>PWC</b>	Price Waterhouse Coopers
<b>R &amp; D</b>	Research and Development
<b>RBV</b>	Resource Based View
<b>ROCE</b>	Return on Capital Employed
<b>ROE</b>	Return on Investment
<b>SC</b>	Supply Chain
<b>SCI</b>	Supply Chain Integration
<b>SCM</b>	Supply chain management
<b>SCR</b>	Supply Chain Relationship
<b>SCS</b>	Supply Chain Strategy
<b>SCU</b>	Supply Chain Uncertainty
<b>SEM</b>	Structural Equation Modeling
<b>SMEs</b>	Small and Medium Enterprises
<b>SP</b>	Supply Performance
<b>SPSS</b>	Statistical Package for Social Sciences
<b>SWOT</b>	Strength, Weakness, Opportunities and Threats
<b>TAM</b>	Technology Acceptance Model
<b>TCE</b>	Transaction Cost Economics
<b>TOE</b>	Technology Organization Environment

<b>TOPSIS</b>	Technique for order of preference by similarity to ideal solution
<b>TQM</b>	Total Quality Management
<b>TU</b>	Technology utilization
<b>UPS</b>	United Parcel Service
<b>VIF</b>	Variance Inflation Factor
<b>VSM</b>	Value Stream Mapping

## DEFINITION OF TERMS

**Agile supply chain (ASC) strategy** It's defined as that strategy that has the objective of quick and effective response of the supply chain to changing customer needs (Christopher & Lee, 2014).

**Environmental uncertainty** is as a core concept in contingency theory captures the changing pace, customer demand turbulence, competition intensity, and technological changes and unpredictability of the task environment that the organization faces (Vickery, Dorge & Calantone, 2009).

**Lean supply chain strategy** it's aimed at creating cost efficiencies in the supply chain by effectively managing inventory and focusing on improving the quality in the supply chain, thus eliminating waste (Christopher & Towill, 2010).

**Manufacturing firms** these are firms in which raw materials, parts and components are processed or assembled into a product, gaining a higher value (Lucas, 2012).

**Performance** it's the analysis of a company's performance against its objectives and goals. The focus is the intra-firm supply chain performance and financial performance, including cost performance, service performance, profitability, and market share and asset utilization. (Lorentz, Solakivi, Halinen & Ojala, 2012).

**Postponement Supply Chain Strategy** is the practice of moving forward or delaying one or more operations or activities such as making, sourcing, and delivering to a much later point in time along the supply chain (Li., 2012).

**Supply chain** is a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flow of products, services, finances, and/or information from a source to a customer (Manuj & Mentzer, 2008).

**Supply chain risk hedging strategy** it refers to company actions aimed at reducing the likelihood of occurrence of risks and negative effects of risks (Juttner, 2013).

**Supply chain strategy** It's defined as a set of approaches utilized to integrate suppliers, manufacturing, warehouses, and stores so that merchandise is produced and distributed at the right quantities, to the right location, at the right time, in order to minimize system-wide costs while satisfying service level requirements (Simchi-Levi & Kaminsky, 2008).

## ABSTRACT

The general objective of this study was to establish the effect of supply chain strategies on the performance of manufacturing firms in Kenya. The independent variables for the study were agile supply chain strategy, risk hedging supply chain strategy, postponement supply chain strategy and lean supply chain strategy; dependent variable was performance of manufacturing firms in Kenya and environmental uncertainties was the moderator. The study was anchored on different theories such as resource based theory, contingency theory, transaction cost economics theory, dynamic capabilities and technology acceptance model. The study used a cross sectional research design. The target population was 829 respondents from manufacturing firms around the country. The study used stratified random sampling technique in data collection. A sample of 270 respondents were selected to constitute the sample. Primary data was used for the study which constituted qualitative and quantitative questions. A pilot test of 10% was done where a cronbach  $\alpha$  threshold of 0.7 was achieved for all variables. Multiple regression model and correlation analysis was applied to examine the relationship between the study variables. The findings indicated that agile supply chain strategy, risk hedging supply chain strategy, postponement supply chain strategy, and lean supply chain strategy had a strong positive and significant effect on performance of manufacturing firms with an r values of .652, .699, .651 and .679 respectively. Further, the results indicated that environmental uncertainties have a significantly negative moderating effect on the relationship between supply chain strategies and performance of manufacturing firms with a change in R square from 73.3% to 34.6%. The study concluded that supply chain strategies are significant contributors of manufacturing firms' performance. The most significant predictor of firm performance is lean supply chain strategy, followed risk hedging supply chain strategy, followed by postponement supply chain strategy and lastly agile supply chain strategy with coefficients  $\beta$  of .229, .224, .159 and .134 respectively. The study recommends that firms should be fully responsive to customer orders by incorporating electronic data interchange and enterprise resource planning to communicate seamlessly with customers. Similarly, firms should develop suppliers through collaboration product development, specifications sharing and development and capacity building. Also, manufacturing firms should delay final product assembly in order to be able to customize customer orders with their requirements. Further, manufacturing firms should conduct demand forecasts and fully utilize their labor and equipments. Lastly, manufacturing firms should regularly scan the environment through pestle and swot analysis.



## **CHAPTER ONE**

### **INTRODUCTION**

#### **1.1 Background of the study**

The volatility of end customers demand, shortened product life cycles, price and quality fluctuations in marketplace, continuous improvement by competitors, alongside market dynamics, mean that supply chains are having challenges in maintaining their stability. To this end, companies are searching for ways to overcome uncertainties (Colicchia & Strozzi, 2012). Through contingency theory, Hult, Ketchen and Slater (2004) have established some synchronized energies between uncertainties in the SC and supply chain strategy (SCS).

During the last decades, there has been an increasing awareness and interest among practitioners and academicians in the field of SC risk management (Colicchia & Strozzi, 2012). Despite this, the research is far from being complete particularly in understanding, reducing, managing, and mitigating uncertainty and risk in supply chains (SCs) (Tang, 2016). Lee (2014) suggested Tripartite principle for formulating robust SC strategies to caution against disruptions in the chain. This is fostering common interests across SC partners, adapting to volatile demands and supply and agility to be able to respond to the effects of short-term fluctuations in the equilibrium of demand and supply.

Volatility across the supply chain has been a core interest for many researchers that have even focused to study the relationship between a company and its immediate environment (Smircich & Stubbard, 2015). The dynamics complexities on environmental matters present an unprecedented challenge to operating businesses. It is therefore the responsibility of the management to mitigate the various SC risks (Jauch & Kraft, 2016). Ansoff dimensionalizes environmental turbulence in five strata's; dynamic, repetitive, escalating, intermittent and astounding. Therefore, these five categories of environmental turbulence should be matched with the organization's behavior, responses and capabilities, in order to increase the performance of the organization. An astonishing level of environmental turbulence

could be a substantial change in technological turbulence (Ansoff, 2017) which refers to the technological change and development of the organization's product portfolio and processes (Jaworski & Kohli, 2013). Organizations then need to be as flexible as possible in order to adapt to the changes, in order to keep abreast with market competition (Ansoff, 2017). Many firms are seeking to find out the role of environmental uncertainty in firm's performance. Uncertain factors in supply chain includes demand, process uncertainty, supply, competitor uncertainty, control and planning uncertainty and transportation uncertainty which affects the supply chain performance negatively (Wilson, 2017; Paulraj & Chen, 2017). Consequently, customer, supplier and technology uncertainty do not affect supply chain management practices (Li, 2012).

Key source of environmental risks are customers (request), providers (supply), innovation and contenders (Fynes, de Búrca, & Marshall, 2014 Sun, 2010), while other prior research have distinguished a few sources of vulnerability, for example, request, producing procedure, supply and control vulnerability. Minimal scholarly research has been done to decide both internal and external factors that influence production network execution which principally comprises of environmental risks (Merschmann & Thonemann, 2011).

A SC strategy indicates how a firm can achieve competitive edge through its SC abilities, for example, cost productivity, reaction speed and adaptability (Ismail & Sharifi, 2016). A SC strategy likewise indicates how the production, purchasing, marketing and sales, and logistics units cooperate to accomplish the ideal competitive strategy (Qi, Zhao & Sheu, 2011). It is subsequently basic for SC managers and staff to comprehend customers' needs, and to pick and actualize an ideal SC strategy technique to fulfill customer needs.

### **1.1.1 Global Perspective of Supply Chain Strategies**

Many organizations worldwide are striving to become effective and flexible in today's company setting, but have encountered difficulties in part because they were largely unable to formulate optimal SC strategies. Incompatible strategies are the primary cause of supply chains issues, and one-size-fits-all supply chain approaches lead to

failure (Ambe, 2012). Lean procedures are being adopted by increasing many companies globally to improve the efficiency of the supply chain. Lean procedures generate value by eliminating waste in the supply chain, including unordered products manufacturing, waiting time, error correction, and surplus processing, motion, transportation, and inventory (Jones & Hines, 2017).

Lean supply chain literature shows the management implementation of lean methods. Organizations have reengineered their supply chains to function globally to take benefit of international product, factor, and capital markets. However, worldwide supply chain leadership may pose several uncertainties, such as variations in financial, cultural, and regulatory settings (Manuj & Mentzer, 2008). Often, lean thinking a dominant problem in modern supply chain design (Rossiter Hofer et al., 2011). In the 1990s, P&G restructured its North American supply networks to resolve the shortcomings in its legacy supply network schemes that had developed over many centuries (Camm et al., 2017).

Examples of what some multinationals such as Unilever are now seeking in their supply chain strategies are Unilever's push for sustainable supply chain growth (Murray, 2014). Some sectors (pharmaceuticals, food, and aviation) are heavily controlled. Some are "savvy" in technology (telecommunications, electronics). Some face volatile supply (oil, raw materials), while others are extremely competitive in nature (automotive, FMCG, retail) with a powerful focus on economies of scale. In distinct sectors, supply chain approaches differ considerably (Lockamy & McCormack, 2014).

While lean global supply chains have been studied across multiple industries (Srai & Gregory, 2008) few researchers have considered the integration of global supply chain and lean processes to ascertain where they are complementary and where they are contradictory. Research conducted by Levy (2017) supported the hypothesis that lean production could potentially facilitate globalization. For example, in one international computer supply chain, a manufacturer was able to continue its globalization efforts while implementing design-for-manufacturing and quality improvements two key aspects of lean production. However, other research has

suggested conflicts between lean and global strategies, while lean and international supply chains have been studied across various sectors (Srai & Gregory, 2008), few scientists have regarded integrating worldwide supply chain and lean procedures to determine where they complement each other and where they contradict each other. Levy (2017) research endorsed the hypothesis that lean production can promote globalization. For instance, a company has been able to continue its globalization initiatives in one global computer supply chain while implementing two main elements of lean production design-for-manufacturing and performance improvements. Other study, however, has suggested disputes between lean and global strategies such as contributing to longer lead times and more inventories from offshore sourcing, which is contrary to lean values (Christopher & Lee, 2004). Lean and global research is based largely on theoretical descriptive case studies, with little attention being paid to empirical or quantitative studies. While some lean and global production practices are inconsistent, companies have used lean process management concepts to enhance the effectiveness of their worldwide supply chain (Das & Handfield, 2017). Bose, Kawasaki and Ford combined lean and worldwide sourcing strategies with cautious logistics planning, consolidation of shipments and single sourcing.

Global company has been growing in nature, increasing client demand and growing uncertainty in worldwide markets. If these are the realities, they would have severe implications for the global supply networks that today characterize most organizations. In addition, a variety of crises and shocks have occurred even before the global financial crisis began to affect supply chains since 2008. For instance, container shipping limitations spiraled the Baltic Dry Index (as a proxy for shipping costs) upward in 2003, with oil prices rising to \$140/barrel due to increasing demand in 2008 from Brazil, Russia, India and China. Amidst some concerns; In particular, it reached the notorious "peak oil" point (Leggett, 2016). Then, demand for many products and services were slashed in the 2008 global financial crisis, requiring significant flexibility to lower ability in many industries. If such uncertainties are indeed a probable characteristic of future times, the obvious issue is whether or not the present supply chain policies are actually fit for purpose? (Holweg, Hong & Reichhart, 2011).

A supply chain disruption's deep effect was demonstrated in March 2011 when a powerful earthquake in Tohoku, Japan adversely affected the worldwide automotive industry's flow (Fujimoto, 2011). The national assembly lines of Japanese automotive manufacturers were shut down for roughly one month and the quake-related shortages of electronic automotive detectors triggered by the knockout of Hitachi's Automotive Systems plant in Tohoku led to the temporary cessation or curtailment of car manufacturing in Germany, Spain, France and the USA (Lee & Pierson, 2011). Nevertheless, according to Black and Ray (2011), only about 10% of companies have detailed plans to deal with uncertainties in the supply chain. The supply chains of today are progressively exposed to the probability of having harmful disruptions in the supply chain (Son & Orchard, 2013). Supply chain risk management and uncertainty as today's most urgent issue for companies. Recent empirical studies show that supply chains are more vulnerable to disruption (Tummala & Schoenherr, 2011). Given enhanced exposure to supply chain risk and uncertainties, companies are increasingly focused on developing the suitable supply chain policies to address environmental uncertainties (Jüttner & Maklan, 2011).

### **1.1.2 Regional Perspective of Supply Chain Strategies and Environmental Uncertainty**

It is demonstrated in today's competitive era that many businesses have failed to maximize the potential of their supply chain because they have often failed to create the performance policies required to fully integrate their supply chain in order to maximize efficiency and effectiveness (Gunasekaran et al., 2004). According to Green et al. (2012), enhancing the performance of the supply chain by using distinct approaches to improve the supply chain's competitive position will assist improve each partner's organizational performance across the supply chain. A triple A supply chain research by Attia (2015) in Egypt's textile industry disclosed that flexible supply chain approach in conjunction with adaptability and alignment all play a critical role in the performance of the supply chain and therefore the performance of the organization. In 2014, Lee launched the theoretical framework for the construction of the triple-A supply chain (agile, adaptable and aligned), providing the basis for enhancing the performance of the entire supply chain.

The impacts of port hazards on supply chains are similar to disruptions in the supply chain. Disruption results were recognized as economic losses (Waters, 2017); deviation, catastrophe disruption (Gaonkar & Viswanadham, 2014); disturbance, unavailability, delay, deviation, discontinuation, loss of service platform. The effect of port risks results in extra expenses for port customers, depending on the severity of the disruptions, due to the enhanced inclusion of ports into the supply chains (Loh & Thai, 2015). Port strikes, for instance, could lead in violation of contractual commitments as supply chain organizations are unable to satisfy customer orders and inventory build-ups on both sides; upstream and downstream supply chain entities (Burgess, 2011).

Disruptions in the supply chain cause adverse effects on the profitability and reliability of companies (Blanchard, 2016), so it is essential to define disruptions caused by port activities in order to minimize the effect of disruptions, particularly given the increasing integration of ports into supply chains (Pettit & Beresford, 2009). Nigeria's port systems, for example, have failed to change and adapt to higher growth, leading to serious issues whereby cargo is not cleared in time for new entrants (Igbokwe, 2011). Similarly, ports in sub-Saharan Africa do not have the required rail and highway connections, making them unable to enjoy the advantages of containerization and multi-modal transport corridors as containers have to go through re-packing in the ports (Ocean Shipping Consultants Ltd., 2008).

Christ and Ferrantino (2011) examined the impact of SSA's (Sub-Saharan Africa) price, time and uncertainty on land export transportation and discovered that inland export expenses and time delays are much greater for landlocked countries, differ significantly between distinct geographical corridors, and display significant uncertainty. They showed that geographic characteristics such as low-road density (e.g. unpredictable and ever-changing road and rail conditions), regulation, market structure, ad hoc administrative obstacles, and bribery (e.g. casual payment demands) contribute to cost, time, and uncertainty.

### **1.1.3 Supply Chain Strategies and Environmental Uncertainty in Kenya**

Supply Chain Strategy (SCS), is an emerging research area of enhancing competitiveness, efficiency and effectiveness in supply chain management (Rose, Singh, & Rose, 2012). Organizations must develop business strategies like the supply chain strategies that are concerned with its performance. The type of strategy describes how an organization will respond to competitors, customers, suppliers and governmental authorities in the market. As stated by Jones and Hines (2017), it is important to recognize that there are different paths to successful supply chain strategies. In the Kenyan, organizations such as SMEs though large contributors to the country's economic growth, are regularly faced with challenges as a result of lack of deliberate strategies to manage the supply chain in order to achieve optimal firms performance (Migiro, 2016).

Mwenda and Aosa (2018) conducted a study on environmental uncertainty and strategy implementation within chartered universities in Kenya. It identified that dealing with environmental uncertainty is very core to an organization performance. Further the study identified developing a risks register and formulating mitigating measures as vital in uncertain environment.

A study by Memia (2018) on influence of contemporary supply practices on performance of large manufacturing firms in Kenya, identified that green supply chain, customer relationship management, supplier relationship management, outsourcing and lean supply chain when well implemented lead to higher performance.

Myamba and Nguni (2021) on aligning the risk hedging strategy with supplier collaboration and manufacturing competitiveness found out that there is a significant positive relationship between risk hedging strategy and manufacturing competitiveness and becomes stronger when supplier collaboration is incorporated. However, the study focused on competitiveness as the dependent variable and not performance measured using customer satisfaction, profitability and market share.

Even though supply chain strategy is an emerging area, a few scholars have researched on areas relatively close to the subject. A study by Osiemo (2012) on strategies on sustainable supply chains noted that most of the supermarkets in Nairobi have integrated strategies on sustainable supply chains such as involving other organizations to develop sustainable products that meet environmental standards, investing in waste minimization activities and managing transport efficiencies by optimal vehicle utilization. Consequently, Maalim (2016) looked at assessment of supply chain management strategies and competitiveness of Kenya SMEs. The study selected variables included process strategies, market strategies and channel strategies. The study concluded that supply chain management strategies are well adopted in SMEs.

However, the above studies did not clearly focus on the specific supply chain strategies such as agile strategy, lean strategy, risk hedging strategy, postponement strategy and efficient strategy. Therefore, there is need to focus on the specific supply chain strategies more so in the manufacturing sector which is a key pillar of Kenya Vision 2030. This will consequently improve manufacturing sector performance.

#### **1.1.4 Performance of Manufacturing Firms in Kenya**

Under Kenya Vision's economic pillar, production is one of the five industries recognized to promote economic development in 2030. It is anticipated to be a dominant and aggressive industry in line with Vision 2030's ambitions to promote domestic development, generate jobs, receive the country's foreign exchange and promote foreign investment (GoK, 2017). Kenya's manufacturing industry grew at 3.5% in 2015 and 3.2% in 2014, contributing 10.3% to GDP (GDP) (KNBS, 2016). However, manufacturing has grown at a slower pace on average than the economy, which in 2015 expanded by 5.6 percent.

The manufacturing sector's growth lagged at 4.3%, which was smaller than the economy's average development of 6.2% between 2010 and 2013. Furthermore, data indicate that Kenya's share of manufacturing exports in its total goods exports is small at just 35% compared to other nations such as South Africa at 47%, Malaysia



at 67% and Singapore at 73%. In 2013, the industry accounted for 26% of goods exports and 12% of total official jobs, employing about 280,000 individuals (KNBS, 2013). In 2015, the production industry rose by 3.5% compared with 3.2% in 2014. Input costs such as petroleum products and electricity were partially ascribed to the development. Overall, credit from KSh 237,422 million in 2014 to KSh 290,069 million in 2015, credit for the manufacturing sector improved. The value of industrial financial institutions authorized manufacturing projects also rose from KSh 569.1 million in 2014 to KSh 1,092 million in 2015. Because of delayed Value Added Tax refunds, the industry has been negatively impacted by inexpensive imports, high capital costs and export disincentives. A 2.7% increase in formal jobs in the manufacturing industry in 2014 from 2,874,000 and reached 2,954,000 in 2015. The industry contributed 11.9 percent of the country's official employment. Approximately one third of the jobs in the production sector has been contributed by food goods and the beverage industry (KNBS, 2016).

The 2018 Kenya National Statistics Bureau (KNBS) Economic Survey demonstrates that the real value-added value of the manufacturing sector in the country grew marginally by 0.2 percent in 2017 compared to a 2.7 percent increase in 2016. The production volume of the sector declined by 1.1 percent, primarily due to a decrease in food products, drinks and tobacco, leather and associated goods, sub-sectors of rubber and plastics and non-metallic minerals. The industry was negatively impacted by uncertainties concerning the extended electioneering period, an increase in inflation, high cost of manufacturing and competition from imported products. The prohibition on the manufacture and use of plastic carrier bags also had adverse effects on the sector's output quantity (KNBS, 2018).

Industrial development in Kenya has stagnated over the past 10 years with a GDP contribution of 10 percent and a further decrease reported to 9.2 percent in 2016. The national government's objective is to raise the production sector's contribution from the present 9.2% gross national product (GDP) contribution to 15% by 2022. A range of policy approaches such as Vision 2030, Kenya Industrial Transformation Program (KITP), National Trade Policy, Investment Policy and Buy Kenya Build Kenya (BKBBK) were designed to boost manufacturing company efficiency.

## **1.2 Statement of the Problem**

Manufacturing sector is one of big four government's agenda focusing on manufacturing, affordable housing, universal health care and food security as the key pillars for economic growth. The expected growth of manufacturing sector is 15% of the GDP. Manufacturing sector is an important stimulus to the economy and a key pillar of the vision 2030 (KIPPRA, 2018). The number of people employed in the formal manufacturing sector accounted for 12.1% of the total number of persons engaged in the formal sector in 2019 (KNBS, 2020). According to KAM (2018) one of the key drivers of manufacturing sector performance is effective supply chain management and adoption of the right supply chain strategies.

Kenya's manufacturing sector accounts for 9.2% of GDP, 11.7% of total employment in the formal sector, and 20.4% of informal employment. The manufacturing sector is lagging in growth at an average growth of 7.7% for 2018, 2019 and 2020. The sector has also contributed an average of 8.4% to the GDP for 2016, 2017, 2018, 2019, 2020 versus an expected contribution of 15% (KIPPRA, 2021). As a result, it can be argued that Kenya is going through premature deindustrialization in a context where manufacturing industry is still relatively under-developed. This slow growth in manufacturing sector performance can be attributed to several factors such as the high production costs, supply disruptions, unavailability of raw materials or demand fluctuations, technological changes, employees' strikes, risk, terrorism and competition from imported goods (KNBS, 2020).

Mwenda and Aosa (2018) conducted a study on environmental uncertainty and strategy implementation within chartered universities in Kenya. It identified that dealing with environmental uncertainty is very core to an organization performance. Further the study identified developing a risks register and formulating mitigating measures as vital in uncertain environment.

A study by Memia (2018) on influence of contemporary supply practices on performance of large manufacturing firms in Kenya, identified that green supply chain, customer relationship management, supplier relationship management, outsourcing and lean supply chain when well implemented lead to higher

performance. There exists a conceptual gap since the study used different supply chain strategies from the ones adopted in this study.

Another study by Myamba and Nguni (2021) on aligning the risk hedging strategy with supplier collaboration and manufacturing competitiveness found out that there is a significant positive relationship between risk hedging strategy and manufacturing competitiveness and becomes stronger when supplier collaboration is incorporated. However, the study focused on competitiveness as the dependent variable and not performance.

Several past studies indicate that firm's external environment has some influence on the performance of the organization. Davidsson, Delmar and Wiklund (2006) indicated that external environment uncertainty influences firm's performance irrespective of the selected supply chain strategy and the context of operation. However, in contrast to above studies, other studies have not identified any relationship between external environment and firm's performance (Pagell & Krause, 2003) ; Rivard, Raymond & Verreault, 2005; Parnel, Donald & Micheal, 2000; Adriany & Djumahir, 2013).

The contradiction of these studies provides a rich background to further explore the relationship between supply chain strategies, environmental uncertainties and performance of manufacturing firms. It is evident that the above studies were not cognizant of the concept of environment uncertainties influencing the nexus between supply chain strategies and performance of manufacturing firms.

It is on this research gap basis that this study sought to create new knowledge and bridge the existing gap by establishing the effect of the supply chain strategies on the performance of manufacturing firms in Kenya with environmental uncertainty moderating the relationship.

### **1.3 Objectives of the Study**

#### **1.3.1 General Objective**

To establish the effect of supply chain strategies on the performance of manufacturing firms in Kenya.

#### **1.3.2 Specific Objectives**

1. To examine the effect of agile supply chain strategy on the performance of manufacturing firms in Kenya.
2. To establish the effect of risk hedging supply chain strategy on the performance of manufacturing firms in Kenya.
3. To determine the effect of postponement supply chain strategy on the performance of manufacturing firms in Kenya.
4. To establish the effect of lean supply chain strategy on the performance of manufacturing firms in Kenya.
5. To determine the moderating effect of environmental uncertainties on the effect of supply chain strategies on the performance of manufacturing firms in Kenya.

### **1.4 Hypothesis**

**H<sub>01</sub>:** Agile supply chain strategy has no effect on the performance of manufacturing firms in Kenya

**H<sub>02</sub>:** Risk hedging supply chain strategy has no effect on the performance of manufacturing firms in Kenya

**H<sub>03</sub>:** Postponement supply chain strategy has no effect on the performance of manufacturing firms in Kenya

**H<sub>04</sub>:** Lean supply chain strategy has no effect on the performance of manufacturing firms in Kenya

**H<sub>05</sub>:** Environmental uncertainties do not moderate the effect of supply chain strategies on the performance of manufacturing firms in Kenya.

## **1.5 Significance of the Study**

### **1.5.1 Manufacturing Firms**

The study gave insights on the appropriate supply chain strategies to undertake depending on the prevailing circumstances. At the same time management of these firms can be able to mitigate the effects of environmental uncertainties in case they occur in timely and proactively manner. This will consequently enable manufacturing firms gain competitive edge.

### **1.5.2 Policy Makers**

This study provided a basis for formulation and implementation of policy with regard to supply chain strategies and environmental uncertainties both in public and private firms. The study will be useful to government in aiding it develop policies to stimulate growth in the manufacturing sector. Further, the study will help in reviewing the existing policies in manufacturing sector and supply chain management with a view of improving them.

### **1.5.3 Academicians and Researchers**

This study provided more knowledge on supply chain strategy and the influence of environmental uncertainties literature. The study did shed more light on supply chain strategies and provide a foundation for future research by researchers. The study helped to draw conclusions and recommendations that are justifiable empirically and therefore provide a good basis for scientific reference in scholarly work. It also contributed towards theoretical and practical advancement of supply chain strategies and environmental uncertainties.

## **1.6 Scope of the Study**

The study looked at supply chain strategies, environmental uncertainties and performance of manufacturing firms in Kenya. The supply chain strategies considered were agile strategy, lean strategy, risk hedging strategy and postponement. Further the study also looked at environmental uncertainty on supply chain strategies. This study was supported by Agarwal, Shankar and Tiwari (2016) who classified the SCs into different categories; lean, agile and risk-hedging and compared them based on performance attributes such as market demand, customer drivers, purchasing policy, cost, quality and lead time and service level. In addition, Matthews & Syed (2014) states that a postponement strategy helps in reducing inventories, improve customer service and responsiveness. The manufacturing sector was used since it's a key pillar of vision 2030 (Kippra, 2018). The study focused on manufacturing firms in Kenya and specifically where they are located. The study was carried between July 2020 and December 2020.

## **1.7 Limitations**

The researcher encountered some challenges during the research period. First, the occurrence of COVID-19 came at the time of conducting data collection and it was difficult to gain entry to some firms due to COVID-19 protocols. The researcher was able to overcome this by ensuring strict compliance to all protocols and requirements set out by firms. Secondly, the researcher faced resistance from respondents as some had fears on the confidentiality of data given. This was mitigated by assuring them of utmost confidentiality of all information given and strictly using the information for academic purposes. A letter of permit from Nacosti and introduction letter from university also helped to confirm that the data obtained was purely for academic purposes. Thirdly, the respondents were at times unavailable for feedback while others took a lot of time for feedback. It was mitigated by giving them more time when needed, do follow ups and being friendly.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter presents theoretical review, conceptual framework, and literature review of variables, empirical review, and critique of existing literature, research gaps and summary. The review of literature is with respect to supply chain strategies, environmental uncertainty and firm's performance.

#### **2.2 Theoretical Review**

Silvermann (2012) a theory is the total set of empirical, interconnected ideas formulated to explain those phenomena. A theory is a logically developed and elaborated network of interrelationships among variables significant to the area under study. The theories highlight and explain matters for easier understanding on otherwise complex issues. The main characteristic of a theory is that it provides an explanation about a phenomenon (Silvermann, 2012). The theories discussed related to supply chain strategies, environmental uncertainty and performance of manufacturing firms.

##### **2.2.1 Resource Based View Theory**

In the company's resource-based (RBV) perspective, intangible knowledge-based assets serve as a source of competitive advantage as they tend to be unique to the company, hard to copy, and culturally integrated. Resources are regarded strategic in the RBV and are a source of competitive advantage if they provide economic value, are distinctive (uncommon), are hard to copy (inimitable) and have organizational assistance (Barney, 2007).

In many different but overlapping methods, strategic resources have been categorized. While some classified these as physical, natural, and capital, others added categories of technological and reputational resources and some proposed proprietary (or tangible) rather than knowledge-based (or intangible) resources (Foss,

1997). While concrete resources allow a company to carry out its business processes, it is the intangible, knowledge-based resources that are more likely to serve as sources of competitive advantage because they enable businesses to integrate precious, rare and inimitable practices into their fabric and have organizational support (Ray et al., 2004).

Existing literature offers countless examples of businesses that have acquired a competitive advantage by managing their supply chain activities strategically. An excellent instance is Toyota, which has used its comprehensive data exchange with its effective capacities that clients can appreciate. Additional value is one of the key roles of the strategy of activities and manufacturing. Most scientists currently pay specific attention to the growth of skills as a means of operationalizing strategy and general firm results in manufacturing and operations management. These studies conclude that the SC may also be a setting for the development of competitiveness (Alain & Martin, 2009).

Supply chain practices are a collection of operations that perform important duties to promote their supply chain strategy, which is, building relationships with providers, eliminating waste, facilitating customization and exchanging data within the supply chain (Zhou & Benton, 2007). The resource-based view indicates companies support their strategy and through resources achieve strategic benefit (Miles & Snow, 2007). Based on the above concept that actions or procedures enable the execution of strategies, we see supply chain practices as resources to promote the execution of supply chain strategies. They constitute the capacity of the company to distinguish itself in operations such as demand forecasting, product accessibility, stock management, and distribution based on superior capabilities (Zielke & Pohl, 2006).

The resource-based views can be extended to the supply chain resources (Gulati, 2009). Indeed, while supply chains are outside an organization, they are less transparent and harder to imitate in many respects. It requires time to learn about environmental and social activities between buyers and providers, such as working with providers to commit to waste reduction targets and creating competent minority business providers, but such learning can have a powerful beneficial impact on



provider efficiency and lower operating costs in supply chain relationships. It may also be harder to replicate supply chains that incorporate social and environmental resources, especially if suppliers devote asset-specific investments to engaging in their customers' disassembly and reuse operations or share wealthy data and create greater levels of confidence connected with close connections (Carter, 2005). Therefore, the RBV is the only theory that promotes and integrates business strategy and firm results. According to Zott (2002), the RBV focuses on the effects of the company's use of inner funds on performance. This theory suggests that strong competitiveness results from the resources it masters in order to grow efficiently and that can have increased value to the customers.

The RBV emphasizes the importance of heterogeneous buying and supply chain management capacities to develop and maintain competitive advantage. Companies like Wal-Mart and Toyota have created distinctive logistics and supply chain technologies to attain superior market efficiency and competitive edge (Barney, 2012). Porter (1996) argues that any strategy's essence is based on the operations it carries out. Building on this overall theme, studies indicate that its methods rely on the essence of supply chain strategy implementation (Morash, 2001). Supply chain procedures are a collection of operations that perform important duties in support of their strategy to build relationships with providers, eliminate waste and facilitate customization and share data within the supply chain (Zhou & Benton, 2007). The resource-based view indicates companies support their strategy and through resources achieve strategic benefit (Miles & Snow, 2007). The proponent of this theory is Wernerfelt (1984) and later further developed by Barney (1991).

### **2.2.2 Transaction Cost Economics Theory**

The theory of transaction costs (TCT) could serve as a useful starting point for the assessment, which explains why certain duties are carried out by companies and others by markets. Coordination costs and transaction risk can be split into transaction costs (Clemons & Row, 1992). Uncertainty and specificity of assets are two variables, respectively increasing the cost of coordination and the risk of transactions (Williamson, 1985). Uncertainty in supply chains and more specifically

in manufacturing is triggered by uncertainty in supply, uncertainty in demand, new product development uncertainty, and uncertainty in technology (Koh & Tan, 2006). Supply uncertainty concerns unpredictable occurrences occurring in the supply chain's upstream portion.

Material shortages and late deliveries are among the causes of supply uncertainty. Clearly, supply uncertainty can interrupt production and adversely affect sales where distributors and retailers are also impacted down the chain. Demand uncertainty can be described in the downstream portion of the supply chain as unexpected occurrences (Koh & Tan, 2006). Uncertainty of demand (or risk of demand) may lead from seasonality, fad volatility, fresh product adoption, or brief product life cycles (PLCs). Another manufacturing uncertainty concerns new product development.

Uncertainty about new product development may result from unexpected occurrences during market research, product design, and product prototyping. Lastly, technology uncertainty relates to the fluidity of selecting an appropriate technology platform (Koh & Tan, 2006). In addition, uncertainty may also be caused by political (fuel crisis), natural (fire, earthquake) and social uncertainty (strikes) (Juttner, 2005). Approaching the notion of transaction cost economics (TCE) uncertainty could provide additional insight into the importance of data sharing among organizations. TCE focuses on the notion of uncertainty that assumes that the rationality of people is bound and that they behave opportunistically.

The decision phase relates to the selection of two businesses as the most suitable type of governance for certain operations to create or develop a partnership. In transaction cost economics (TCE), which places supply chain relationships at the midpoint on a market-hierarchy continuum, this choice is handled exhaustively. Asset specificity, exchange uncertainty and frequency with which transactions recur (Williamson, 1991) are the main factors influencing the choice to partner. Other studies have been based on TCE and have complemented the partnership requirements with, for instance, the danger of the agreement and trust between partners and the promising advantages of partnerships such as enhanced client responsiveness and more accurate

supply chain resource allocation (Lambert et al., 1998). Risk management of inter-company interactions has become a key problem for supply chains ' resilience (Ringsberg, 2014). While facing an increasing number of hazards during exchanges, companies must simultaneously look for appropriate forms of transaction governance to handle and decrease such hazards effectively. Transaction cost economics (TCE) is one of the strongest theories used to explain how economic agents minimize transaction hazards and associated expenses through vertical relationship management.

Uncertainty in supply chains and more specifically in manufacturing is triggered by supply uncertainty, uncertainty about demand, uncertainty about new product development, and uncertainty about technology (Koufteros, 1999). Supply uncertainty concerns unpredictable occurrences occurring in the supply chain's upstream portion. Material shortages and late deliveries are among the causes of supply uncertainty. Clearly, supply uncertainty can interrupt production and adversely affect sales where distributors and retailers are also impacted down the chain. Demand uncertainty can be described in the downstream portion of the supply chain as unexpected occurrences (Koufteros, 1999). Uncertainty of demand (or demand danger) may lead from seasonality, fad volatility, fresh product adoptions, or brief cycles of product life (PLCs) (Johnston, 2005). In addition, (Choi & Krause, 2005) identifies three sources of demand uncertainty. They include availability of goods in market, and changes of the consumers taste or preferences and price variations.

Food supply chains are a nice field of research to investigate various types of transaction hazards due to the specific characteristics of food production. In addition to the hazards posed by financial agents ' opportunistic behavior, there are many other risks associated with unexpected modifications in the financial setting (Henson & Humphrey, 2010). These include, for instance, the reliance of agricultural raw materials on climatic circumstances, frequent food security incidents, fast changes in customer preferences, the steady development of the food legal structure, and the globalization of food supply chains (Carbone, 2017). These are major difficulties that affect vertical relationships and their organization. By working with external

partners, a business can decrease its complete transaction costs. TCA has often been used in supply chains in making or buying choices. Examples include the outsourcing of buyer-supplier relationships logistics operations and supply chain reorganization (Croom, 2001). Essentially, TCE is a helpful tool for deciding whether to carry out a transaction on the marketplace or in-house.

Transaction Cost Economics (TCE) examines how company partners who work together shield each other from a damaging subsidiary with different relationships (Klein, 1995). It was the most significant new organizational theory that emphasizes the choice on the predicament of sourcing, whether to outsource or not. A company's sourcing situations are also defined as a company's choice to make or purchase. The two main drivers of Transaction Cost Economics are uncertainty induced by the coordination costs and Transaction costs (Fink, 2006). According to Transaction Cost Economics, a company could also choose outsourcing first if the aggregate expenses, which integrate all used on the project, are smaller than the expenses of making the same function in the company itself (Lyons, 2005). The proponent of this theory is Williamson (1985).

### **2.2.3 Contingency Theory**

The theory of contingency indicates that the structure of an organization depends on contextual variables such as setting, approach, and size. Prior study identifies variables of contingency (institutional and external environment) that influence the implementation of performance measurement technologies and the selection of instruments and procedures for performance measurement in the government, private and third industries. Size, organizational structure, strategy, technology, culture and leadership are the multiple organizational variables that affect the implementation of performance management schemes in organizations.

External environment is an important contingent variable that involves a degree of environmental unpredictability or uncertainty, the degree of rivalry or hostility displayed, and the organization's environmental dynamism or turbulence (Gerdin & Greve, 2004). Building on the claim of contingency theory that the procedures of an organization should align with their setting, we examine inclusion of the supply

chain (SCI) as a reaction to uncertainty. Both inter-organizational data flows and wealthy casual data sharing processes characterize SCI, which assist supply chain members deal with uncertainty.

Specifying that the performance of an organization depends on the fit of its structure, procedures and atmosphere (Lawrence & Lorsch, 2007). Its task environment includes components appropriate to the achievement of the objective, including clients, vendors, rivals and regulatory authorities. A main contingency for supply chain strategies has long been environmental uncertainty (Cao, Vonderembse, Zhang, & Ragu-Nathan, 2010). The theory of contingency has two fundamental hypotheses: First, there is no best way to organize. Second-There is no similarly efficient way of organizing. Researchers have long postulated in contingency theory research that performance depends on the fit between a company's policy and the company environment, and it is this congruence that determines company performance rather than just the strategy itself (Gresov, 2009).

The theory of contingency highlights the significance of situational factors on organizational management and questions the existence of a single, best manner of managing or organizing a company (Donaldson, 2001). Higher company efficiency is accomplished when strategies match environmental environments properly (Hambrick, 2003). Studies constantly show that in supply chain situations, inferior organizational performance is associated with discrepancies between strategic strategies and environmental features (Lee, 2002). The fundamental assumption of the theory of contingency is that companies deliver the highest output when their structures are applicable to the contingencies imposed by their size, their technology and their environment. The theory of contingency is intended to know how companies align their anticipated performance with the inner and external company setting.

Contingency theory is a suitable method to investigate supply chain risk mitigation decisions as there is no one correct strategy to manage and prevent supply chain risk. Therefore, according to contingency theory, the selection of supply chain approach in relation to a particular organization will depend on the environmental hazards and

uncertainties. This theory considers the external environment to be a main determinant of a company's performance (Johannesson & Palona, 2010). The proponent of this theory is Fiedler (1967).

#### **2.2.4 Dynamic Capabilities Theory**

Dynamic capabilities are recognized as strategic alternatives that organizations use when the chance arises to allocate their regulated funds (Schilke, 2014). The word dynamic implies the capacity to renew skills in order to attain consistency with the evolving company setting. This idea is crucial as inability to comprehend and adapt to environmental modifications will result in bad results. Strategic awareness is recognized as a specific capacity that involves shaping the company's strategic position. Companies regard their strategic plan as essential for their strategic consciousness, which emphasizes reasonable behavior and decisions (Wiesner & Millet, 2012).

Improving dynamic capacity means choosing an approach that results in lower expenses (Schilke, 2014). Companies with honorable intention to alter can attain higher output than their rival as they deploy substantial resources to create their capacities by taking on the necessary approach. A difficult issue rises the equilibrium between managed assets and dynamic capabilities, as there is a danger of a resource development failure on company capacities and strategies. The theory of dynamic capacities examines how companies react to dynamic environmental hazards and uncertainties by integrating the correct sustainability capacities and strategies in their performance (Huesch, 2013). As a result, manufacturing units, dynamic capabilities and strategies are all aimed at achieving the performance of the organization in changing and unpredictable environments. This is clarified by the ongoing growth of particular skills and strategies to deal with changing setting based on the procedures, routes and positions of an organization. Process will involve how an organization conducts its operations while routes will be the main resources of intellectual property, technology, complementary assets, supplier relationships and client base. At the same moment, routes will be the strategic options that an organization will have to consider its procedures and positions. Process will involve how an

organization conducts its operations while routes will be the main resources of intellectual property, technology, complementary assets, supplier relationships and client base. At the same moment, routes will be the strategic options accessible to an organization, taking into account its procedures, positions and climate aimed at gaining competitive benefit (Teece, 2014).

Therefore, as manufacturing is subject to the vibrant setting, it is essential that any company employ particular supply policies so that greater efficiency can be achieved. As a result, a company needs to define and integrate the suitable supply chain strategy to deal with environmental changes and increase firm's performance. This theory was proposed by Teece and Pisano (1994).

### **2.2.5 Technology Acceptance Model (TAM)**

Davis (1986) provided the Technology Acceptance Model (TAM). The primary objective of the model is to clarify the conduct of ICT use, that is, what are the primary causes for accepting or rejecting the use of information technology by prospective ICT adopters. TAM forecast user acceptance and any technology is based on perceived utility and perceived ease of use. The perceived utility (U) within the TAM is defined as the extent to which a user believes their performance will be improved by using a system (Venkatesh & Davis, 2000). Perceived Ease of Use (EOU) on the other hand is defined as the extent to which a given user believes that by using a given system, his/her efforts will be reduced ((Venkatesh & Davis, 2000). Both the perceived usefulness and the perceived ease of use are based on users' perceptions of the system's faith. According to the TAM, U and EOU have a major impact on the attitude of a user towards using a scheme (Venkatesh & Davis, 2000). This theory is applicable to the Kenyan manufacturing sector as technology is seen as one of the factors of uncertainty affecting the output of a company. By screening technological changes and subsequently technological adjustments, company performance will be increased by providing timely data, allowing a company to implement the correct supply chain approach (Dehning, Richardson & Zmud, 2007).

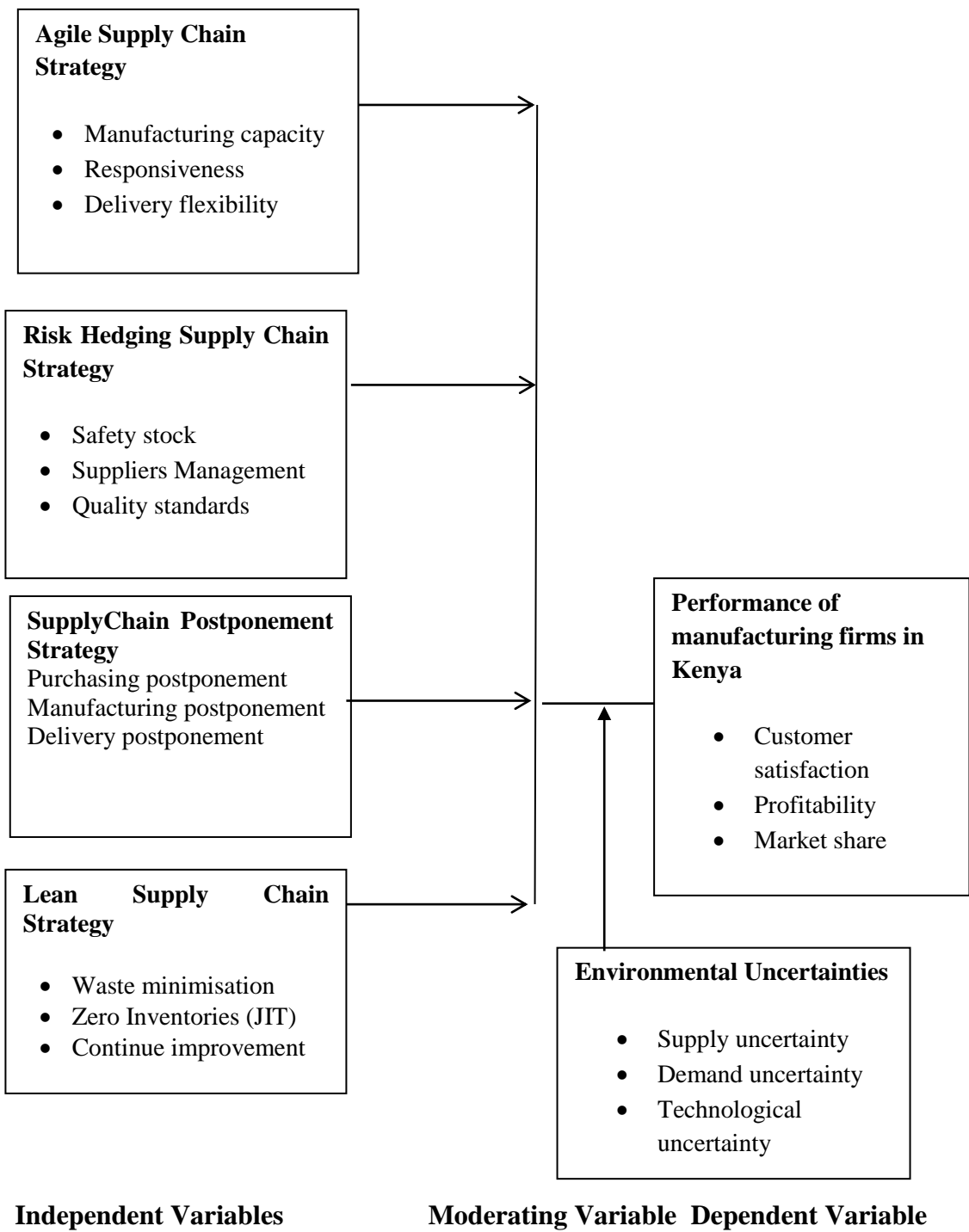
The perceived ease of use and acceptance is strongly associated with the training and abilities staff have. The Kenyan manufacturing companies should train their staff to continually screen the environment for technological advances and thus its implementation will allow the technology to be applied effectively and efficiently. IT implementation allows supply chain executives to maintain a healthy network and communication among all supply chain partners such as suppliers, clients and logistics service providers. This allows the company to mitigate environmental uncertainty and increase the focus of the company on its performance metrics (Williams, 2006). The proponent of technology acceptance model was Davis in 1986.

### **2.3 Conceptual Framework**

A conceptual framework is a model presentation in a diagram showing relationship among independent variables, moderating variable and dependent variable as shown below (Orodho, 2008). Supply chain strategies have been adopted from literature reviewed from these authors Lee (2012); Qi et al. (2011); Lee and Tang (2007); Whang and Lee (2009) while environmental uncertainty have been adopted from following researchers Lee, (2012); Vorst and Beulens, (2012); Zhou and Benton, (2007).

Supply chain strategies will be the independent variables consisting of agile strategy, lean strategy, risk hedging strategy and postponement strategy while the dependent variable was manufacturing firms' performance. Consequently, a moderating variable environmental uncertainty will moderate the relationship between supply chain strategies and manufacturing firms' performance. This is as shown respectively in the conceptual diagram;





**Figure 2.1: Conceptual Framework**

Adapted from Lee (2012), Zhou et al., (2007) and Birhanu (2014)

### **2.3.1 Agile Supply Chain Strategy**

Since its beginnings in the early 1990s, agility has been extensively studied as a fresh paradigm for improving competitiveness. The idea is now acknowledged in its multiple forms as a winning development strategy if not a fundamental one for survival in some company settings. With modern opinions redefining the unit of competition as a supply chain or a demand network, the concept of establishing flexible supply chains (ASC) has become the next logical move for scientists and a focus zone. Supply chain agility is the ability of the entire supply chain and its members to align the network and its operations quickly with the demand network's dynamic and turbulent requirements (Ishmail & sharifi, 2016). In the 1990s, the search for a solution to the increasing rate of change and uncertainty in the business environment, previously sought in flexibility mainly provided by technology automation, led to the creation of agile thinking.

The notion of agility is applied to production more frequently (Goldman et al., 2015), but also to supply chains (Christopher & Towill, 2010). In an environment of constant and unpredictable change, agility has been defined as the ability to thrive and prosper (Maskell, 2011). Swafford (2013) conducted an empirical survey and recognized flexibility as a critical factor in determining and affecting the agility of the supply chain of businesses. The Iacocca Institute (2011) stated that a company could flourish in a rapidly and unpredictably changing setting through agile action. Companies required an efficient reaction to an ever-changing and extremely competitive company setting. Hiebelar et al. (2008) created the agile procedure where minimal lead times are needed to provide high availability for volatile customer demand. There are a number of distinctive characteristics in the agile supply chain.

It is sensitive to the market with the ability to respond to real-time demand changes. Similar to the agile manufacturing concept, the drivers behind the need for agility in supply chains stem from the increasing rate of change and uncertainty in the business environment. The dynamics of operations extended to supply chains will add to the business environment's uncertainties and thus the vulnerability of businesses

(Svensson, 2010). Organizations need to acquire capacity to respond to potential volatile demand fluctuations.

Using IT to share data between customers and vendors is critical to agile delivery (Harrison et al., 2009). In anticipation of anticipated and often distorted demand, this will enhance the visibility of demands and decrease inventory holdings (Hewitt, 2009). Shared information between supply chain partners is needed to sustain the extended business where collaborative alliances support information exchange to enable activities such as joint product development and common systems. Childerhouse and Towill (2010) claim that for innovative products where demand is unpredictable, adopting agile principles is important.

Lee (2014) indicates that the primary goals of supply chain agility are to react rapidly to short-term demand or supply shifts and to deal smoothly with external disruptions. Intuitively, the agile supply chain is also extremely responsive to the market, because it can respond quickly to sudden peaks of demand. Fisher (2007) says that innovative products should always require a responsive supply chain that reacts rapidly to unexpected demand to minimize stock-outs, forced markdowns and outdated inventories. Market responsive procedures can be developed through the decisive deployment of surplus production ability and substantial buffer stocks of products, through aggressive investment in ways to decrease lead time, Key vendors are selected mainly for velocity, flexibility and quality. Successful delivery chain agility always needs demand-driven strategy, excellent end-to-end visibility, and profound process cooperation among all supply chain partners. Ismail et al. (2011) may suggest that requiring networks to stay competitive should strive to achieve adequate amount of agility to match the amount of change and uncertainty in both the general and individual company setting. A systematic method is needed to determine the suitable amount of agility and hence the supply chain strategy. To survive and thrive in the ever-changing company environment, companies need to enhance their supply chain agility by implementing the right approach in configuring the supply chain structure and establishing the relationship with their partners (Christopher & Towill, 2010).

Despite a number of researchers suggesting that companies can enhance their agility by capitalizing on their suppliers' agile capabilities through long-term, collaborative relationships (Peck and Juttner, 2010), there are some arguments that a tight relationship with one supplier. By applying the correct strategy in configuring the supply chain framework and creating relationships with their partners, businesses need to improve their supply chain agility (Christopher & Towill, 2010).

Although a number of researchers suggest that companies can increase their agility by capitalizing on the agile capabilities of their suppliers through long-term, collaborative relationships (Peck & Juttner, 2010), there are some arguments that a close connection with one provider may avoid an adaptive and flexible design of the supply chain (Jordan & Michel, 2010) Can discourage adaptability and flexibility of the supply chain layout (Jordan & Michel, 2010). In a setting of turbulent and volatile markets, agility is regarded one of the basic features required for a supply chain to survive and flourish (Agarwal et al., 2007). Because of reduced product life cycles, these circumstances become the norm, increasing demand for tailored products and services, decreased demand visibility, and constant change. Swafford et al. (2008) have recognized that agility is more important than ever before for their strength and competitiveness (Lin et al., 2016). Agility has been observed as an organizational enabler for a rapid and efficient response that allows the company to develop a competitive benefit (Swafford et al., 2016). In addition, the agility of the supply chain of a company was recognized as a critical factor influencing its worldwide competitiveness as a whole. In the supply chain, the role of agility is to enable the respective members to respond quickly to unforeseen changes in supply and/or demand (Lee, 2014). Over time, the motive for businesses to attain agility seems to be driven by the need to provide client value in a setting where client demands are becoming more tailored.

Agile manufacturing is seen as a means of responding quickly to demand changes and meeting commonly diverse client demands in terms of price, specification, quality, quantity and distribution (Katayama & Bennett, 2009). Gehani (2015) indicates that some activities are required to implement an agility-based approach such as cross-functional teams, technology integration, the ability to delay design

specification, and learning entrepreneurship assimilation. Technological skills, and in particular information technology, appear prominently as an enabler of agility throughout the literature. Zhang and Sharifi (2001) made a significant contribution by categorizing agility capacities as responsiveness, skill, flexibility and velocity. Sanchez and Nahi (2011) observed that there is also a need for cooperation and synergy to create agility, along with responsive development and distribution of customer-valued, high-quality mass tailored products and/or services. Sharp et al. (2009) conceptualize supply chain agility as a supply chain's capacity to react quickly to market and client demand shifts. Runfola and Guercini (2013) fashion markets are characterised with rapid change and, as a result, success or failure in those markets is largely determined by the organization's flexibility and responsiveness. The significance of time as a competitive tool has been recognised for long. The ability to meet the needs of customers for ever-shorter delivery times and to ensure that supply can be matched to meet the highs and lows of demand is a vital attribute to an organization's competitiveness.

In the past few years there has been a growing focus in the formulation and implementation of agile supply chain strategies. Supply chain performance improvement activities strive to synchronize supply to demand thus reducing costs and consequently improving customer satisfaction. Traditional supply chains have been lengthy with long lead-times and are forecast driven. On the contrary, agile supply chains are shorter and focus to be demand-driven. Further, conventional supply chains are forecast driven which means that they are inventory-based. Agile supply chains seem to be directed as information-based. A key principle of QR (quick response) is the matching of organizational functions to demand. All activities within an organization should be matched to demand and customer behavior. Products and services should be produced and delivered in the quality and quantity that match demand. To achieve quick response, drivers of demand must be matched with supply chain. QR brings to attention that both consumers and products are continuously changing and therefore the organization has to match the same (Christopher et al., 2014).

### **2.3.2 Risk Hedging Supply Chain Strategy**

The significance of risk management in company decision-making in general, and particularly in strategic choices, has become mainly evident over the past 15 years. Researchers have noticed that risk factors should be included in organizational policies after nearly 50 years of extensive studies on managerial conduct under uncertainty (March & Shapira, 2007). Chopra and Sodhi (2004) argue that most businesses are developing plans to safeguard their supply chains against recurring low-impact hazards. However, many are unaware of high-impact, low-like hazards. Managers can tailor balanced, efficient risk reduction policies by knowing the range and interconnectedness of supply chain hazards, Managers can tailor their company's balanced, efficient risk reduction strategies. Hauser (2013) indicates that risk-adjusted supply chain management can translate into enhanced economic results and competitive benefit in today's progressively complicated setting. Juttner et al. (2015) suggest researching risk management in various supply chains and developing environment-based strategies.

The most significant risk occurrences for worldwide supply chain executives are currency, transit time variability, forecasts, quality, safety, company disturbance, survival, ownership of inventories (and instruments), culture, dependence and opportunism, fluctuations in oil prices and risk activities Influences providers and clients. The supply chain supports all of these risk occurrences (Chopra & Sodhi, 2014). Supply chain risk management is the identification and assessment of hazards and consequent losses in the worldwide supply chain and the execution of suitable policies through a coordinated strategy between supply chain members with the aim of decreasing one or more of the following losses, likelihood, event velocity, loss rate, time to detect incidents, frequency or exposure Risk hedging is a costly approach because this includes generating various decision variables alternatives. Dual sourcing, for instance, can be used as a hedge against quality, amount, disturbance, cost, performance variability, and opportunism hazards. Hedging needs elevated investment rates that are justified and useful only when a supply chain faces high supply hazards (Juttner et al., 2015). Risks are shared or transferred by outsourcing and/or writing flexible contracts with provisions that account for

possible environmental modifications and related hazards (Macneil, 2008). Risk sharing and transfer may occur in either short-term or long-term focused supply chains. Peck (2015) analyzes the vulnerability of the supply chain, explaining the level at which a supply chain is at risk. In order to decrease vulnerability, businesses must obtain additional understanding about their drivers, enhance the resilience of the supply chain and thus improve "a system's capacity to return to its initial (or desired) condition after being disrupted." Juttner (2015) also emphasizes Risk assessment problems across the supply chain, as opposed to risk management within a single organization.

Manuj and Mentzer (2008) align their supply chain risk management method primarily with the overall risk management process by defining and assessing hazards, choosing suitable management approaches and applying risk mitigation strategies. There are seven risk management strategies categories: avoidance, delay, speculation, control, sharing, transfer, safety and hedging (Juttner et al., 2013). Today, businesses can safeguard themselves against various market hazards, especially by hedging, which is described as a deliberate Threat restriction through risk compensation. While holding strategic inventory security stocks and keeping alternatives with various providers are expensive strategies, if companies are compelled to curtail activities, the adverse impacts of such events may outweigh the cost of using redundancy strategy (Caldentey & Haugh, 2016).

Natural supply chain hedging seeks a deliberate and targeted exercise of impact on the hazards of two or more businesses in a value network, where one firm takes threat-limiting measures in favor of another partner. Natural supply chain hedging enhances current risk strategies by including value network partners. The natural hedging approach is consistent with a supply chain risk hedging strategy, sharing supply disruption hazards through pooling and sharing of resource structures within and across businesses (Sun et al., 2009). Risk, unlike hazard and uncertainty, means a future decision-making domain. Consequently, risk management generates the expectation that uncertainty and chance will be decided and managed (Power, 2007). Porter (2015) claims that there are two main ways in which a business can achieve competitive advantage over its rivals: cost advantage, and differentiation. Risk

management capabilities can theatrically affect both a company's costs and the value it creates for its customers (differentiation).

According to Son and Orchard (2013) contemporary supply chains are increasingly exposed to the possibilities of encountering supply chain disruptions as a result of due to size, dynamic environment, and complex changing customer demands and requirements (Ponomarov & Holcomb, 2009). Therefore, the demand for effective management of supply chain risk is becoming a necessity in today's global supply networks where suppliers and customers are outstretched geographical while at the same time commercial environment are continuously dynamic (Antai & Olson, 2013). Past empirical studies have showed high vulnerability of supply chains to disruptions in today's environment. Consequently, managing supply chain risks is the single major area of focus in modern organizations (Tummala & Schoenherr, 2011). It is in cognizance of these supply chain risks exposure that firms' are increasing driving their activities towards supply chain resilience and risk mitigation strategies. Organizations are continuously putting in place measures to formulate and implement supply chain risks resilience strategies that can cope with ever changing environment (Wieland & Wallenburg, 2013).

### **2.3.3 Postponement Supply Chain Strategy**

Each business wants to create precisely what clients want to eat at the right location and moment (Ballou, 2009). Ideally, they only activate the entire design-make-ship cycle when there is a clear demand signal. This can be categorized as the greatest delay stage, allowing businesses to maximize their earnings by completely understanding actual client demands. The potential of e-business is thought to be wide-ranging (e.g. in the new cyber retailer Amazon.com and the internet business-to-business procurement network General Electric Global eXchange Services) and thus possibilities exist to reengineer current supply chains or to design new supply chains or use postponement approaches to develop fresh supply chains (Lee & Whang, 2011).

Postponing can improve a company's flexibility to satisfy the increasing product range and rapid response requirements efficiently (Lee et al., 2014). The quantity of



study addressing postponement has risen significantly in latest times. At the same moment, businesses as varied as Hewlett-Packard (HP) Company, Dell Computer, Motorola, Japan's National Bicycle Industry Company (NBIC), Toyota Motor Corporation, Gillette Company, and Benneton clothing manufacturer are using this idea. Despite increasing attention to postponement, its application are far less than anticipated at the moment (Battezzati & Magnani, 2010). For instance, in the food sector, a forecast is that by 2010, over 50% of all inventories will be stored in a semi-finished state, and final processing and delivery will be processed against a particular client order.

In the moment postponement category of Zinn and Bowersox (2018), it is suggested that an anticipatory inventory be maintained at one or several strategic places. They also provide insight into how four kinds of postponement (labeling, packaging, installation and production) can be applied to enhance the physical distribution system's productivity. In latest literature, further postponement calls for the strategically centralized storage of differentiated Achieving a balance between price and responsiveness of the inventory. In the distribution channel, the repositioning of manufacturing operations also involves postponement, not restricted to relocating inventories. This thinking is not surprising when it is regarded that the achievement of postponement policies depends in part on where particular end products should take shape in the process. Postponement may move the final setup from manufacturer plants closer to the end-use client, enabling fast delivery of tailored products and rapid response to modifications in display mixes (Bowersox & Closs, 2016).

The nature of product flow and the routing of manufacturing may also have consequences for postponement implementation (Yang & Burns, 2013). Postponing implies prolonging some stage, generally preceding the point of differentiation. Companies may tend to apply upstream postponement in terms of inventory expenses, as inventories of raw materials are generally cheaper than inventories of end items. The best location for postponement in other contexts could be the convergence of the bill of materials in that it is the place in the supply chain where the quantity of parts, components, sub-assemblies or assemblies is the lowest. Taking this into account, it can be delayed. The variety, value, quantity and weight of a

product rises by postponing the cost of saving on stock carrying and keeping, assortment, storage and obsolescence. Postponing is useful when capacity is non-responsive (i.e., supplier lead times are long, production schedules are inflexible, or production amounts are restricted) (Zinn & Bowersox, 2008).

Postponing is one of the most useful strategic processes for managing product range and uncertain sales hazards (Aviv & Federgruen, 2011). Furthermore, since the postponement of manufacturing enables businesses to function without a completed inventory, businesses can profit from keeping the bulk by delaying costly activities and point of product differentiation of their inventories in the cheaper and/or pre-customized form. Using commonality in components can also allow postponement of purchases. Following this approach, until client order has been placed, Dell will not purchase monitors for its PCs. In reality, it is not necessary to ship monitors first to Dell. Instead, Dell receives an e-mail from United Parcel Service (UPS) and draws a monitor directly from provider stocks and coordinates it with the PC to reach the client. This postponement strategy is estimated to save \$30 in freight costs per display unit (McWilliams, 2007).

Apparently, the manufacturing method must allow a stream of discrete measures to take place to postpone. In this regard, modularity in production (decoupling the process in at least two sub-processes, separated in time and/or place) is a prerequisite for postponement of production. Since postponement of manufacturing means that customer orders are fulfilled through production rather than through the holding of finished products, a reliable supplier network capable of supplying parts and services plays a key role in its application (Feitzinger & Lee, 2017). The selection of distinct approaches for postponement relies on the extent to which a business can modularize its goods and procedures (Yang et al., 2013). In the event of SmartCar, the comprehensive use of manufacturing postponement causes vendors to take over portion of the assembly plant where they deliver parts from their workshop adjacent to the plant straight into the final assembly line (Van Hoek, 2018).

Yang et al. (2014) further expanded and refined the postponement idea to include postponement of product development, postponement of purchases, postponement of

manufacturing and postponement of logistics. Postponement of production and postponement of logistics are comparable to previously deliberated impressions of postponement. Purchasing postponement concerns the notion of risk shift by delaying the acquisition of raw materials to the point of manufacturing. However, postponement of product growth expands the concept of postponement to the earliest phases of the supply chain. The postponement of product development offers a chance to decrease lead times in design and expensive redesigns. By concentrating originally on product specification choices that are likely to stay stable, design choices can be delayed until better data is accessible about less stable parts of the product. Toyota technicians and executives, for instance, delay certain choices and provide vendors with partial data while exploring many prototypes (Ward et al., 2015).

Postponement fosters a fresh approach to the supply chain (Yang & Burns, 2013) and has been recognized as a significant feature of contemporary and competitive supply chains (Van Hoek, 2009). Considering, for instance, the potential for postponement in saving stock holding and cost sharing, the longer and broader the supply chain, the higher the potential advantages of postponement. To enhance its responsiveness to client requirements, Benetton used postponement. Benetton is better placed to react to common colored clothing requirements by postponing the dyeing of its clothes and reducing surplus inventory of less common colors (Dapiran, 2012). By postponing the shipment of appliances to Sears until a customer order is received, Whirlpool was able to achieve a significant reduction in the cost of inventory and transport. The final assembly of its DeskJet printers was delayed by Hewlett Packard until the very early phases of the supply chain. This postponement of final assembly, coupled with shifting assembly sites closer to clients, led in a more cost-effective manufacturing method while lowering transport and logistics expenses (Feitzinger & Lee, 2007).

#### **2.3.4 Lean Supply Chain Strategy**

A lean supply chain produces what is needed and how much, when it is needed, and where it is needed. In lean thinking, the fundamental theme is to create more or do more with fewer resources while providing the end client precisely what they want.

This implies that each item and its value stream are concentrated. To do this, organizations need to be prepared to ask and comprehend what operations are really worthwhile and what are wasteful. The most important thing to remember is that lean isn't just about disposing of waste, it's about eliminating waste and increasing value (Tompkins, 2013). Lean providers are the primary elements of the lean supply chain, lean procurement, Lean production, lean storage, lean transport and lean clients (Tompkins, 2013). Speed and client responsiveness, decreased inventories, decreased expenses, enhanced customer satisfaction, supply chain as a competitive weapon are the main elements of a lean supply chain (Schultz, 2016).

Lean supply chain strategies focus on waste reduction, helping firms eliminate overtime, labor, equipment, space, and inventory-related non-value-adding activities across the supply chain. Such strategies allow companies to enhance quality, decrease expenses and enhance customer service as traditional mass production and supply chain methods (Larson & Greenwood, 2014). As supply chains increase in complexity and duration, lean methods are becoming increasingly hard to enforce and maintain. Cox et al. (2017) states that the lean approach can only be successful for products operating in chains characterized by regularity, high volume and standardized demand (automotive, chemical, food retail, aerospace). Lean supply chains at its core mean reducing waste to the greatest extent possible, where waste is any activity or cost that from the customer's point of view does not directly add value to the product. Lean is a process of incremental optimization. The gradual removal of more and more waste leads to more effectiveness. If lean is correctly applied, flexibility can be increased. The development of a lean supply chain requires lean application as a mechanism to the supply chain (Phelps, 2014).

The aim of the lean supply chain is to deliver as little waste as possible to the right product at the right time. To achieve this objective, businesses need to define fresh methods of cutting expenses while enhancing productivity, quality, and client satisfaction (Ross, 2013). Anywhere in the channel network, a lean supply chain aims to reduce waste; standardize processes across traditional, vertical organizational structures; and optimize important assets. A lean supply chain aims to decrease waste in the channel network anywhere; standardize procedures across traditional, vertical

organizational structures; and optimize key assets. Lean supply chains try to generate customer-winning value by synchronizing product / service requirements with the ideal provider in real time at the lowest price. Lean supply chains are devoted throughout the expanded supply chain to the continuous improvement of individuals and procedures. Lean value chains focus on eliminating waste through the demand-based scheme with a bias towards pulling products. Lean is a strategy that recognizes the inherent value of particular products, defines the value stream for each item, promotes value flow, allows the producer to draw the value of the client, and pursues perfection. The theory expands beyond functional strategy to a wider supply chain strategy employed by the business through this holistic, enterprise-wide approach to lean execution (Goldsby, 2005).

A major paradigm for present production is the lean manufacturing system. Therefore, the primary pillars are: Produce only what is necessary, at the required quantity and at the required time (Just-in-time (JIT) philosophy); and autonomy (employee empowerment) (Holweg, 2007), aimed at maximizing value for the customer by eliminating waste in the production flow (Dennis, 2008). Arkader (2011), the function of the supplier to reduce waste throughout the supply chain is very crucial. Wu (2013) adds that vendors who adopt lean production methods attain a higher competitive advantage in logistics than providers who do not adopt lean production. Sun (2010) therefore specifies that supplier choice and inclusion has a beneficial impact on lean manufacturing adoption.

In turn, for the focal company, usually a manufacturer, it is also essential for manufacturers to pursue lean production methods in their position as the primary customer in the supply chain. Whether by the manufacturer's recommendation or due to compulsory problems, providers must comply with the criteria enforced, which may include, for instance, high product quality, high quality process control, and quality inspection scheme (D'Angelo & Amato Neto, 2008). Simpson and Power (2015) indicate that lean manufacturing findings are dependent on dissemination Knowledge and sharing in the focal company-supplier relationship of lean production principles. Lean philosophy is one of many measures adopted by significant companies around the globe to stay competitive on the progressively

worldwide market (Schonberger, 2017). The lean strategy focuses on cost reduction by eliminating non-value-added (NVA) operations and using lean instruments for sustainability and supply optimization. A lean supply chain's key thrust is to produce a simplified, extremely effective system that generates finished products with little or no waste at the speed that clients demand (Shah & Ward, 2013). Lean is relevant in many supply chains, predominantly those seeking to improve performance by eliminating waste. For example, cost competitive supply chains can benefit from utilizing lean to remove waste and reduce costs.

Lean production is a key manufacturing philosophy whose foundation is customer-focused process improvements. The main focus is to increase value to customers while at the same time decreasing the number of resources used and cycle times through waste elimination (Ciarniene & Vienazindiene, 2012). To attain competitiveness and reduce costs, many manufacturers are engaging lean manufacturing methods to drastically reduce cycle time and enhance their competitive edge.

### **2.3.5 Environmental uncertainty**

Environmental uncertainty includes those occurrences and variables that vary randomly and unpredictably, affecting a company's very life (Turner, 2013). As a consequence of progressively demanding clients, today's markets are becoming hyper-competitive (Thomas & Griffin, 2016), and environmental uncertainty has become a major force affecting the competitiveness of the supply chain. Uncertainty influencing supply chain activities is a significant barrier to delivering superior value to customers (Mason-Jones & Towill, 2018). In the face of such uncertainty, the supply network of manufacturing firms will either strive to monitor the differences, thereby increasing On-cost or otherwise buffer up inventory against such differences, risking extra stock holding expenses and obsolescence. Uncertainty is a strategic issue in supply chains, suggesting that it comes from four main sources: supply side, production process, control systems, and demand side.

Environmental turbulence includes uncertainty or unpredictability and has a significant effect on key supply chain integration choices, especially on risk assessment and the need for more flexibility. Turbulence is traditionally linked to transaction costs, including finding, selling, negotiating, tracking and dispute resolution expenses. In open market transactions with other companies (Coase, 2017). Furthermore, theorists of organizations (Dess & Beard, 2014) emphasize the need for organizations to adapt flexibly or protect themselves from progressively turbulent and complicated environmental circumstances. On the one side, businesses would tend to have a more flexible and easy structural arrangement when faced with an extremely complicated setting by concentrating on a few main operations in a value chain and outsourcing other less core operations. On the other side, companies are more likely to try to minimize the uncertainties of coping with internal providers by tightly monitoring these operations at different phases of the supply chain. Greater environmental uncertainty calls for higher integration of the supply chain to capture the advantages of organizational hierarchy-derived coordinated operations (Williamson, 2015). Costs connected with manufacturing decoupling, inventory scheduling and R&D coordination across various sides are significantly improved under turbulent environmental circumstances.

Vorst and Beulens (2012) Supply chain uncertainty relates to decision-making circumstances in the supply chain where the decision-maker certainly does not know what to decide because he is indifferent to the goals; lacks environmental or supply chain data; lacks information processing ability; is unable to predict correctly the effect of potential control actions on supply chain behaviour; or lacks efficient control activities. Donk and Vaart's (2015) regard uncertainties of technology and demand as an exogenous factor experienced by a supply chain company. This implies the supply chain's primary function is not to minimize uncertainty about technology or demand, but to mitigate the adverse impact on delivery performance of technological and demand uncertainties. Therefore, it is asserted that companies that have been able to incorporate particular supply chain strategies they outperformed those businesses that did not (Mason-Jones & Towill, 2017), as required by their competitive setting.

Fisher (2017) shows that technological uncertainty varies depending on the product or industry sector. Technological uncertainty can be caused by the enhanced complexity of components or the novelty of part features in the automotive industry. When this happens, the probability of delay in shipment and issues with product quality will increase (Oh & Rhee, 2008). When such technological uncertainty is experienced concurrently by several sides in a supply chain, an integrated supply chain with a higher capacity for collaboration has aligned goals and shares information will be able to mitigate its adverse effect on delivery performance can be mitigated. Demand uncertainty is the extent to which a customer's needs and demands change and are unpredictable (Chang et al., 2012). Geary et al. (2012) states that uncertainty of supply can be seen as the distinction between its customers' real demand for the end-marketplace and the orders placed with an organization. Customers today also want quicker and more reliable delivery while requiring more range, greater quality, and better product. This does not imply that clients can continuously pass on to their upstream providers a predictable demand. Typically, products with high demand variability, uneven purchasing, elevated innovation rate, and brief product life cycle will produce a greater level of demand uncertainty for upstream providers (Chang et al., 2012).

The globalization of supply chains implies that a range of infrastructures, environments and cultures and the relationships between them are now affecting the manufacturing of many products and services. As a consequence, there is potential for enhanced uncertainty, risk and complexity in the supply chain (Bhatnagar & Sohal, 2015; Merschmann & Thonemann, 2011). Therefore, identifying the main sources of uncertainty within supply chains and developing strategies for managing them is a significant business task. Delivery uncertainties impose serious operational problems, making it hard for businesses to reliably satisfy client demand. Hendricks and Singhal (2013) discovered component shortage to be the major cause of crashes in the supply chain. Other sources of manufacturing delay include quality issues and lengthy lead times in supplying the vendors with the correct components at the correct moment. Therefore, businesses have to adapt to supply differences to be responsive. Effectively managing supply uncertainties enables a business to reliably procure supplies (Handfield & Pannesi, 2015) and mitigate the adverse effect of



supply uncertainties on the capacity of a business to pursue mass customization because it can more efficiently match supply with demand.

Environmental uncertainty is often encountered by the growth of a data sharing scheme between supply chain partners by management and by enhancing powerful cooperative trust-based partnerships (McNamara et al., 2012). In research covering UK, New Zealand and Thailand supply chains, Childerhouse et al. (2011) established that most companies around the world are facing elevated rates of uncertainty, yet they still need to effectively streamline and integrate their supply chain procedures to their and their partners' detriment. However, internal resources and capacities appear to be less efficient in addressing environmental uncertainty than concentrating on external resources. Increasing Total Quality Management (TQM) methods under environmental uncertainty have been suggested to impact organizational efficiency. Only under low environmental uncertainty, quality practices affect company efficiency. It was found that management could give more significance to other dimensions under uncertain circumstances like marketing orientation and supply strategies than quality practices (Carter et al., 2010).

It has long been acknowledged that the fit between environmental uncertainty and flexibility policy, including flexibility in the supply chain, is essential to organizational efficiency (Wagner et al., 2012). Flexibility approach has its own advantages and expenses for the organization, the weights of which differ across levels of environmental uncertainty such as improving product range and diversity (Anand & Ward, 2014), decreasing reaction times to client requirements, assisting companies to customize and improving customer loyalty (Hartmann & Grahl, 2011). An extremely evolving environment, while challenging the current supply chain strategy and business activities, also provides higher possibilities. Therefore, the advantage of a less flexible supply chain approach that suits the stable environment is not as great as the advantage of the flexible approach that suits the evolving environment. In other words, the result of a policy that suits a greater atmosphere is a marginal efficiency rise (Barreto, 2012).

### **2.3.6 Performance of Manufacturing Firms in Kenya**

Martin and Patterson (2009) regard efficiency as one of the performance aspects to include inventory, cycle time and economic, including the use of assets. Lai, Ngai, & Cheng (2012) split performance into two categories, customer-facing and internal-facing performance, concluding that measures such as reliability of the supply chain, flexibility and responsiveness can be regarded as customer-facing, while expenses and usage of assets are internal. Lorentz et al. (2012) evaluated intra-company supply chain performance and economic performance, including cost efficiency, service quality and asset usage as performance dimensions of the intra-company supply chain Performance and economic performance, including price performance, service performance and use of assets as aspects of intra-company supply chain performance, and economic performance measurement such as Return on Assets (ROA), Return on Employed Capital (ROCE) and Earnings Before Interest.

Return on sales and return on investment can be evaluated by market share, profit margin, sales development, overall product quality, overall competitive position, average selling price. The measurement of firm performance can be split into two categories that are economic and non-financial measures. Non-financial measures include elements such as satisfaction of customers, environmental performance, Satisfaction of employees, social performance, significance, effectiveness and effectiveness (Ganeshkumar & Nambirajan, 2013). Empirically, Hudaib and Haniffa (2016) documents important adverse link between firm size and firm efficiency. On the other side, big companies are reported to have a direct impact on company performance (Aljifri & Moustafa, 2017). Kumar (2014) reports that, due to economies of scale, big companies are more effective than small companies and market power. Because of their capacity to diversify their risks, larger companies are better performers than smaller companies. Haniffa and Hudaib (2016) report that big companies have more analysts who are concerned about the results of companies and as such will be under greater pressure to perform well.

When defining achievement, there are certain elements that must be regarded. They include the time frame and its point of reference. Past and future performance may differ as a better previous does not ensure superior future efficiency (Carneiro, 2015). Output can also be short, medium, and long-term. Performance can also be evaluated against the average sector, rivals, goal or previous performance (Carneiro, Silva, Rocha, & Dib, 2017). To enhance the efficiency of the company through supply chain management, organizations need to plan to incorporate cross-functional operations within the company and to link them internally efficiently with the procedures of their supply chain company partners, vendors and clients (Narasimhan, 2017). The inclusion approach of the supply chain generates value for the clients of a company and brings providers and clients into the process of value development (Vickery et al., 2013). Gregory & Platts (2015) concluded that performance could be split into four aspects of quality, time, price and flexibility. These dimensions have been altered from the supply chain view by Beamon (2009), dividing supply chain efficiency into three classifications: resource-related, output-related and flexibility-related.

## **2.4 Empirical Review**

### **2.4.1 Agile Supply Chain Strategy and Performance of manufacturing firms**

Tarafdar and Qrunfleh (2017) focused on agile supply chain strategy and supply chain performance. The objectives of the study were to examine the mediating effect of supply chain practices on the relationship between Agile Supply Chain (ASC) strategy and Supply Chain (SC) performance and also to examine the moderating effect of Information Systems (IS) capability for agility on this mediated relationship. The study tested the hypotheses using survey data from members of senior and executive management in the logistics/supply chain functions, of 205 firms. Using the theoretical lenses of complementarity and the information processing view of the supply chain, the study found that strategic supplier partnership, customer relationship, postponement, and lean practices, mediate the relationship between ASC strategy and SC performance. In addition, the study found that IS capability for agility moderates each of these mediated relationships. The

study focused on only one form of supply chain strategies thus showing a conceptual gap. The current study will focus on more supply chain strategies which include; risk hedging supply chain, postponement supply chain strategy, lean supply chain strategy and performance of manufacturing firms, environmental uncertainties

Sendil (2015) did a study on developing a successful and sustainable agile supply chain in alignment with business strategy for profitability. The study objectives included examining the supply chain network and the factors influencing the network, it examined the supply chain alignment with the business strategy and its implementation, it explored the supply chain drivers and metrics to improve the supply chain profitability and also it discussed managing supply chain relationships for co-operation and trust. The study was based on past studies literature. The study found that the main supply chain challenges included global supply chain with long lead times, rising and shifting customer expectations, increase in labor costs in developing countries, increase in logistics costs, rising energy prices, rail capacity pressure, truck driver shortage and security requirements.

A framework supporting the design of a lean-agile supply chain towards improving logistics performance was done by (Ngwainbi, 2018). The objective of the project was to develop a framework that supports the design of a lean agile supply chain towards improving logistics performance. The research questions were for identifying those efficient metrics that affects logistics performance and the implementation of a lean-agile supply chain design to improve on them. The study used case study research design. Semi-structured interviews were conducted with different companies within the municipality of Malardalen in Sweden. Therefore, results and conclusions to this project was a framework which supports the need for a lean agile supply chain design towards improving logistics performance. It has supported the fact that a lean logistics system will provide an efficient flow of material through the supply chain by eliminating waste, minimizing stocks and costs, gives shorter lead times and work toward a JIT process, whereas agility at the other hand, has equally proven beyond convincing doubts that it's manifestation in every industrial landscape is unstoppable through its ability to give flexible manufacturing systems that can switch rapidly to fast changing market demands.

In United Kingdom, Purvis (2010) did a study on Agile Supply Chain Management in the UK Fashion Sector. The objective of the study was to determine how companies operating in the UK fashion market sector to achieve high levels of agility. The study used case study research design. The study main findings were threefold. First, due to the fact that traditional supply chains are either too complex or cost-laden to distribute low-cost products effectively or too asset-intensive and inflexible to quickly harness and deploy innovation, companies need to build 'fit-for-purpose' supply chain networks. This involves configuring supply networks in a tailored fashion to deliver innovation and responsiveness for premium brands and high efficiency for mass value products. Second, through high levels of process integration companies should accelerate the innovation process so that new products and promotions can be introduced into stores more cheaply and quickly. They should also reinvent the value chain by reconfiguring operations to radically cut costs and proactively meet customer demands. Third, to enable high levels of agility in a global sourcing context through rapid supply systems reconfiguration, new supply chain structures and actors, such as trade agents / intermediaries, need to be involved.

On a study that focused on agility and product supply chain design Marche, Boly, Morel, Mayer & Ortt (2019) found that agility had a significant effect on performance. The objective of the study was to demonstrate that an innovative company can reconfigure and make its supply chain agile to adapt it to the specifications of the new product and increase its success rate when it is launched on the market and also to better describe the two concepts agile supply chain and agility of the supply chain" based on the case of Swatch. The study used case study research design. The study findings indicated that it is possible to describe the links between a product and its supply chain and also to visualize the evolution of the latter if the product gains greater novelty. The study adopted a case study research design thus developing a methodological gap. The current study will adopt a descriptive research design.

In Iran, Ghatari, Mehralian, Zarenezhad and Rasekh (2013) did a study on developing a model for agile supply in Iranian pharmaceutical supply chain. The main objective of the study was to promote supplier selection in pharmaceutical

industry according to the formative basic factors. Moreover, this paper can configure its supply network to achieve the agile supply chain. The study analyzed the supply part of supply chain based on SCOR model, used to assess agile supply chains by highlighting their specific characteristics and applicability in providing the Active Pharmaceutical Ingredient (API). This methodology provides an analytical modeling; the model enables potential suppliers to be assessed against the multiple criteria using both quantitative and qualitative measures. In addition, for making priority of critical factors, TOPSIS algorithm was used as a common technique of MADM model. The study found that the common factors that affect agile supply included delivery speed, planning and reorder segmentation, trust development and material quantity adjustment are identified and prioritized as critical factors for being agile in supply of API. The study further established that organizations need agility to deal with these situations and they should track these categories not only in the organization but also in their entire supply chain.

In a study on impact of agile supply chains' delivery practices on firms' performance, Khan, Bakkappa, Metri & Sahay (2009) found that collaborative distribution, order commitment, distribution flexibility and inventory management are the key SCM distribution practices associated with agile supply chains, and have significant impact on organizational performance. The aim of the study was to identify the critical distribution practices of agile supply chains and provide a comprehensive framework that can be used to improve the responsiveness of supply chains. The research was carried out in the context of different manufacturing industries and provides empirical evidence that agile supply chain distribution enhances organizational performance. The paper employed survey research, using a sample of 128 manufacturing companies. Data were collected from a single node/respondent of a supply chain.

According to Jermsittiparsert, Sutduean, Sriyakul and Khumboon (2019) supply chain agility has emerged as one of the key areas of supply chain research. Jermsittiparsert, Sutduean, Sriyakul and Khumboon (2019) therefore focused on the role of customer responsiveness in improving the external performance of an agile supply chain. The study also examined the moderating role of customer

responsiveness in the relationship between agile supply chain and external supply chain performance of Indonesian firms. The SEM-PLS is used to analyze the data collected by mean of an adopted questionnaire from operation managers of Indonesian firms. The findings of the study indicated a direct and indirect relation through structural equation modeling appears significant and positive.

While investigating the mediating role of information sharing strategy on agile supply chain, Alzoubi and Yanamandra (2020) indicated that supply chains need to redesign their existing strategies and must develop new strategies to effectively face the challenges posed by certain disruptions, both man-made and natural. This requires the supply chains to be highly flexible, visible, reliable and cost-effective leading to the achievement of Agile Supply Chain (ASC). The study also discovered that in today's competitive market, achieving agility in supply chain needs dynamic leadership, strategic vision, mutual cooperation from all members and effective utilization of information technology through customer focus. The study further indicated that in spite of their initiatives to achieve ASC for improving their organizational performance, barring a few large companies, the medium and small size manufacturing companies have not yet been able to adopt and design supply chains which lead to ASC. It is also found that information sharing plays a major mediating role in ASC to achieve superior supply chain performance.

Research by Routroy and Shankar (2015) focused on performance analysis of agile supply chain. The paper considered Agile supply chain (ASC) as the best alternative to serve difficult markets having uncertain demand, immature and innovative products, ever changing and increasing customer expectations, etc. The paper further considered continuous performance evaluation is therefore necessary to ensure competitive advantage and business sustainability. Time pressures and difficulty in application to real time situations remain the major reasons for the limited usage of the many available models for measuring agility of ASC. Also, these approaches are not necessary if supply chain managers are only interested to know the agile performance enhancement along certain specified time horizons. The study used a methodology of combining Fuzzy Analytic Hierarchy Process (FAHP) and Performance Value Analysis (PVA) to analyze ASC performance along specified

time horizons. This proposed approach is applied to an apparel supply chain considering three-time horizons and it was observed that there was significant improvement of ASC performance after two years.

In India, Vinodh, Devadasan, Vimal and Kumar (2013) did a study on Design of agile supply chain assessment model and its case study in an Indian automotive component manufacturing organization. The study indicated that agile manufacturing paradigm is fast instilled in modern organizations. Agile manufacturing enables an organization to evolve products and services quickly and economically in response to the customers' dynamic demands. In addition, the study indicated that effectiveness of AM is largely determined by the performance of Agile Supply Chains (ASC). In order to assess their performance, an ASC assessment model was reported in this research paper. This model is encompassed with agile supply chain attributes whose performance levels need to be determined for assessing the overall ASC performance of the organization. The computation was performed using fuzzy logic approach. The working of this model was examined by conducting a case study in an Indian automotive component manufacturing organization. The experience gained by conducting this case study favored the use of a computerized system which will ensure accuracy of computations involving fuzzy logic.

Carvalho, Azevedo and Cruz-Machado (2012) did a study on agile and resilient approaches to supply chain management: influence on performance and competitiveness. The main objective of this paper is to propose a conceptual framework for the analysis of relationships between agile and resilient approaches, supply chain competitiveness and performance. The study was cross sectional. The study indicated that supply chain management must adopt different and more innovative strategies that support a better response to customer needs in an uncertain environment. In addition, the study indicated that the supply chains must be more agile and be more capable of coping with disturbances, meaning that supply chains must be more resilient. The simultaneous deployment of agile and resilient approaches was also found to enhance supply chain performance and competitiveness.



Centobelli, Cerchione and Ertz (2020) did a study on agile supply chain management: where did it come from and where will it go in the era of digital transformation? The study was based on past literature. The study indicated that agile supply chain has become a key strategic move to cope with market instability, handle competitive pressures and strengthen operational and organizational performance in today's dynamic business environment. ASC was also found to be a good example of a strategy drawing heavily on digitization since as a demand chain management it was information-centric and technology-centric from its inception. The study therefore reports descriptively and analytically how technology was addressed within the ASC literature. Second, it maps a nomological network of ASC research. Third, it finds that technology appears as a necessary but not-sufficient enabling factor for ASC deployment. Finally, a research agenda is proposed to suggest future research avenues to improve contributions to ASC performance.

A study done by Ambe (2009) focused on agile supply chain as a strategy for competitive advantage. The study specifically sought to explore the concept of agile supply chain and to determine the link between agile supply chain and competitive advantage. The study used past literature to draw the findings. The study found that order for businesses, they need to respond to ever increasing levels of volatility in demand and focus their efforts upon achieving greater agility. Agility has the ability to rapidly respond to changes in market and customer demands as the bearer of competitive advantage. Therefore, companies need to re-design their supply chain to tackle issues of agility in order to stay ahead in a highly competitive global market.

Malakouti, Rezaei and Shahijan (2017) did a study on agile supply chain management: a management decision-making approach. The purpose of this paper was to determine agile supply chain management among SMEs in manufacturing-related services sector. The study proposed that Entrepreneurial Orientation (EO), participative management style, supplier relations, resource management, just-in-time (JIT) methodology and technology utilization (TU) are several drivers of ASCM – an effective management decision-making approach. Structural equation modelling was employed using partial least squares approach to assess measurement and structural model for reflective and formative constructs. The results revealed that EO,

supplier relations, resource management, JIT methodology and TU positively influence ASCM while participative management style is not a predictor towards an effective ASCM. In addition, EO was found to be a second-order formative construct comprising of innovativeness, risk taking and proactiveness, and ASCM is a first-order formative construct.

Pool, Jamkhaneh, Tabaeian, Tavakoli and Shahin (2018) did a study on the effect of business intelligence adoption on agile supply chain performance. The purpose of this paper was to examine how business intelligence (BI) adoption affects agile performance in supply chain. Drawing from the computer behaviour literature, the study tested the relationship among technology organisation-environment (TOE) framework, BI adoption and agile performance. A structural equation modelling (SEM) test with maximum likelihood estimation was performed to test the relationship among the research variables. The empirical results from the structural model suggested that TOE framework positively influenced business intelligence adoption. Furthermore, BI adoption was a direct antecedent of agile performance.

#### **2.4.2 Risk Hedging Supply Chain and Performance of manufacturing firms**

Liu, Chen, Li and Zhai (2014) did a study on risk hedging in a supply chain. The study focused on two risk hedging strategies which included option contract and advance purchase discount contract, in a two echelon supply chain. The study further focused on optimal decisions under each contract for both the supplier and the retailer respectively. The study was cross sectional in nature and derived the conditions under which either contract should be adopted from the supplier's perspective. The study further demonstrated that supply chain coordination could be reached under the option contract.

Luo and Chen (2017) did a study on risk hedging via option contracts in a random yield supply chain. The study specifically investigated the role of option contracts in a random yield supply chain in the presence of a spot market. The study developed game models to derive the manufacturer's optimal ordering policy and the supplier's optimal production policy under two contract mechanisms. The study found that option contracts can coordinate the manufacturer's order quantity as well as the

supplier's production quantity, and eventually achieve optimal supply chain performance, that is the random yield supply chain can be completely coordinated with option contracts in our setting. However, the study findings also revealed that the supplier and the manufacturer are not always better off with option contracts than without.

In Boston, Krey and Riahi (2013) did a study on risk hedging strategies under energy system and climate policy uncertainties. The study adopted modeling techniques from finance and in particular modern portfolio theory to a systems engineering model of the global energy system and implement several alternative representations of risk. The study objectives were to identify salient characteristics of least-cost risk hedging strategies that are adapted to considerably reduce future risks and are hence robust against a wide range of future uncertainties. These lead to significant changes in response to energy system and carbon price uncertainties, in particular; higher short- to medium-term investments into advanced technologies, pronounced emissions reductions, and diversification of the technology portfolio. The study found that there are strong interactions and synergies between different types of uncertainties. Cost-effective risk hedging strategies thus need to take a holistic view and comprehensively account for all uncertainties jointly. With respect to costs, relatively modest risk premiums (or hedging investments) can significantly reduce the vulnerability of the energy system against the associated uncertainties. The extent of early investments, diversification, and emissions reductions, however, depends on the risk premium that decision makers are willing to pay to respond to prevailing uncertainties and remains thus one of the key policy variables.

Kouvelis, Wu and Xiao (2019) did a study on framework of hedging decisions for supply chain partners. The study specifically focused on cash flow risk hedging in a bilateral supply chain of a supplier and a manufacturer that use internal cash to invest in production efficiency improvements. The study found that the correlation of cash flow risks of supply chain partners significantly affects the hedging decisions of firms via impacts on production efficiencies. When the cash flows of firms are independent, the cost reduction effect favors hedging, whereas the flexibility effect favors not hedging. A firm is more likely to hedge when the supply chain is more

profitable or its supply chain partner hedges. When the cash flows of firms are correlated, the cost reduction and flexibility effect of hedging may complement each other and support the same hedging choice. The impact of market size on firms' hedging decisions is contingent on the cash flow correlation.

Turcic, Kouvelis and Bolandifar (2015) did a study on hedging commodity procurement in a bilateral supply chain. The study explored the merits of hedging stochastic input costs (that is reducing the risk of adverse changes in costs) in a decentralized, risk neutral supply chain. Specifically, the study considered a generalized version of the well-known 'selling-to-the-newsvendor' model in which both the upstream and the downstream firms face stochastic input costs. The study identified conditions under which the risk of the supply chain breakdown will cause the supply chain members to hedge their input costs: The downstream buyer's market power exceeds a critical threshold; or the upstream firm operates on a large margin, there is a high baseline demand for downstream firm's final product, and the downstream firm's market power is below a critical threshold. In absence of these conditions there are equilibria in which neither firm hedges. To sustain hedging in equilibrium, both firms must therefore hedge and supply chain breakdown must be costly.

Bolandifar and Chen (2015) did a study on the optimal hedging strategy for commodity processors in supply chain. The study specifically focused on the optimal hedging strategies for risk neutral players in a competitive supply chain setting. It considered two processors procuring two commodities from spot markets to process and sell through index-based contracts to a retailer. The study first characterized the optimal index-based contracts for processors which implies that processors prefer to be exposed to commodity price risks. The study showed that the processor's optimal contract consists of a processing margin which is independent of its financial hedging decisions and a hedge ratio which is a function of commodity price volatility. Further findings indicated that processors can benefit from market pricing, when these prices are linked to input commodity prices and index-based contracts are a means to link these prices. The study focused on optimal hedging strategy for commodity processors in supply chain but left out the aspect of performance.

Brusset and Bertrand (2018) did a study on hedging weather risk and coordinating supply chains. The study illustrated its action design with case studies of three companies: a company manufacturing automotive replacement parts, a clothing company and a company producing of sunscreen products. The study found that the sales of many products can be influenced by weather conditions, positively or negatively. One of the entrepreneurial risks is to incur lower than expected sales because of adverse weather conditions. The variability of weather conditions is expected to continue to rise because of climate change. Manufacturers can choose to do nothing and suffer the financial consequences, or transfer the weather risk partly or wholly to others. The study therefore presented an approach to transfer weather risks to risk takers and reduce sales volatility using weather index- based financial instruments. The risk of adverse weather conditions was calculated on the basis of adverse conditions observed in the past. Forecasts of weather conditions were not used.

Kiio and Jagongo (2017) did a study on financial risk hedging practices and performance of firms listed in Nairobi Securities Exchange (NSE), Kenya. The study had four specific objectives which were; to assess the effect of foreign exchange hedging practices, examine the influence of commodity price hedging practices, to evaluate the effect of interest rate hedging practices and to examine the effect of equity risk hedging practices on the performance of listed firms at the NSE. The study applied both descriptive and inferential statistics to analyze collected quantitative data. In descriptive analysis the study used the mean and standard deviation to measure the average distribution and variation, respectively. The inferential statistics employed the use of multiple regression model. The study established a positive relationship between hedging practices, the moderator (central bank controls) and dependent variable performance of listed firms. The R<sup>2</sup> of the study increased from 0.391 without the moderator variable (central bank controls) to 0.617 when the model regressed includes the moderator variable.

### **2.4.3 Postponement Supply Chain Strategy and Performance of manufacturing firms**

Świerczek (2010) focused on the relationships between postponement strategies and manufacturing performance in supply. The main research questions were; What are the significant indices of manufacturing performance in investigated supply chains? Which aspects of manufacturing performance should be considered while implementing the postponement strategies in supply chains operating in different industries worldwide? In order to realize an empirical goal of the research the statistical analyses have been carried out. The sample was compiled from surveys of manufacturing firms and consisted originally of 861 manufacturer. The study established that postponement strategy is one of the most popular concepts, widely implemented in contemporary supply chains. Generally, the postponement strategy means delaying supply chain activities purposefully, until the customers' order is received. There is a diverse degree of a delay which is mostly determined by appropriate locations of material decoupling points in a flow of products among parties in a supply chain.

In China, Yeung, Selen, Deming and Min (2007) did a study on postponement strategy from a supply chain perspective. This research widens the scope of the use of postponement by addressing how the generic supply chain structure and information sharing/relationship among supply chain actors affects the postponement decision, based on empirical data of Chinese manufacturers in the Pearl River Delta. This study was exploratory in nature. The research design that was used was a Case analysis, cross-case comparisons, semi-structured interviews. The study found that a cross-case analysis including study of the downstream structure, downstream relationship, upstream structure, upstream relationship, production method and inventory position produced a postponement classification into five categories: balanced structure without customer information; customer dominated; manufacturer dominated; balanced structure with loose suppliers, and finally virtual supply chain. Based on this classification, two propositions are postulated: when a supply chain has a balanced structure, it should use speculation or production postponement. When the

supply chain has an unbalanced structure, it should use purchasing postponement or product development postponement.

Boone, Craighead and Hanna (2017) did a study postponement: an evolving supply chain concept. The specific objective of the study was to assess and document the progress of postponement research, identify current gaps, and provide direction for future research efforts. The study used a desktop research design. Postponement literature published from 1999 to 2006 was reviewed. The review revealed a significant increase in the number of postponement research efforts, many of which at least partially addressed past challenges noted in previous research. Several opportunities to continue addressing these past challenges were identified.

Ivanov and Sokolov (2009) did a study on adaptive supply chain management. The objective of the study were to examine the key drivers and enablers that have transformed postponement into a viable supply chain strategy over the past five years and to identify the critical success factors and benefits resulting from successful postponement implementations. Two streams of primary research were executed for this study. The results from these surveys, in combination with secondary research, formed the basis for the findings highlighted in this report. The study found that the primary reason companies have not considered a postponement strategy is a general lack of understanding of postponement. In addition, key inhibitors of postponement are the perception of risks associated with uncertainty of value realization and technology limitations to support implementation. In addition, increased difficulty to forecast demand and customers demanding higher levels of customization are the primary drivers for implementing postponement. The study also found that key challenges for successfully implementing postponement are organizational alignment and implementation complexity. Postponement often involves the changing of decade-old manufacturing processes. Without consistent top-down sponsorship and support, from design through implementation, a postponement implementation is destined for failure.

Case studies of postponement in the supply chain were done by Rietze (2016). The thesis addressed the growing trend in business to offer a wide variety of products while maintaining customer order fulfillment expectations. This trend was happening at the same time the US is losing manufacturing jobs to overseas labor markets, namely China, India, and Central America. While it may not be possible for the US to compete with these countries on the basis of labor costs or even quality in manufacturing, it can compete in the area of faster delivery times and product-service interaction which must inherently take place onshore. Postponement is a strategy that allows businesses to take advantage of the offshore capacity and labor for manufacturing in addition to local finishing centers for final assembly, packaging, and distribution. Postponement is widely used in the automotive, apparel, and consumer electronics industries. Many companies produce products that are candidates for postponement but are unlikely to undergo the implementation changes necessary to support it. This thesis highlights some of the leading companies who are pioneers of postponement and includes case studies of additional companies who have followed their lead. They have seen the tangible benefits of lower inventory costs, quicker response time, better forecasts, and more variety as well as the intangible benefits of better customer service and the coordination and integration of manufacturing, sales, and marketing functions. The assortment and range of case studies suggest that postponement is used across a breadth of industries and not only profitable as a business strategy but also as a means for creating local jobs because of the inherent product-customer interaction.

Yang and Yang (2010) did a study on postponement in supply chain risk management: a complexity perspective. This study attempted to explore the role of postponement in supply chain risk management from a complexity perspective. After a review of the relevant literature, it first draws insights emerging from normal accident theory that addresses the system characteristics of catastrophic accidents and applies them to supply chain disruptions. This is followed by the utilization of normal accident theory to explain the role of postponement in supply chain risk management. The study also investigated the complexity implications of some commonly recommended measures to mitigate supply chain disruptions. In certain circumstances, the introduction of those measures may add to the complexity of a



system and thus become inherently infeasible. The study concluded that companies are encouraged to simplify their systems to protect them against disruptions. The study also suggests that companies should examine the complexity of their supply chains prior to adopting commonly recommended supply chain risk mitigation strategies. In certain circumstances, the introduction of those strategies may add to the complexity of a system and thus become inherently infeasible.

An approach to assess logistics and ecological supply chain performance using postponement strategies was done by Simão, Gonçalves and Rodriguez (2016). The study presented a methodology that helps managers evaluate how to assess the impact of postponement on supply chain performance considering logistics and ecological criteria. The study considered a green supply chain design that considers CO<sub>2</sub> transport emissions under different postponement strategy scenarios using a simulation tool. It also focused on a relevant extension of postponement theory by including green considerations into the evaluation of postponement strategies in green supply chain design. Moreover, it provides some insight on how to measure and evaluate the impact of postponement regarding supply chain transport performance, considering different transport mode (container ocean ship and truck) using the European Platform on Life-Cycle Assessment (EPLCA) of ELCD European Life-Cycle Database. The study found that logistics and packing postponement strategies can improve the performance of logistics (total inventory and order lead-time) and, at the same time contribute to reducing the environmental impact of CO<sub>2</sub> emissions from transportation process.

Ferreira, Tomas and Alcantara (2015) did a study on theoretical framework for postponement concept in a supply chain. The aim of this paper was to propose a model approach to the postponement concept based on drivers, steps for implementation, and performance measures. This study used a qualitative approach and the theoretical-conceptual method focused on the literature review and the development of new theories on the adoption of the postponement strategy. The time frame of the study included articles on the subject between 1950 and 2012. The study indicated that postponement can be understood as a way to change the form, identity,

or location of products at the latest possible point in time and can be applied at different levels in the supply chain.

Zhou, Huang and Zhang (2014) did a study on a two-stage queuing network on form postponement supply chain with correlated demands. The study developed a two-stage tandem queuing network with MAP arrival to address this issue. Particularly, it introduced a Markov Arrival Process (MAP) to characterize the correlation of the demand. By using of matrix geometric method, it derived several performance measures of the supply chain, such as inventory level and unfill rate. The study established that to ease the conflict between quick response and product variety, more and more business models are developed in supply chains. Among these, the Form Postponement (FP) strategy is an efficient tool and has been widely adopted. To the supply chain with FP strategy, the design mostly involves two problems: determination of Customer Order Decoupling Point (CODP) position and semi-finished product inventory control. The numerical examples show that both the variance and the correlation coefficient of the demand lead to more delayed CODP position and more total cost

Carbonara and Pellegrino (2018) did a study on real options approach to evaluate postponement as supply chain disruptions mitigation strategy. The purpose of this paper was to assess the value of postponement as strategy for mitigating supply chain disruptions. To accomplish this objective, the study developed a real option computational model that quantifies the value of postponement in mitigating both supply and demand disruptions by taking into account the value of managerial flexibility to decide whether exploiting or not the strategy, if and when disruptions occur, and whenever product differentiation proves valuable based on information available at that time. Numerical experiments show the importance of incorporating an option valuation method when pricing the value of postponement. This ensures managers implement postponement only when it is valuable, thus avoiding burdening the company with its initial sunk costs. By modelling the postponement implementation under different conditions, the study identified the situations in which postponement performs better as supply chain disruptions mitigation strategy. The study derived the operational configurations, in terms of decoupling point

position, and external conditions, in terms of riskiness of the environment, which make the postponement an effective mitigation strategy.

Jabbarzadeh, Haughton and Pourmehdi (2019) did a study on robust optimization model for efficient and green supply chain planning with postponement strategy. This study presented a bi-objective robust optimization model for the integrated production and distribution planning of a supply chain with the postponement strategy. The two objectives were economic (cost minimization) and environmental (greenhouse gas emissions minimization). The robust model is capable of incorporating decision makers' risk attitudes in addressing demand uncertainties under conditions of very limited historical data. The application of the proposed approach was examined using real data of an actual pharmaceutical supply chain as well as a benchmark problem in the existing literature. The study results focused on exploring the extent to which the tradeoffs between economic and environmental objectives are influenced by the decision makers' risk preferences and postponement strategy. The study found that independent of the amount of greenhouse gas emissions and degree of demand variability, the postponement strategy can consistently provide cost savings for the supply chain.

Seth and Panigrahi (2015) did a study on application and evaluation of packaging postponement strategy to boost supply chain responsiveness: a case study. The purpose of this study was to demonstrate how packaging postponement can be effectively leveraged in a dynamically changing diverse retail market where responsiveness is key. The study also guided about the empirical evaluation of how packaging postponement affects the performance in the sanitary pads supply chain by considering operating measures. The focal company belongs to the Indian Fast Moving Consumer Goods sector, hygiene products category. It also examined the measures that are critical to a responsive supply chain and presents a comparative analysis of selected measures before and after implementation. The findings illustrated that the packaging postponement not only improves competitive advantage but also significantly contributes to improving product proliferation and supply chain responsiveness. The study provided understanding of drivers and obstacles for

packaging postponement strategy with operational insights about ‘how-to’ implement.

Budiman and Rau (2019) did a study on a mixed-integer model for the implementation of postponement strategies in the globalized green supply chain network. The study proposed a mixed-integer model of an integrated Green Supply Chain Network (GSCN) for both single and multi-period planning horizons that incorporate postponement concept, and modularized products and processes. Using these models, various speculation strategies coupled with postponement strategies were analyzed in configuring green supply chain system with mass customization principle subjected to various carbon tax and carbon cap policies under a global supply chain environment. Computational examples of a mass customization notebook computer supply chain showed that postponing product differentiation reduces excessive production processes. As a result, the configured supply chain is able to comply with strict environmental policies with just a slight cost increase. This justifies postponement strategies application in configuring eco-efficient supply chain operations.

#### **2.4.4 Lean supply chain strategy and Performance of manufacturing firms**

Ahmed and Huma (2021) did a study on impact of lean and agile strategies on supply chain risk management. The objective of the study was to propose a conceptual framework to analyse driving factors for the leagile strategy and further to provides empirical evidences of effectiveness of lean and agile supply chain strategies on risk management in term of creating a robust and resilient supply chain. Data were collected from 140 supply chain professionals working in the manufacturing industry for hypotheses testing via structural equation modelling. The findings of this study revealed that market orientation as an external force has a greater impact on driving the agile strategy as compared to lean, while the Quality management system as an internal force is highly related to developing lean supply chain strategies. Furthermore, lean and agile strategies also have a significant impact on the robust supply chain and the resilient supply chain.

Qrunfle and Tarafdar (2013) did a study on lean and agile supply chain strategies and supply chain responsiveness: the role of strategic supplier partnership and postponement. The objectives of the study included; to examine the role of strategic supplier partnership and postponement respectively, on the relation between lean and agile supply chain strategy and supply chain responsiveness and also to look at the relation between supply chain responsiveness and firm performance. The study applied the strategic-choice theory and the resource-based view of firms. The study utilizes survey data from 205 senior executives and managers in the purchasing and supply chain functions from manufacturing firms in the USA. The results were based on covariance-based analysis and structural equation modeling using AMOS software. The study found that strategic supplier partnership fully mediates the relationship between lean supply chain strategy and supply chain responsiveness, and that postponement partially mediates the relationship between agile supply chain strategy and supply chain responsiveness. It is also shown that supply chain responsiveness is associated with enhanced firm performance.

Daud and Zailani (2011) did a study on lean supply chain practices and performance in the context of Malaysia. The specific objectives were to determine the effect of demand management on performance and to determine the effect of waste management on performance. The research was quantitative. It involved selecting a sufficient number of data and information from the selected population. This study has shown that demand collaboration, sales and operation planning, inventory management practices, waste and value added activities are the most influence lean supply chain practices for lean performances, regardless of the demand signal, which has no influence data survey limitation. Hence, this information can be utilized to promote the acceptance and implementation of lean supply chain practices.

Afonso and Cabrita (2015) did a study on developing a lean supply chain performance framework in a SME: a perspective based on the balanced scorecard. This research aimed at developing a conceptual framework for managing LSC, integrating both financial and non-financial performance dimensions and so it expands the existent knowledge and provides indication of how LSC performance can be assessed and improved in this and other kinds of organizations. To keep ahead

of the completion, organizations look for continuous improvement in Supply Chain Management (SCM). Lean paradigm connected to SCM is a strategy based on cost and time reduction to improve the effectiveness. At the operational level, Lean Supply Chain (LSC) is focused on optimizing the processes of all supply chain, searching for simplification, reducing waste and reducing activities that do not add value. A well-defined lean supply chain measurement system increases the chance for success because it enables managers to see areas where supply chain performance can be improved, so they can focus their attention, and obtain higher levels of performance.

Vanichchinchai (2019) did a study on the effect of lean manufacturing on a supply chain relationship and performance. This study aimed at exploring the impact of lean manufacturing (LM) or transaction-based supply chain management on a supply chain relationship (SCR) and supply performance (SP) in manufacturing industries in Thailand. The measurement instruments for LM, SCR, and SP were developed from comprehensive literature reviews, verified by experts, and statistical techniques to assure reliability and validity. The hypothesized model was tested with path analysis of structural equation modeling. It was found that the set of LM, SCR, and SP frameworks were reliable and valid for Thai manufacturing industries. LM had not only a direct effect on the SCR and SP but also an indirect effect on the SP through the SCR. The SCR also had a direct impact on the SP. The study presents insights into the debate concerning the impact of transaction-based SCM on relationship-based SCM and SP.

A study on influence of lean supply chain on performance of public universities in Kenya was done by Mwangangi and Achuora (2019). This research adopted descriptive design. The target population of this study was from employees in administration, accounts and procurement departments in public universities. The data collected from the field was analyzed qualitatively and quantitatively. The study established a significant positive relationship between Lean Supply chain and Organizational Performance. This implies that an increase in on organizational performance in public universities in Kenya is likely through adoption of Lean Supply chain initiatives.

In Malaysia, Daud (2010) did a study on lean supply chain implementation in Malaysia's electrical and electronics industry. The purpose of the study was to explain the extents of lean supply chain practices and lean performances towards lean supply chain performances as experienced by Electrical and Electronics firms in Malaysia. The analysis approach that were used in this study were simple regressions and multiple regressions in order to determine whether it's have the statistically significant to the existence of extensions between the set of variables to be tested for several defined groups like top management, middle management and lower management that directly involve in lean supply chain. The finding revealed that cheaper cost towards internal waste lead and cycle time reduction were the most influential extended factors on lean supply chain performances, followed by better quality and faster throughput towards supplier engagement and collaboration. Whereas, demand signal component shows that there no direct influences through lean performances and lean supply chain performances.

Hadrawi (2019) did a study on the impact of firm supply performance and lean processes on the relationship between supply chain management practices and competitive performance. The primary objective of the present paper was to explore the link between supply logistic integration, competitive performance, lean process and supply performance. To achieve the study objectives, the study developed a unique model, which conceptualizes the said relationship. Porter's value chain and the resource based views were used as theatrical lenses of the current study using Amos software package based on a data set of 220 Iraqi manufacturing firms. Structural Equation Modeling (SEM) was employed to analyze the dataset. The findings of the study showed that the there was a positive relationship between supply logistics and competitive performance (operational) and supply performance and lean processes were partially mediating this relationship. The study also showed the importance of managing both internal (production processes) and external processes (logistics and supply chain) of firms' operations in an integrated manner in which supply chain management acts through key internal processes to impact competitive performance.

Achieng, Githii and Ombati (2018) on their study on lean supply chain and performance enablers at Homa Lime Company indicated that business environment has become competitive in the recent past, many companies discover that they need to apt their game in order to remain competitive and continue to be relevant in business. The purpose of the study was to identify the Lean Supply Chain Management activities applied at Homa Lime Company and to find out benefits of practicing Lean Supply Chain Management at Homa Lime Company. The study adopted a case study research design. Primary data was collected through face-to-face interviews by use of interview guide. Secondary data was also used. It included information from archival sources like published reports and journals magazines in order to help the research achieve reliability of the information captured through triangulation. The study established that, LSCM practice, lean procurement, lean supply, lean transportation, lean manufacturing and lean warehousing are the performance enablers at Homa Lime Company.

Al-Tit (2016) did a study on the impact of lean supply chain on productivity of Saudi manufacturing firms in Al-Qassim region. The objective of this study was to identify the contribution of the Lean Supply Chain (LSC) to manufacturing firms in the Kingdom of Saudi Arabia (KSA). Out of the population of the study, 150 firms were selected from the Al-Qassim region to encompass the sample of the study. Four variables of the study included waste elimination, cost reduction, manufacture supplier relationship, and manufacturer customer relationships were constructed as predictors of productivity. A questionnaire-based survey was conducted to collect the study variables. A total of 75 questionnaires were distributed in the sample, of which 69 were returned. All of them were valid for the statistical analysis. The results of the study confirmed the hypotheses that the constructed predictors could predict the productivity of the manufacturing firms in the Al-Qassim region. That is, there were statistically significant impacts of LSC dimensions on the productivity.

Tortorella, Miorando and Marodin (2017) did a study on lean supply chain management: Empirical research on practices, contexts and performance. The study had two major objectives. First, we aim to provide a framework in order to define the exact practices and bundles that should be considered as pertained to Lean Supply



Chain Management (LSCM). The aforementioned relationships were determined and validated through a survey carried out with 89 Brazilian companies and their supply chain. Two major findings were suggested. First, the identification and empirical validation of bundles of LSCM practices provides means to focus on the most popular and elementary practices among different industry sectors and supply chains. Further, the concurrent application of these bundles appears to make a significant contribution to supply chain performance. Second, supply chain context matters with regard to implementation of LSCM practices, although not all aspects matter to the same extent and effect.

Wee and Wu (2009) did a study on lean supply chain and its effect on product cost and quality: a case study on Ford Motor Company. The purpose of this research was to address how Toyota can continuously and consistently achieve its dramatic success through its competences - continuous waste elimination and the objective of long term philosophy. The paper aimed to summarize some solid suggestions and comprehensive ideas for those industries planning to implement lean production. The methodology used is the case based approach (CBA), which described lean supply chain (LSC) through value stream mapping (VSM) using a case study from the Ford Motor Company in Chung Li, Taiwan. The study followed a four- step problem solving process to demonstrate how lean supply chain affects product cost and quality. Using VSM case study to demonstrate LSC, all the measurable indices helpful for cost reduction, quality enhancement and lead time reduction are shown.

Jasti and Kodali (2015) did a study on critical review of lean supply chain management frameworks: proposed framework. The present study objective was to perform review on existing LSCM frameworks and proposes a new LSCM framework. The study collected 30 LSCM frameworks with the help of extensive literature survey. The sample of LSCM frameworks was classified based on novelty of the framework, contribution of various researchers to develop LSCM framework, verification status and modes of verification methodology used by the researchers, and also the degree of standardization of LSCM elements. The study found that many researchers have proposed novel frameworks, lack of participation of practitioners and to some extent consultants in the field of LSCM framework

development. It was also found that a huge number of incoherent elements were used to propose the LSCM frameworks.

Manzouri, Ab Rahman, Saibani and Zain (2013) did a study on Lean supply chain practices in the Halal food. The paper involves a comprehensive review of articles on lean in the supply chain using structured content analysis. The reviewed articles were classified based on the basic characteristics and contextual issues of the articles. The researchers in the field agree that the identified benefits of lean in the supply chain, which include reduced cost, improved quality, faster delivery and flexibility, are linked to the implementation of certain lean principles, practices and techniques in the supply chain. Most of the reviewed articles are case studies, and evidence for the benefits of lean in the supply chain is anecdotal. While the empirical work done in the field is encouraging, quantitative studies to substantiate the claims for the efficiency of lean in the supply chain are lacking. In the reviewed articles, the manufacturing sector received much attention, while the service sector received little attention from researchers in the field. It was generally suggested that the supply chain members, suppliers and manufacturers should be considered in the implementation of lean in the supply chain, while the inclusion of distributors and end customers was not discussed in detail in many of the reviewed.

#### **2.4.5 Environmental Uncertainties**

Zimmermann, Ferreira and Moreira (2020) did an empirical analysis of the relationship between supply chain strategies, product characteristics, environmental uncertainty and performance. This paper aimed to investigate supply chain (SC) strategies, analyzing the adoption of lean, agile, leagile and traditional SC strategies with respect to product characteristics, environmental uncertainty, business performance and innovation performance. The study presented an empirical analysis carried out on a sample of 329 companies. Cluster analysis was applied, based on lean and agile SC characteristics, to identify patterns among different SC strategies. Cluster analysis indicated that the companies studied adopt four types of SC strategies; lean, agile, leagile and traditional. The differences between the clusters are identified and discussed, highlighting that companies adopting a leagile SC strategy

present the highest performance, while those that adopt a traditional SC present the lowest; companies adopting an agile SC compete in the most complex and dynamic environments, while companies with a lean SC present a clear predominance of functional rather than innovative products.

Haque and Ali (2016) did a study on uncertain environment and organizational performance: the mediating role of organizational innovation. The purpose of the study was to determine the role of organizational innovation for improving performance in today's competitive, dynamic and uncertain business environment. The study used structured closed ended survey questionnaire and data is collected through self-administered technique to increase the response rate. The analysis techniques included validity analysis through confirmatory factor analysis (CFA) reliability analysis through Cronbach alpha, correlation analysis, hypotheses testing utilizing structure equation modeling (SEM) in AMOS software whereas, mediation through method of Baron and Kenny (1986). Results showed that organizational innovation plays the mediating role between uncertain environment and organizational performance. Practical implications: The study proposes that organizational innovation is inevitable for maintaining organizational performance in uncertain business environment particularly in dynamic industries. The study focused on how organizational innovation moderates the relationship between uncertain environment and organizational performance.

Linn and Maenhout (2019) did a study on the impact of environmental uncertainty on the performance of the rice supply chain in the Ayeyarwaddy Region, Myanmar. The objectives of the study were to identify the different sources of uncertainty perceived by the different actors in the supply chain, to measure the rice supply chain efficiency, and to study the impact of the environmental uncertainty on the supply chain efficiency. The data of 215 respondents is collected from the Ayeyarwaddy Region by using a purposive and stratified random sampling method, and the results were analyzed through descriptive statistics, an exploratory factor analysis, data envelopment analysis (DEA), and Tobit regression analysis. The study found that the global rice supply chain performance is significantly impacted by the planning and control uncertainty and the climate uncertainty. Therefore, mitigation initiatives must

be developed such as financial insurance mechanisms and extension services should be widespread. Both aim to improve the impact of the climate adverse conditions and to increase the efficiency of resource utilization in the supply chain. Moreover, the actors should organize themselves in cooperatives such that the scale of operations can be increased and information is captured and shared between different parties in the supply chain. This is crucial to operational control and planning because a higher quality of information input will increase the quality of managerial decision making.

In Indonesia, Fernandes (2017) did a study on the mediating effect of strategic orientation and innovations on the effect of environmental uncertainties on the performance of business in the Indonesian aviation industry. The study objectives were; to examine the mediating effect of strategic orientation on the effect of environmental uncertainties on business performance and to examine the mediating effect of innovation on the effect of environmental uncertainties on performance of the business in the aviation industry in Indonesia. The research design was conducted through a survey, and the testing form was carried out using relationship causal studies or a study to analyze the causality among environmental uncertainties, strategic orientation, innovations and performance of branches/stations of airlines in the Indonesian aviation industry. These research findings provide a contextual overview of the aviation industry in Indonesia that activities to make innovations in airline branches play a vital role in encouraging business performance. Moreover, the analysis shows that the more innovative a branch the better its business performance.

Farooque, Suhail and Faisal (2017) in their study that focused on grey based approach for managing uncertainties and performance in automotive supply chains indicated that automotive supply chains are among the most complicated chains to manage because of the involvement of enormous number of suppliers and the associated uncertainties. Any disruption in the chain has a great impact on the performance of the entire chain. Uncertainties in supply chains interfere with their performance and managing uncertainties and risks to reduce this interference is a costly affair. The supply chain managers, therefore, need to prioritise uncertainties in terms of their negative impact on the performance. This will help them identify and adopt an appropriate mitigation strategy to reduce the effect of any kind of

uncertainty on a given parameter of performance. Since the occurrence of any kind of uncertainty and its effect on a given performance parameter cannot be ascertained for a selected time horizon, a grey-based modelling technique has been developed to model the relationship between uncertainty and performance.

Song, Augustine and Yang (2016) did a study on environmental uncertainty, prospector strategy, and new venture performance: the moderating role of network capabilities. The study examined the network capability of new ventures and its relationship to uncertainty management, engagement in the prospector strategy, and performance outcome in a transition economy. Using data from a survey of 302 new ventures based in China, the study found that new ventures respond to a high environmental uncertainty by engaging more in prospector strategy, consequently enhancing the ventures' performance. In addition, the study found that network capabilities significantly moderate these relationships by not only strengthening the relationship between environmental uncertainty and engagement in the prospector strategy (the E-S relationship) but also by enhancing the relationship between engagement in the prospector strategy and new venture performance (the S-P relationship).

Widyaningdyah and Aryani (2016) did a study on perceived environmental uncertainty, performance measurement systems, and competitive advantage. The study investigated the effect of diagnostic and interactive Performance Measurement Systems (PMS) on competitive advantage with Perceived Environmental Uncertainty (PEU) as antecedent variable. This study was motivated by the implementation of the Asean Economic Community (AEC) and the continuous performance declining most of large-scale manufacturing firms in Indonesia, which has a huge impact on the managers' inability in predicting a competitive business environment. The study focused on large-scale manufacturing firms in East Java Indonesia using surveys and interviews as data collection methods with structural equation modeling technique. The study found that the use of PMS (both diagnostically and interactively) contributes to competitive advantage when managers perceive the uncertainty of the business environment as accordance with RBT. Furthermore, the study suggested that interactive use of PMS drives the diagnostic use of PMS in case of manager

perceive the environmental uncertainty in order to survive and achieve the competitive advantage.

Hammad, Jusoh and Ghazali (2013) did a study on decentralization, perceived environmental uncertainty, managerial performance and management accounting system information in Egyptian hospitals. The purpose of this paper was to provide empirical evidence concerning: the relationships between decentralization, perceived environmental uncertainty, and Management Accounting Systems (MAS) information and the relationships between MAS information and managerial performance within Egyptian hospital. Data was collected using questionnaires that were sent personally to the managers or heads of departments of Egyptian hospitals. Departmental level was used as the unit of analysis. Data obtained from 200 hospital managers were analyzed using partial least squares. The study revealed that decentralization and environmental uncertainty, to some extent, are essential factors in designing efficient and effective MAS. Hospitals with decentralized structure make better use of timely, aggregated and integrated MAS information. Environment in which the hospitals operate does have significant influence on the type of information provided by the MAS.

Boccia (2009) did a study on an empirical analysis of environmental uncertainty, real options decision patterns and firm performance. Using a survey instrument designed to measure a range of real options-theoretic decision patterns, data was collected from a sample of 173 U.S. manufacturing firms. This project has established, for certain classes of real options-theoretic decision patterns, that two central premises regarding real options as strategic theory are empirically justified. First, there is no inherently or universally optimal real options decision pattern. The appropriateness of any decision pattern depends on the relative presence of different sources of uncertainty, and those different sources of uncertainty frequently comprise countervailing incentives and disincentives for the same decision pattern. Second, the project represents the first empirical confirmation that real options principles are positively associated with firm performance, and has further clarified that those performance impacts are also mediated by the relative presence of different sources of uncertainty.

Kinyua (2015) did a study on the effects of environmental uncertainties in SMEs: A case of Unga farm care (EA) Ltd distributor. The purpose of this study was to learn when environmental uncertainty occurs and how it affects the performance and survival of SMEs. The study reviewed the instability and complexity posed by the environment and how strategic managers ensure continued survival through environmental scanning, changing technologies, efficient use of resources, regulations and policies, strategic orientation and the alignment of organizational strategies. The research design was descriptive with the dependent variable being the environmental uncertainty occurring in the operating environment of SME's and the independent variables being the specific objectives of the study. The target population included directors, senior managers, administrators, supervisors and general workers of all three branches. The study found that most SME's in Kenya face business environmental uncertainty, with most respondents attributing this to regulations and policies in the industry as well as lack of adequate accessibility to all the necessary resources. The study further indicated that the performance and growth of SME's is influenced by changing technologies, increased operational costs and the power of competitors' strategies. Managers acknowledge that in order for an SME to have strong internal capabilities, good team work is imperative. The study also indicated that managers have to continuously handle change through environmental scanning and monitoring of the environments. Additionally, long term plans foster sustainability and strategies are aligned with the intended performance. Managers are seen as risk takers who need to allocate the right resources to the right departments.

Bendickson, Gur and Taylor (2018) on their study on reducing environmental uncertainty: How high performance work systems moderate the resource dependence-firm performance relationship indicated that firm performance is a major concern for all organizations and involves a multitude of antecedents. In addition, reducing environmental uncertainty and dependency through the use of strategic actions in the resource dependency theory (RDT) framework and enhancing work practices through high performance work systems (HPWS) lead to higher levels of firm performance. The study was based on past literature. The study findings indicated that the interconnectivity between RDT and HPWS and develop propositions as to how components of HPWS positively moderate the relationship

between firm performance and the environmental uncertainty- reducing strategic actions proposed by RDT such as mergers and acquisitions, joint ventures, boards of directors, political action, and executive succession.

Abdelkader and Abed (2016) did a study on the effect of information technology on competitive advantage of firm: the role of environmental uncertainty. The aim of this study was to assess the relationship between IT and the competitive advantage of firms. Beside the adoption of Resource-Based View (RBV) as a theoretical framework, this work tries to find out the moderation effect of environmental uncertainty, as a contextual variable in the relationship between IT and competitive advantage of firm. Using data from 36 Algerian firms and multiple regression analysis with Process Macro, the regression analysis show no moderation effect of environmental uncertainty in the relationship between IT and competitive advantage (even the model is statistically significant), probably due to the small sample size adopted.

Ganbold and Matsui (2017) did a study on impact of environmental uncertainty on supply chain integration empirical evidence. Drawing on the resource dependence theory, this study aimed to examine the impact of environmental uncertainty on supply chain integration initiatives. Environmental uncertainty is considered in terms of three types, namely, supply uncertainty, demand or customer uncertainty, and technology uncertainty, based on its sources. Supply chain integration is comprised of internal integration, customer integration, and supplier integration. Data for this study were collected through a survey of manufacturing firms in Japan during September through October in 2013. The study found positive and significant relationships between environmental uncertainties and supply chain integration. Advocates of the resource dependence theory state that under conditions of uncertainty, firms attempt to interact closely with the supply chain partners to manage detrimental outcomes of such uncertainties.

An explanatory study was done by Jangga, Ali, Ismail and Sahari (2015) did a study on the effect of environmental uncertainty and supply chain flexibility towards supply chain innovation. The study indicated that as a supply chain competes with



other supply chains, businesses would see that supply chains that are flexible will outperform those that are less agile in an increasingly uncertain environment. What it means is that, supply chain flexibility has emerged as an important management strategy to achieve competitive advantage and so businesses now have to look into improving their supply chain management practices to become flexible and responsive to an unpredictable environment and to cope with changing customers' requirements. The study further suggested a relationship between environmental uncertainties, supply chain flexibility and supply chain innovation.

Pham and Doan (2020) did a study on supply chain relationship quality, environmental uncertainty, supply chain performance and financial performance of high-tech agribusinesses in Vietnam. The objective of this article was to assess the impact of supply chain relationship quality on supply chain performance and financial performance through environment uncertainty of high-tech agricultural enterprises in Vietnam. The study conducted data analysis based on 198 agricultural firms applying high technology in high-tech agricultural group and in all of Vietnam. The results showed that, agricultural enterprises applying high technology with supply chain relationship quality had a strong positive impact on supply chain performance and supply chain flexibility. In addition, supply chain performance played a significant role in financial performance. Finally, Environment uncertainty and technological innovation played a statistically significant moderate role in the relationship between supply chain relationship quality and supply chain performance. For businesses with less environment uncertainty, the relationship was stronger and vice versa.

James and George (2018) did a study on exploring the influence of environmental uncertainty and supply chain practices a quarterly. The objective of the study was to explore the influence of environmental uncertainty and supply chain practices on supply chain performance in the coir industry in India. The study was conducted using direct interview with the help of standard scales among 78 respondents. SEM was used for analysis of the data. The study found that Environmental Uncertainty enhances Supply chain performance by positively influencing the adoption of Supply chain practices. The study not only reinforces the earlier researches on the role of

Supply chain practices in influencing supply chain performance, but also brings out its significant role in improving supply chain performance even under environmental uncertainty.

#### **2.4.6 Performance of firms**

Singh (2020) did a study on managing environmental uncertainty for improved firm financial performance: the moderating role of supply chain risk management practices on managerial decision making. The study attempts to answer the research question of how environmental uncertainty within a firm's supply chain, impacts firm financial performance. It further evaluate the role of supply chain risk management practices in mitigating the negative impact of such disruption events. To answer the research question, a literature review was conducted. The hypothesis were developed using both primary and secondary data. The results show that environmental uncertainty has a negative impact on firm financial performance, with entrepreneurial managerial capitalism mediating the impact. However, organisations that adopt macro and network supply chain risk management practices are able to improve managerial decision making frame, and mitigate the negative impact of environmental uncertainty on firm financial performance.

Gligor, Holcomb, Maloni and Davis-Sramek (2019) did a study on achieving financial performance in uncertain times: leveraging supply chain agility. The study focuses on how a firm's supply chain agility affects performance through the lens of resource orchestration theory. Findings indicated that a firm's capabilities must be considered within the context of larger uncontrollable and environmental factors. While the Fisher model focuses explicitly on a product's demand volatility, the contemporary environment for many firms can be portrayed as rapidly changing with turbulent markets, rapid product life cycles, and a changing competitive landscape. Focusing on three underlying dimensions of environmental uncertainty, namely dynamism, munificence, and complexity, we theorize that this uncertainty facilitates market orientation and moderates the mediating relationship between the firm's market orientation and supply chain orientation and a firm's supply chain agility. In short, orchestrating resources for a firm's supply chain agility may or may not be as

significant to achieving financial performance, depending on environmental uncertainty.

Bae (2017) did a study on empirical relationships of perceived environmental uncertainty, supply chain collaboration and operational performance. There were two aims of this study: one is to analyze the relationship among perceived environmental uncertainty, supply chain integration and operational performance and the other is to test direct, indirect and total effects among the variables. To achieve the aims of this study, mixed research design was used. The population is Korean firms in China. Questionnaires were sent to the sample firms, and 208 data were used in the analysis. The results are as follows. First, the relationship between perceived environmental uncertainty and supply chain integration is the causal link. Environmental uncertainty is an antecedent of supply chain integration and this is explained by information processing theory. Second, supply chain integration has a positive effect on operational performance. To improve performance, managers have need of interaction with suppliers and customers as well as inter-departments. Third, there is no direct effect between environment and performance but there are direct, indirect and total effects among the variables. The negative effect of perceived environmental uncertainty on performance (direct effect) is changed with positive effect (indirect and total effects).

Oke, Walumbwa and Myers (2012) investigated the interactions of innovation strategy execution and innovation-focused human resource (HR) policy adoption on innovation performance and revenue growth. In addition the study investigated the moderating role of environmental uncertainty on the effects of innovation strategy execution and innovation-focused HR policy on innovation performance. Results showed that the interaction of innovation strategy execution and innovation-focused HR policy is positively related to innovation performance. Results also showed that environmental uncertainty positively moderates the innovation strategy execution–innovation performance relationship. Finally, innovation performance mediates the interaction of innovation strategy execution and environmental uncertainty on firms' revenue growth. The study focused on moderating role of environmental uncertainty

on the effects of innovation strategy execution and innovation-focused HR policy on innovation performance.

Srinivasan, Mukherjee and Gaur (2011) examined the relationship between buyer–supplier partnership quality, and supply chain performance, in the presence of supply and demand side risks and environmental uncertainty. The theory was descriptive in nature. Based on the theoretical underpinnings of resource-based view, relational capital theory, and transaction cost economics, the study proposed a positive relationship between partnership quality and supply chain performance, which is strengthened in the presence of high demand and supply-side risks, but weakened in the presence of high environmental uncertainty.

## **2.5 Critique of Existing Literature**

A review of the reviewed literature did not obviously show all approaches in the supply chain. For example, Ambe (2012) research to determine an ideal strategy looked only at agile strategy, lean strategy, and leagile strategy. Another research by Cox, Chicks and Palmer (2017) on heavenly stairways or oblivion treadmills? In red meat supply chains, the creation of sustainable approaches focuses only on lean approach. Similarly, Bruce, Daly, and Towers (2014) also concentrated on lean and flexible approaches in their research of textiles and apparel sector. This research concentrated primarily on the two (lean and agile) approaches. There are many other supply chain strategies, however, namely efficient, lean, agile, responsive, postponement and risk-hedging, pull and push (Birhanu, Lanka & Rao, 2014; Lee & Whang, 2001; Juttner et al., 2013).

Evidence arising from previous research (Hsu et al., 2019) is that supply chain activity plays an significant part in the capacity of the company to achieve superior output from its supply chain policy. Studies also indicate that the supply chain approach of a company should be aligned efficiently with its supply chain procedures to attain increased performance and resource optimization across the supply chain (Green et al., 2018). However, the literature on the supply chain is still mainly deficient in providing theoretical frameworks or empirical research on how this is accomplished. This may be why different scientists do not have clear supply chain

strategies reference point. This is the situation for research by Kalaitzi et al. (2018) on supply chain approaches in an age of natural resource scarcity that focuses as supply chain policies on buffering and bridging policies.

Sillanpaa (2014) on supply chain policy in Europe and Asia introduces the supply chain policy structure that offers a structure that shows the relationship in an organization between supply chain policy and corporate policies. Likewise, the study also demonstrates that there is not much research to explain this connection between supply chain strategies and corporate strategies explicitly. The research focuses on Europe and Asia, so it may not generalize its results worldwide. The research also lacks a multi-faceted strategy to SCS as it focuses solely on agile and lean approaches.

Christopher and Towill (2012) research on the development of market-specific supply chain policies looked like agile and lean supply chain approaches. However, the study's results could be generalized worldwide as the range was on Europe, Asia, North America, Central America, Non-E.U., Africa and others that could be deemed representative. On the other side, as it concentrated only on agile and lean approaches, the research still lacked inclusiveness on SCS. Most of the supply chain strategy research focused only on concrete goods or products supply chains. However, it is essential to remember that both products and services are supply chains. Past studies have therefore been biased in terms of focus and breadth and therefore restricted study on SCS for service or service industries (Sillanpaa, 2014; Kalaitzi et al., 2018; Cox, Chicks & Palmer, 2007; Bruce, Daly, Towers, 2004). In a UK, New Zealand, and Thailand supply chains research, Childerhouse et al. (2011). The research in its results shows that a majority of companies around the world are facing elevated rates of uncertainty and yet they still need to effectively streamline their supply chain system to match or compete with the competitor.

This research, however, may be biased in generalizing its results worldwide as it focused on UK, New Zealand, and Thailand. A study by Agbejule and Burrowes (2017) on perceived environmental uncertainty, supply chain purchasing strategy, and use of MAS (Management accounting systems) information found out that perceived

environmental uncertainty determines supplier development. Further, the study identified that supplier development determines management accounting systems. The study concludes that perceived environmental uncertainty mediates the relationship between perceived environmental uncertainty and management accounting systems.

## **2.6 Summary**

This chapter dealt exclusively on reviewing literature on supply chain strategies, firm's performance and environmental uncertainties. A theoretical foundation is established which supports the study a review of RBV theory, TCE theory, contingency theory, technology acceptance model and dynamics capability theories. Further, the study gave an insight of the relationship on the independent variables (Agile strategy, risk hedging strategy, postponement strategy and lean strategy), dependent variable (Firm's performance) and the moderating variable (environmental uncertainties). This is illustrated by the conceptual framework diagram in figure 2.2.

Literature reviewed show that there is a positive relationship between supply chain strategies and firm's performance. Similarly, environmental uncertainties influence the performance of firms. The study also identifies that much of the supply chain strategies and firm performance has been done in developed countries with little research being done in developing countries. This forms a research gap which the study will seek to fill. On other hand, studies on supply chain strategies, firm's performance and environmental uncertainties jointly are at nascent stage globally as supported by literature review.

## **2.7 Research Gaps**

Supply chain operations play an significant part in the capacity of the company to attain adequate superior output from its supply chain policy (Hsu et al., 2009) Studies also indicate that the supply chain strategy of a company should be aligned efficiently with its supply chain procedures in order to attain increased performance and resource optimization across the supply chain (Green et al., 2008).

The supply chain literature (Wisner, 2013), however, is still mainly deficient in providing theoretical frameworks or empirical research on how to attain the supply chain strategy's efficiency. SC strategy is a fresh area with a great deal of theoretical and practical potential. Similarly, there is no clear knowledge in practice of what is a supply chain approach and different strategic categories (Storey, et al., 2016). Not much has been achieved so far in literature on the supply chain approach leading to a substantial gap (Chae & Hill, 2010).

The available research done on supply chain strategies has focused on limited areas such as meat supply chains, automobile supply chains, textile apparel industry, and retail goods. (Christopher & Towill, 2012; Qrunfleh & Tarafdar, 2013; Martinez-Olvera & Shunk, 2016). This gap was addressed by this study since it cuts across many sectors in the manufacturing industry. Similarly, previous studies done has been in developed countries more so other areas other than Sub Saharan Africa such as Childerhouse et al. (2011) focused on UK, New Zealand and Thailand; Sillanpaa, 2014; focused on Europe and Asia, Narasimhan, Kim & Tan, 2008; looked at USA firms; Cox, Chicks and Palmer, 2017; looked at UK firms). This clearly shows a gap on under developed and developing countries and therefore the study will focus on Kenya as a developing country to fill this gap.

Previous studies in Kenya have tried to look at the notion of supply chain management policies, although their range is restricted. For example, Maalim's (2016) research on an evaluation of Kenyan SMEs ' supply chain management policies and competitiveness recognized process strategies, market strategies, and channel strategies as supply chain management strategies. The research found that the supply chain management policies and company results had a favorable connection. Similarly, Waithera, (2016) on her study on effects of supply chain management strategies on competitive advantage of food and beverage processing companies in Nairobi County looked at supply chain integration, supply chain collaboration and supply chain agility as the independent variables. The study concluded that there was need to incorporate supply chain integration, supply chain collaboration and supply chain agility in their supply networks in order to boost the firm's performance. The above two studies clearly give a different opinion on supply

chain strategies. Similarly, the two studies have a different view on supply chain management strategies contrary to the expectations. Similarly, Waithera (2016) study on the effects of supply chain management strategies on the competitive advantage of food and beverage processing companies looked at supply chain integration, supply chain collaboration, and supply chain agility as independent variables. The study concluded that supply chain integration, supply chain collaboration and supply chain agility needed to be incorporated into their supply networks to boost the performance of the company. The two studies above obviously offer a distinct view on policies for the supply chain. Likewise, the two studies view supply chain management strategies differently from expectations. These researches portray the inconsistencies and differences on supply chain strategies variables.

Studies done on supply chain strategies have largely looked at supply chain strategies and firm's performance. The studies have failed to look at supply chain strategies, firm performance and the moderating effect of environmental uncertainty. For instance, a study by Sillanpaa (2014) on supply chain strategy in Europe and Asia presents the supply chain strategy framework gives a framework on supply chain strategies and corporate strategies. A study by Wanyonyi (2013) on supply chain strategies and green logistics performance at unilever in Kenya. The study was anchored on three objectives namely to determine the motivating factors influencing the adoption of supply chain strategies on green logistics at Unilever; to evaluate the relationship between the motivating factors and green logistics performance at Unilever and to establish the challenges facing the implementation of supply chain strategies on green logistics at Unilever. However, a thorough scrutiny of the study found the focus was on green logistics strategies and motivating factors considered being top management support and ICT networks. Their study fails to capture the moderating effect of supply chain strategies. This gap will be addressed by this study.

A study by Nyaoga, Magutu and Aduda (2015) on supply chain performance and firm performance of large manufacturing firms found out that supply chain strategies explain 76.7% of firm's performance. Another study by Magutu, Mbeche and Njihia (2013) found out that supply chain strategies affect 51.3% of firm's supply chain



performance. Further, the study found out a strong relationship between supply chain strategies, supply chain technology and firm's performance. However, the two studies mainly focused on broader supply chain strategies namely long range supply chain strategies and middle range supply chain strategies (synergistic; project logistics; Nano-chain; information networks; market dominance; value chain; extended; efficient; cash-to-cash cycle; innovation; speed to market; risk-hedging; micro-chain; tie down; none existent; and demand supply chain strategies) while this study will be based on more specific supply chain strategies namely agile SC strategy, risk hedging SC, lean SC strategy and postponement SC strategy. Further, these two studies failed to look at the effect of environmental uncertainties as a moderator between the supply chain strategies and firm's performance.

Further, the manufacturing sector in Kenya is a one of the key pillars of Vision 2030 and Government's four agenda of economic growth. However, the manufacturing sector still lags in growth at average of 9.2% contribution to the gross domestic product (GDP) versus an expected contribution 15% by 2022 (KAM, 2018). This study will seek to fill this gap by proposing ways to boost the performance of the industry.

It's on basis of these research gaps identified that the researcher will seek to investigate the moderating effect of environmental uncertainties on supply chain strategies and firm's performance of manufacturing firms in Kenya.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

This chapter explores the systematic methodological approach of the study and it comprises the research design, population, sampling frame, sample and sampling technique, data collection procedure, instruments, pilot testing, and data analysis and presentation.

#### **3.2 Research Design**

A research design is a blueprint for information collection, measurement and evaluation of data, (Cooper & Schindler, 2011; Saunders et.al 2007) A cross-sectional design was adopted in this research. The design was suitable as it is was used to acquire empirical information to determine the linkages between variables under study at a single point in time. Also the design was used assist to gather information at once to test hypothesis and answer study questions (Sekeran & Roger, 2010).

##### **3.2.1 Research Philosophy**

Research philosophy explains how to collect and analyze information on a certain phenomenon. It can also be said about knowledge growth to a scheme of convictions and assumptions. The word epistemology (what is known to be true) as compared to doxology (what is thought to be true) includes the different study strategy philosophies. Philosophy of research can be split into three epistemological categories: positivism, interpretation, and realism (Saunders, Lewis, & Thornhill, 2009). This study embraced a positivism strategy where it argues that the investigator is external to the method of studies whereby not much can be accomplished to change the content of the gathered information. The investigator is autonomous from the study topic (Saunders et al., 2009). Positivists think that truth is stable and can be observed and defined from an objective point of view where the phenomena being studied are not interfered with.

### **3.3 Target Population**

Population refers to a whole group of people or components that have at least one thing in common, according to Orodho (2003). Population also relates to the bigger sampling group. Target population has been described as all sets of individuals or organizations that have certain homogeneous features of the bigger sample group (Mugenda & Mugenda, 2009). All manufacturing companies in Kenya were the target population as listed by KAM (2018). For this research, the target population was 829 companies in Kenya's manufacturing sector categorized into 12 main industrial sub-sectors in processing and adding value. The two non-included sub-sectors are consultancy and new products and services that provide support services to the other sub-sectors. The sub-sectors are described by import businesses of the sort of raw materials or the products they produce. The research picked from each of the companies that engage in the research the supply chain managers, supply chain directors or procurement heads.

### **3.4 Sampling Frame**

A sampling frame is described as a list or index of selected cases (Mugenda & Mugenda, 2009). In this research, a list of all manufacturing companies in the 12 main industrial subsectors of the manufacturing sector in Kenya was the sampling frame. These subsectors include the following; Building, Construction and Mining; Chemical and Allied; Energy, Electrical and Electronics; Food and Beverages; Leather and Footwear; Metal and Allied; Motor Vehicle and Accessories; Paper and Board; Pharmaceutical and Medical Equipment; Plastic and Rubber; Textiles and Apparels; Timber, Wood and Furniture. This list was obtained from manufacturers and exporters directory of Kenya Association of Manufacturers (KAM, 2019). Further, the list of supply directors, managers and procurement heads was obtain from the respective firm's human resource registry.

### **3.5 Sample and Sampling Technique**

A sample relates to a target population sub-set. If suitable sample size and sampling techniques are used, a sample may be used to derive population inferences. A sample

size is the number of observation units to be collected by the investigator from Saunders et al. (2007). Proportionate stratified random sampling was used to select the sample size participants. This method is intended to guarantee that strata of sample size are proportionate to population strata. This would assist the investigator to generalize the results of the research to the whole population. Each of the 12 sub-sectors recognized formed a stratum from the sampling frame. Therefore, the study comprised of 12 strata from where the sample was obtained as shown in the Table 3.1. The study used a sample size of manufacturing firms. The following formula by Yamane (1967) given as;

$$n = N / (1 + N (0.05)^2)$$

$$n = 829 / (1 + 829(0.05)^2)$$

$$n = 269.8 \approx 270$$

Where n is the sample size

This comprised a sample size of 270 manufacturing firms. The study selected the supply chain managers or directors from each of the firms who participated in the study. This is shown in Table 3.1.

**Table 3.1: Sample Size**

<b>Sub-sector</b>	<b>Population</b>	<b>Percentage in sector</b>	<b>Sample</b>
Building, Construction and Mining	35	4	11
Chemical and Allied	84	10	27
Energy, Electrical and Electronics	55	7	19
Food and Beverage	217	26	70
Leather and Footwear	8	1	3
Metal and Allied	88	11	30
Motor Vehicle and Accessories	55	7	19
Paper and Board	79	9	24
Pharmaceutical & Medical Equipment	25	3	8
Plastic and Rubber	88	11	30
Textiles and Apparels	68	8	21
Timber, Wood and Furniture	27	3	8
<b>Total</b>	<b>829</b>	<b>100</b>	<b>270</b>

### **3.6 Data Collection Instrument**

The study used primary data collection methods. Primary data is described as first-hand information received from participants in a study (Kothari, 2004). Data collection is the means by which information is obtained from the selected participants of an investigation (Mugenda & Mugenda, 2003). Primary data was collected using a questionnaire. Questionnaire was preferred since it maintains confidentiality, save on time, and easy to administer (Mugenda & Mugenda, 2003). The questionnaire had both quantitative and qualitative questions. The quantitative questions were directed to achieving limited responses in line with the researcher's interest while qualitative questions gave the respondents the freedom to express their views. Further, the quantitative questions adopted the Likert scale as follows: 1=Strongly Disagree, 2=Disagree, 3=Neither Agree nor Disagree, 4=Agree, 5=Strongly Agree.

### **3.7 Data Collection Procedure**

The researcher first sought for permit for authorization from NACOSTI to collect data. Once the permit was granted, the researcher requested for a letter of introduction from the university. The research assistants were trained on the research instrument, data collection process and clarifications made. Thereafter, the researcher with help of research assistants dropped the questionnaires to the respective respondents as well as collecting them once they were duly filled. The respondents were given two - three weeks to fill and then collected thereafter. However, in special cases extension was made to facilitate questionnaires to be full filled.

### **3.8 Pilot Test**

According to Kothari (2004) pilot test ensures reliability and validity of the research instrument. Pilot study is therefore done to test weaknesses in design and instrumentation which can help in improvement of the instrument. According to Mugenda and Mugenda (2003) the pre-test should be between 10% of the target population. Therefore, a pilot test of 27 respondents from 27 manufacturing firms was done which did not constitute the sample.

### **3.8.1 Reliability of the Research Instrument**

Reliability refers to the consistency of a measure. A test is referred reliable if it produces the same results when done recurrently Cooper & Schindler (2011). Internal consistency was used to test for reliability using Cronbach Alpha coefficient whose value should be equal or above 0.7 for a value to pass the reliability test. Drost (2012), measures consistency within the instrument and questions how set of items measures a specific behavior or characteristics within the test.

### **3.8.2 Validity of the Research Instrument**

Validity is to what extent an instrument measures what it is meant to evaluate and to what extent outcomes can be generalized (Mugenda & Mugenda, 2003). The research used validity of content as well as build validity. The validity of the content was accomplished by formulating and operationalizing the questionnaire according to the research variable. This ensured that the items in each variable are adequate and representative in relation to the study's purpose and objectives. Similarly, the validity of content was confirmed by expert opinion from managers, supply chain professionals and other supply chain experts. The specialist assisted to determine whether the questionnaires are sufficient to determine the moderating impact of environmental uncertainties on the connection between supply chain policies and production companies' results in Kenya.

Construct validity, on the other side, defined as the degree to which a test measures a hypothetical construct designed (Mugenda & Mugenda, 2003). Using a construct-friendly panel of specialists is a way to evaluate this sort of validity; specialists can examine the items and decide what the particular item is meant to evaluate (Kothari, 2004). Construct validity was accomplished by limiting the questions to conceptualizing the variables and ensuring that each variable's indices are within the same structure. This guarantees that each measure properly evaluates the structure to be evaluated.

### 3.9 Data Analysis and Presentation

Data analysis is the method of adding order, structure and significance to the gathered information, Creswell (2007). Analysis of data can be described as refining and arranging raw data into transparent, meaningful and systematic data that is readily understood and interpreted (Mugenda & Mugenda, 2003). Both qualitative and quantitative data was edited, coded, categorized and analyzed after information collection. It is anticipated that the research would produce both qualitative and quantitative data. The data was coded using the Social Scientist Statistical Package (SPSS) version 24. Quantitative data was analyzed using descriptive statistics and inferential analysis. This technique is appropriate as it provides easy summaries of sample information and quantitative descriptions are presented in a manageable manner (Orodho, 2003). Descriptive data was analyzed by the use of mean, and standard deviation.

Simple linear model;

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

Simple linear model with moderator

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

The regression model before moderation was as follows;

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

The regression model after moderation was as follows:

$$Y = Y = \beta_0 + \beta_1 X_1 * Z + \beta_2 X_2 * Z + \beta_3 X_3 * Z + \beta_4 X_4 * Z + \varepsilon$$

Where; Y= Performance of manufacturing firms

$\beta_0$ =constant

$\beta_i$  is the coefficient for  $X_i$  (  $i=1, 2,3,4$ )

X1=Agile strategy

X2=Risk hedging strategy

X3=Postponement strategy

X4=Lean strategy

Z= Environmental uncertainties (moderator)

$\varepsilon$  = error term

$X_i * Z$  = Product term / interaction term of the environmental uncertainties with each of the independent variables (x1, x2, x3, x4)

The data was presented using frequency distribution tables.

### **3.9.1 Diagnostic Tests**

#### **i. Multicollinearity Test**

Multicollinearity test was done by use of Variance Inflation Factor (VIF). A value of 1 indicates that there is no correlation between this independent variable and any others. VIFs between 1 and 5 suggest that there is a moderate correlation, but it is not severe enough to warrant corrective measures. VIFs greater than 10 represent critical levels of multicollinearity where the coefficients are poorly estimated, and the p-values are questionable (Julie, 2011).

#### **ii. Normality Test**

Data that appears to be normally distributed follows the diagonal line closely and does not appear to have a non-linear pattern (Cohen, Cohen, West & Aiken, 2013). Tests for normality was done using Shapiro-Wilk test where a P value (Sig. value) greater than 0.05 shows the data is normally distributed.



### **iii. Heteroscedasticity Test**

If the error variance is not constant, then there is heteroscedasticity in the data. Running a regression model without accounting for heteroscedasticity would lead to biased parameter estimates. Heteroscedasticity was tested by correlating standardized predicted values with standardized residual values. A probability value  $>0.05$  denoted satisfaction of the homoscedasticity assumption (Park, 2008).

### **iv. Autocorrelation Test**

The Durbin Watson Test being a measure of autocorrelation (also called serial correlation) was used to test for autocorrelation. The Durbin Watson test reports a test statistic, with a value from 0 to 4, where; 2 is no autocorrelation, 0 to  $<2$  is positive autocorrelation (common in time series data),  $>2$  to 4 is negative autocorrelation (less common in time series data). A rule of thumb is that test statistic values in the range of 1.5 to 2.5 are relatively normal. Values outside of this range could be cause for concern. Field (2009) suggests that values under 1 or more than 3 are a definite cause for concern.

## **3.9.2 Factor Analysis**

Factor analysis was used to reduce constructs into factors that would be used in the regression model (Field, 2010). The study used the indices generated from factor analysis to run a multiple regression analysis.

## **3.9.3 Operationalization of Study Variables**

The supply chain strategies used were adopted from; Lee (2002); et al., (2011); Lee & Tang (1997); Whang & Lee (1999), while environmental uncertainty were adopted from Lee, (2002); Vorst & Beulens, (2002); Zhou & Benton, (2007). Supply chain strategies include; agile strategy, risk hedging strategy, postponement strategy while environmental uncertainties comprised of supply chain uncertainty, demand uncertainty and technological uncertainty. A five-point Likert scale and a set of open-ended questions were adopted with respect to the variables under study.

**Table 3.2: Operationalization of study variables**

<b>Type of Variable</b>	<b>Variable</b>	<b>Indicator</b>
Dependent	Performance of Manufacturing firms	Customer satisfaction Profitability Market share
Independent	Agile Supply Chain Strategy	Manufacturing capacity Responsiveness Delivery flexibility
Independent	Risk hedging Supply Chain Strategy	Safety stock Multiple suppliers Long term supplier relationship
Independent	Postponement Supply Chain Strategy	Purchasing postponement Manufacturing postponement Delivery postponement
Independent	Lean Supply Chain Strategy	Waste minimization Inventories (JIT) Continue improvement
Moderating Variable	Environmental Uncertainties	Supply chain uncertainty Demand uncertainty Technological uncertainty

## **CHAPTER FOUR**

### **RESEARCH FINDINGS AND DISCUSSION**

#### **4.1 Introduction**

In this chapter, findings are presented as per the study objectives. The outcomes are also interpreted and discussed with reference to reviewed empirical literature in chapter two. The chapter starts by providing results on data reliability and response rate. Second, findings on demographic characteristics of the respondents are provided. Descriptive statistic results on each variable are then provided followed by factor analysis, diagnostic tests, correlation results and finally regression results are presented.

#### **4.2 Reliability Statistics**

The Cronbach Alpha was calculated in a bid to measure the reliability of the questionnaire. This was done by subjecting the questionnaire to 27 respondents. A threshold of 0.7 and above was used. Other studies such as Bonett and Wright (2015) and Quansah (2017) also supported the use of 0.7 cut off point. The findings in Table 4.1 indicate that performance of manufacturing firms had a coefficient of 0.831, agile supply chain strategy [0.765], risk hedging supply chain strategy [0.821], postponement supply chain strategy [0.812], lean supply chain strategy [0.750], and environmental uncertainties [0.762]. Further, the overall alpha coefficient is 0.790. Based on the findings, all the variables had coefficients above 0.7 implying that the items measuring the study variables were reliable. They were all used in the subsequent analyses.

**Table 4.1: Reliability Results**

<b>Variable</b>	<b>No of Items</b>	<b><math>\alpha &gt; 0.7</math></b>	<b>Comment</b>
Performance of manufacturing firms	5	0.831	Reliable
Agile supply chain strategy	7	0.765	Reliable
Risk hedging supply chain strategy	8	0.821	Reliable
Postponement supply chain strategy	6	0.812	Reliable
Lean supply chain strategy	7	0.750	Reliable
Environmental Uncertainties	7	0.762	Reliable
N = 27			

### 4.3 Response Rate

A total of 270 questionnaires were administered to the target respondents who comprised of supply chain managers. Out of the 270 questionnaires, 202 were properly filled and returned. This represented 75 percent response rate. The high return rate could be attributed to use of research assistants as well as follow ups. A response rate above 50 percent is considered adequate for analysis (Saunders et al., 2009). Table 4.2 illustrates the findings.

**Table 4.2: Response Rate**

<b>Response</b>	<b>Frequency</b>	<b>Percent (%)</b>
Returned	202	75%
Unreturned	68	25%
<b>Total</b>	<b>270</b>	<b>100</b>

#### 4.4 Demographic Information

This section provides background information including organization duration of existence, respondent duration of work, type of manufacturing sector and number of employees.

##### 4.4.1 Period of Existence

The respondents were asked to indicate the period of time their organization has been in existence. The findings in Table 4.3 reveal that 29 percent of the respondents noted that their organizations have been in existence over 16 years, 23.8 percent cited 6-10 years, 21.8 percent cited 11-15 years, 20.8 percent noted more than 20 years, while 4.5 percent indicated under 5 years. The duration of time the manufacturing firms have been in existence was considered critical in their ability to adopt and implement appropriate supply chain strategies.

**Table 4.3: Period of Existence**

<b>Period of Existence</b>	<b>Frequency (N)</b>	<b>Percent (%)</b>
Under 5 years	9	4.5
6-10 years	48	23.8
11-15 years	44	21.8
Over 16 years	59	29.2
More than 20 years	42	20.8
<b>Total</b>	<b>202</b>	<b>100</b>

##### 4.4.2 Period of Work

The respondents were asked to indicate the period of time they had worked in the organization. Results in Table 4.4 reveal that 28.2 percent of the respondents had worked in their respective organizations for a period of 6-10 years, 25.7 percent had worked for over 16 years, 21.3 percent had worked for 11-15 years, 16.3 percent had worked for more than 20 years, while 8.4 percent had worked for less than 5 years.

The duration of time the respondents had worked was expected to determine their knowledge and understanding of the supply chain process in the manufacturing sector and particularly their respective organizations.

**Table 4.4: Period of Work**

<b>Period of work</b>	<b>Frequency (N)</b>	<b>Percent (%)</b>
Under 5 years	17	8.4
6-10 years	57	28.2
11-15 years	43	21.3
Over 16 years	52	25.7
More than 20 years	33	16.3
<b>Total</b>	<b>202</b>	<b>100</b>

#### **4.4.3 Type of Manufacturing Sector**

The respondents were requested to state the type of manufacturing sector in which their company falls. The results in Table 4.5 indicate that 24.8 percent of the organizations were from Food & Beverage, 12.4 percent Metal & Allied, Chemical & Allied, and Plastic & Rubber respectively, and 10.9 percent were from Paper and Board. This implied that the data collected was a representation of the different segments in the manufacturing sector.

**Table 4.5: Type of Manufacturing Sector**

<b>Type of manufacturing sector</b>	<b>Frequency (N)</b>	<b>Percent (%)</b>
Metal & Allied	25	12.4
Pharmaceuticals & medical equipment	5	2.5
Textile & Apparels	16	7.9
Building, mining & construction	6	3
Food & Beverage	50	24.8
Chemical & Allied	25	12.4
Energy, electrical & electronics	13	6.4
Plastic & Rubber	25	12.4
Timber, Wood products and Furniture	4	2
Leather	1	0.5
Motor Vehicle & Accessories	10	5
Paper and Board	22	10.9
<b>Total</b>	<b>202</b>	<b>100</b>

#### 4.4.4. Number of Employees

The respondents were asked to state the number of employees in their organization. The findings in Table 4.6 indicate that majority of the respondents (63.4 percent) noted that their organizations had more than 100 employees, while 18.3 percent had 50-100 and 1-10 employees each.

**Table 4.6: Number of Employees**

<b>Number of employees</b>	<b>Frequency (N)</b>	<b>Percent (%)</b>
1-10	37	18.3
51- 100	37	18.3
Above 100	128	63.4
<b>Total</b>	<b>202</b>	<b>100</b>

## **4.5 Descriptive Statistics**

This section provides descriptive statistic findings in terms of percentages, mean and standard deviation. The results are based on the study variables: agile supply chain strategy, risk hedging supply chain strategy, postponement supply chain strategy, lean supply chain strategy, environment Uncertainties, and performance of the firm.

### **4.5.1 Descriptive Statistics on Agile Supply Chain Strategy**

The respondents were asked to indicate their agreement or disagreement with the statements on agile supply chain strategy using a five level likert scale (1- strongly disagree, 2-disagree, 3-neutral, 4- agree, and 5- strongly agree). The results are shown in Table 4.7.

The findings indicate that majority of the respondents agreed with the statement that they are able to quickly meet changes in requirements in delivery times from customers (64.9%), they are able to respond to changes in quantities as requested by our customers (58.4%), they are able to deliver products to various customer locations (60.4%), they have capacity to fulfill high orders and urgent orders (52.5%), they always meet customer volumes as ordered (55.9%), they respond quickly to customers' requirements and enquiries (67.8%) and they are always willing to provide solution our suppliers and customers (60.4%).

The aggregate mean of 3.6 indicated that majority of the respondents agreed with the statements about agile supply chain strategy. This means that most of the manufacturing firms have embraced agile supply chain strategy. The specific strategies include delivery flexibility, manufacturing capacity and responsiveness. Additionally, the overall standard deviation of 1.1 implied that the data was distributed around the mean. This denoted that majority of the respondents' shared similar opinion in regard to most of the statements on agile supply chain strategy. The findings supported Ambe (2012) assertion that agile supply chain strategy was significant in influencing firm performance.



**Table 4.7: Descriptive Statistics on Agile Supply Chain Strategy**

<b>Statements</b>	<b>SD</b>	<b>D</b>	<b>N</b>	<b>A</b>	<b>SA</b>	<b>M</b>	<b>STD DEV</b>
We are able to quickly meet changes in requirements in delivery times from our customers.	4.00 %	16.30 %	14.9 0%	41.6 0%	23.3 0%	3.6	1.1
We are able to respond to changes in quantities as requested by our customers.	5.40 %	17.80 %	18.3 0%	36.1 0%	22.3 0%	3.5	1.2
We are able to deliver products to various customer locations.	3.50 %	15.30 %	20.8 0%	33.7 0%	26.7 0%	3.7	1.1
We have capacity to fulfill high orders and urgent orders.	6.40 %	21.80 %	19.3 0%	29.2 0%	23.3 0%	3.4	1.2
We always meet customer volumes as ordered.	3.00 %	19.80 %	21.3 0%	30.7 0%	25.2 0%	3.6	1.2
We respond quickly to customers' requirements and enquiries.	0.50 %	13.90 %	17.8 0%	39.1 0%	28.7 0%	3.8	1.0
We are always willing to provide solution to our suppliers and customers.	2.50 %	18.80 %	18.3 0%	34.7 0%	25.7 0%	3.6	1.1
Aggregate mean N = 270						3.6	1.1

#### 4.5.2 Other factors that affect agile supply chain strategy

Supply chain agility is the ability of the entire supply chain and its members to align the network and its operations quickly with the demand network's dynamic and turbulent requirements (Ishmail & sharifi, 2016). The respondents were asked to suggest other factors that affect agile supply chain strategy in their firms. From table 4.8, it was noted that flexibility of the process and procedure was the most critical factor affecting supply chain strategy with 24.6% followed by manufacturing capacity with 18.5% and closely followed by lead time factor at 11.3%. The least critical factor was manufacturing design at 5.25%. The findings were as indicated as in the table below.

**Table 4.8: Factors that affect agile supply chain strategy**

<b>Factors</b>	<b>Frequency</b>	<b>Percent</b>
Flexibility of process and procedures	61	24.6
Good relationship with suppliers	25	10.1
Resources availability	31	12.5
Manufacturing design	13	5.2
Organizational culture	18	7.3
Availability of information technology	14	5.6
Employees empowerment	12	4.9
Manufacturing capacity	46	18.5
Lead time	28	11.3
<b>Total</b>	<b>248</b>	<b>100</b>

#### **4.5.3 Descriptive Statistics on Risk Hedging Supply Chain Strategy**

The respondents were asked to indicate their agreement or disagreement with the statements on risk-hedging supply chain strategy using a five level likert scale (1-strongly disagree, 2-disagree, 3-neutral, 4- agree, and 5- strongly agree). The results are shown in Table 4.9.

The findings reveal that majority of the respondents agreed with the statement that they usually keep safety stock (64.3%), they don't suffer stock outs (68.3%), they contract many suppliers for supply (63.9%), they establish long term relationships with suppliers (61.9%), and they develop the suppliers' capacity (67.8%). Further, the respondents noted that they established quality requirements in their processes (55%), they ensure compliance to quality requirements (59.9%) and they share quality standards with suppliers (55%).

The aggregate mean of 3.7 indicated that majority of the respondents agreed with the statements about risk hedging supply chain strategy. This means that most of the manufacturing firms have adopted the use of risk hedging supply chain strategy. In

particular, the firms have adopted safety stock, suppliers' management and quality. Additionally, the overall standard deviation of 1.2 implied that the data was distributed around the mean. This denoted that majority of the respondents' shared similar opinion in regard to most of the statements on risk-hedging supply chain strategy. The study agreed with Birhanu, Lanka and Rao (2014) observation that adoption of risk hedging supply chain strategy enhances competitiveness of businesses and the market position against their rivals.

**Table 4.9: Descriptive Statistics on Risk-Hedging Supply Chain Strategy**

<b>Statements</b>	<b>SD</b>	<b>D</b>	<b>N</b>	<b>A</b>	<b>SA</b>	<b>M</b>	<b>STD. DEV</b>
We usually keep safety stock	2.00	20.3	13.4	36.6	27.7	3.7	1.1
	%	0%	0%	0%	0%		
We don't suffer stock outs	2.00	16.3	13.4	39.1	29.2	3.8	1.1
	%	0%	0%	0%	0%		
We contract many suppliers for supply	3.50	14.4	18.3	33.7	30.2	3.7	1.1
	%	0%	0%	0%	0%		
We establish long term relationships with suppliers	4.00	19.3	14.9	32.7	29.2	3.6	1.2
	%	0%	0%	0%	0%		
We develop our suppliers' capacity	1.00	14.4	16.8	31.2	36.6	3.9	1.1
	%	0%	0%	0%	0%		
We have established quality requirements in our processes	2.50	23.8	18.8	23.8	31.2	3.6	1.2
	%	0%	0%	0%	0%		
We ensure compliance to quality requirements	4.00	22.8	13.4	31.2	28.7	3.6	1.2
	%	0%	0%	0%	0%		
Aggregate mean						3.7	1.2
N =270							

The respondents were asked to suggest other factors that affect risk hedging supply chain strategy in their firms. Based on the responses, several factors were identified as critical in determining the effectiveness of risk hedging supply chain strategy. These included: avoidance of risks, reduction of risks and sharing of risks. Majority of the respondents observed that the above-mentioned factors were key in improving risk hedging supply chain strategy in the manufacturing firms.

#### 4.5.4 Other factors affecting risk hedging supply chain strategy

The natural hedging approach is consistent with a supply chain risk hedging strategy, sharing supply disruption hazards through pooling and sharing of resource structures within and across businesses (Sun et al., 2009). The respondents were asked to give suggestion on other factors affecting risk hedging supply chain strategy. From table 4.10 showing other factors affecting risk hedging supply chain strategy, it was evident that setting up of risk mitigation measures was the most critical component at 33.5%, followed by quality assurance and control factor at 18.9% and closely followed by conducting critical frequent stock taking at 15.7%. The least factor for consideration was noted to be contract management at 4.3%.

They are summarized below in table 4.10

**Table 4.10: Factors affecting risk hedging supply chain strategy**

<b>Factor</b>	<b>Frequency</b>	<b>Percentage</b>
<b>Proper forecasting</b>	11	6
<b>Frequent stock taking</b>	29	15.7
<b>Contract management</b>	8	4.3
<b>Setting up of risk mitigation measures</b>	62	33.5
<b>Quality assurance and control</b>	35	18.9
<b>Favorable policies</b>	22	11.9
<b>Regular inspection</b>	18	9.7
<b>Total</b>	<b>185</b>	<b>100</b>

#### 4.5.5 Descriptive Statistics on Postponement Supply Chain Strategy

The respondents were asked to indicate their agreement or disagreement with the statements on postponement supply chain strategy using a five level likert scale (1- strongly disagree, 2-disagree, 3-neutral, 4- agree, and 5- strongly agree). The results are shown in Table 4.11.

The findings show that majority of the respondents agreed with the statement that they only buy raw materials or supplies when demand requirements are known (66.3%), they delay final product manufacture or assembly activities until customer orders have been received (67.4%), they delay final product manufacture or assembly activities until the last possible time (70.3%), they delay deliveries until customer orders are received (71.3%), and they store parts/products at distribution points closer to the customer (62.9%). Further, 45.5% of the respondents noted that they delay purchase of materials or supplies until the last possible time.

The aggregate mean of 3.7 indicated that majority of the respondents agreed with the statements about postponement supply chain strategy. This means that most of the manufacturing firms have adopted the use of postponement supply chain strategy. The particular strategies include purchasing postponement, manufacturing postponement and delivery postponement. Additionally, the overall standard deviation of 1.2 implied that the data was distributed around the mean. This denoted that majority of the respondents' shared similar views in regard to most of the statements on postponement supply chain strategy. The study findings were consistent with Nyaoga, Magutu and Aduda (2015) assertion that postponement supply chain strategy significantly influenced firm performance.

**Table 4.11: Descriptive Statistics on Postponement Supply Chain Strategy**

Statements	SD	D	N	A	SA	M	STD DEV
We only buy raw materials or supplies when demand requirements are known	5.90%	16.80%	10.90%	35.60%	30.70%	3.7	1.2
We delay final product manufacture or assembly activities until customer orders have been received	6.40%	15.30%	10.90%	34.70%	32.70%	3.7	1.2
We delay final product manufacture or assembly activities until the last possible time	2.50%	12.90%	14.40%	33.20%	37.10%	3.9	1.1
We delay deliveries until customer orders are received	4.50%	13.40%	12.40%	31.70%	38.10%	3.9	1.2
We store our parts/products at distribution points closer to the customer	1.50%	9.40%	26.20%	33.20%	29.70%	3.8	1.0
Aggregate mean						3.7	1.2
N= 270							

#### 4.5.6 Other factors affecting postponement strategy

Postponing is one of the most useful strategic processes for managing product range and uncertain sales hazards. Postponement of manufacturing enables businesses to function without a completed inventory, businesses can profit from keeping the bulk by delaying costly activities and point of product differentiation of their inventories in the cheaper and/or pre-customized form (Aviv & Federgruen, 2011).

The respondents were asked their opinions on other factors affecting postponement strategy. From table 4.12, it was evident that the most predictor factor was the level of product customization at 27.7%. This was followed by the factor on fluctuations in demand at 13.5% while the third most predictor variable was variations in customer

requirements at 13%. The least contributor was logistics systems efficiency at 3.2%. The opinions are summarized below;

**Table 4.12: Factors affecting postponement strategy**

<b>Factors</b>	<b>Frequency</b>	<b>Percentage</b>
Fluctuations in demand	21	13.5
Changes in customer requirements	20	13
Level of product customization	43	27.7
Sales fluctuations	16	10.3
Cooperation with suppliers	13	8.4
Management support	18	11.6
Economies of scale from delays	19	12.3
Logistics system efficiency	5	3.2
<b>Totals</b>	<b>155</b>	<b>100</b>

#### **4.5.7 Descriptive Statistics on Lean Supply Chain Strategy**

The respondents were asked to indicate their agreement or disagreement with the statements on lean supply chain strategy using a five level likert scale (1- strongly disagree, 2-disagree, 3-neutral, 4- agree, and 5- strongly agree). The results are shown in Table 4.13.

The findings indicate that majority of the respondents agreed with the statement that they reduce any kind of waste (58.4%), they make sure there is minimal or no idle time in machine (64.4%), their labor is fully utilized (74.7%), they keep minimum inventories as possible (54.4%), they always seek continuous improvement in our products (68.4%), and they review the manufacturing processes regularly to identify areas for improvement (65.4%). However, 62.9% of the respondents disagreed that they keep zero inventories.

The aggregate mean of 3.5 indicated that majority of the respondents agreed with most of the statements about lean supply chain strategy. This implies that most of the manufacturing firms have embraced the use of lean supply chain strategy. The particular strategies include waste minimization, zero inventories and continuous

improvement. Additionally, the overall standard deviation of 1.2 implied that the data was distributed around the mean. This denotes that majority of the respondents' shared similar views in regard to most of the statements on lean supply chain strategy. The results were similar to Bruce, Daly and Towers (2014) observation that lean approaches lead to enhanced performance.

**Table 4.13: Descriptive Statistics on Lean Supply Chain Strategy**

<b>Statements</b>	<b>SD</b>	<b>D</b>	<b>N</b>	<b>A</b>	<b>SA</b>	<b>M</b>	<b>STD. DEV</b>
We reduce any kind of waste	5.90%	25.20%	10.40%	28.70%	29.70%	3.5	1.3
We make sure there is minimal or no idle time in machine.	4.00%	16.80%	14.90%	32.70%	31.70%	3.7	1.2
Our labor is fully utilized.	3.50%	10.90%	10.90%	49.00%	25.70%	3.8	1.0
We keep zero inventories.	22.30%	40.60%	9.90%	18.80%	8.40%	2.5	1.3
We keep minimum inventories as possible.	10.40%	21.30%	13.90%	37.10%	17.30%	3.3	1.3
We always seek continuous improvement in our products.	5.40%	16.80%	9.40%	44.60%	23.80%	3.6	1.2
We review our manufacturing processes regularly to identify areas for improvement.	5.90%	20.80%	7.90%	40.60%	24.80%	3.6	1.2
Aggregate mean						3.5	1.2
N =270							

#### **4.5.8 Other factors affecting lean supply chain strategy**

Speed and client responsiveness, decreased inventories, decreased expenses, enhanced customer satisfaction, supply chain as a competitive weapon are the main elements of a lean supply chain (Schultz, 2016). The study sought to find out other factors that affect lean supply chain strategy. From table 4.14 it was evident that processes and procedures improvement was the most considered predictor variable at



19.7%. The second most considered predictor factor was demand collaboration with customers at 18.7%. The third most considered factor was a key focus on quality at 17.8% while the least considered factor was employees support at 4.2%.

They are summarized in table 4.14 below

**Table 4.14: factors affecting lean supply chain strategy**

<b>Factor</b>	<b>Frequency</b>	<b>Percentage</b>
Company culture	16	7.5
Continue improvement	21	9.8
Employees support	9	4.2
Use of just in time philosophy	37	17.2
demand collaboration with consumers	40	18.7
Focus on quality	38	17.8
Sales planning	11	5.1
Process and procedures improvement	42	19.7
<b>Total</b>	<b>214</b>	<b>100</b>

#### **4.5.9 Descriptive Statistics on Environment Uncertainties**

The respondents were asked to state their agreement or disagreement with the statements on environment uncertainties using a five level likert scale (1- strongly disagree, 2-disagree, 3-neutral, 4- agree, and 5- strongly agree). The outcomes are indicated in Table 4.15.

The results reveal that majority of the respondents agreed with the statement that suppliers' delivery timelines are unpredictable sometimes (76.2%), they experience unexpected raw material shortages (70.3%), there are new products entering the market from competitors (64.9%), and there are changes in customers tastes and

preferences, 71.8%. Further, 71.3% of the respondents noted that there are changes in technology regularly, they experience high rate of product innovations from competitors (64.8%), and there is uncertainty on accessibility of the latest technology (66.3%).

The aggregate mean of 3.8 revealed that majority of the respondents agreed with most of the statements about environment uncertainties. This implies that the manufacturing firms experience environmental uncertainties related to demand, supply and technology. Additionally, the overall standard deviation of 1.3 implied that the data was distributed around the mean. This denoted that majority of the respondents' shared similar views in regard to most of the statements on environment uncertainties. The findings supported Farooque, Suhail and Faisal (2017) establishment that uncertainties in supply chains interfere with their performance and managing uncertainties and risks to reduce this interference is a costly affair. Additionally, the findings concurred with Singh (2020) observation that environmental uncertainty has a negative impact on firm financial performance.

**Table 4.15: Descriptive Statistics on Environment Uncertainties**

<b>Statements</b>	<b>SD</b>	<b>D</b>	<b>N</b>	<b>A</b>	<b>SA</b>	<b>M</b>	<b>STD. DEV</b>
Suppliers' delivery timelines are unpredictable sometimes	3.00		5.40	36.60	39.60		
	%	15.30%	%	%	%	4.3	1.1
We experience unexpected raw material shortages	5.90		8.90	30.70	39.60		
	%	14.90%	%	%	%	3.8	1.3
There are new products entering the market from competitors	6.40		8.90	34.20	30.70		
	%	19.80%	%	%	%	3.6	1.3
There are changes in customers tastes and preferences	5.40		5.00	34.70	37.10		
	%	17.80%	%	%	%	3.8	1.3
There are changes in technology regularly	5.90		7.40	37.60	33.70		
	%	15.30%	%	%	%	3.8	1.2
We experience high rate of product innovations from competitors	12.90		5.00	29.70	35.10		
	%	17.30%	%	%	%	3.6	1.4
There is uncertainty on accessibility of the latest technology	8.40		10.40	26.20	40.10		
	%	14.90%	%	%	%	3.8	1.3
Aggregate mean						3.8	1.3
N = 270							

#### 4.5.10 Descriptive Statistics on Performance of the Firm

The respondents were asked to state their agreement or disagreement with the statements on performance of the firm using a five level likert scale (1- strongly disagree, 2-disagree, 3-neutral, 4- agree, and 5- strongly agree). The outcomes are indicated in Table 4.16.

The results reveal that majority of the respondents agreed with the statement that they get regular compliments from our customers (77.3%), they effectively fulfill the requirements of the customers (83.2%), they respond to customer enquiries timely (80.7%), and their customers have been increasing over time (84.6%). Further, 51% of the respondents cited that their firm is profitable, 67.3% noted that profit margin for the firm has increased over the years, while 50% indicated that profit margins have stagnated. In addition, 61.4% of the respondents agreed that their products are available in the market, 73.3% stated that distributors are ordering more items, and 61.4% opined that their products are highly competitive in the market. On the other hand, 66.3% of the respondents disagreed with the statement that they get regular complaints from customers.

The aggregate mean of 3.7 revealed that majority of the respondents agreed with most of the statements about performance of the firm. This means that the manufacturing firms have been experience growth in performance based on the level of customer satisfaction, profitability and market share. Furthermore, the overall standard deviation of 1.1 implied that the data was distributed around the mean. This denoted that majority of the respondents' shared similar views in regard to most of the statements on firm performance.

**Table 4.16: Descriptive Statistics on Performance of the Firm**

Statements							STD
	SD	D	N	A	SA	M	DEV
We get regular complains from our customers.	39.60%	26.70%	6.40%	25.20%	2.00%	2.2	1.3
We get regular compliments from our customers.	4.50%	11.90%	6.40%	42.60%	34.70%	3.9	1.1
We effectively fulfill the requirements of the customers.	2.00%	7.40%	7.40%	41.10%	42.10%	4.1	1.0
We respond to customer enquiries timely.	5.90%	7.90%	5.40%	38.60%	42.10%	4.0	1.2
Our customers have been increasing over time.	4.50%	7.40%	3.50%	38.10%	46.50%	4.2	1.1
Our firm is profitable.	10.40%	29.70%	9.40%	28.20%	22.30%	3.1	1.2
Profit margin for the firm has increased over the years.	5.40%	15.80%	11.40%	48.50%	18.80%	4.1	1.2
Profit margins have stagnated.	3.00%	29.70%	17.30%	23.80%	26.20%	3.6	1.1
Our products are available in the market.	7.90%	18.30%	12.40%	29.70%	31.70%	3.3	1.1
Distributors are ordering more items.	5.90%	13.40%	7.40%	31.20%	42.10%	4.1	1.0
Our products are highly competitive in the market.	5.90%	17.30%	15.30%	24.80%	36.60%	3.7	1.3
Aggregate mean						3.7	1.1
N= 270							

The participants were further asked to indicate the rate at which revenue/income has increased in their firm over the last three years. The findings in Table 4.17 reveal that 33.7% of the respondents noted that in 2016, their firms' revenue increased by 41-60%. In 2017, 52% noted that the revenue grew by 0-20%. In 2018, the revenue according to 43.1% of the respondents increased by 21-40%.

**Table 4.17: Revenue/Income**

<b>Year</b>	<b>0-20%</b>	<b>21-40%</b>	<b>41-60%</b>	<b>61-80%</b>	<b>81-100%</b>
2016	16.3%	17.3%	33.7%	26.7%	5.9%
2017	52.0%	26.7%	6.4%	10.4%	4.5%
2018	21.3%	43.1%	12.9%	20.8%	2.0%
N=270					

In addition, the participants were asked to indicate the rate at which operational costs has increased in their firm over the last three years. The findings in Table 4.18 indicate that 55.4% of the respondents cited that in 2016, their firms' operational cost increased by 21-40%. In 2017, 47.5% noted that the operational cost grew by 61-80%. In 2018, the operational cost according to 36.6% of the respondents increased by 41-60%.

**Table 4.18: Operational Cost**

<b>Year</b>	<b>0-20%</b>	<b>21-40%</b>	<b>41-60%</b>	<b>61-80%</b>	<b>81-100%</b>
2016	13.9%	55.4%	1.0%	21.8%	7.9%
2017	17.3%	11.4%	3.0%	47.5%	20.8%
2018	17.3%	30.2%	36.6%	2.5%	13.4%
N=270					

Lastly, the respondents were asked to indicate the rate of average growth in market share of their firm in the last three years. The results in Table 4.19 reveal that 44.1% of the respondents cited that in 2016, their firms' market share grew by 11-15%. In 2017, 47.5% noted that the market share grew by 6-10%. In 2018, the market share according to 36.6% of the respondents grew by 0-5%.

**Table 4.19: Market Share**

<b>Year</b>	<b>0-5%</b>	<b>6-10%</b>	<b>11-15%</b>	<b>16-20%</b>	<b>21-25%</b>	<b>Above 25%</b>
2016	15.8%	23.3%	44.1%	10.9%	5.9%	0.0%
2017	38.1%	47.5%	5.0%	6.9%	2.5%	0.0%
2018	36.6%	24.8%	15.3%	17.3%	5.9%	0.0%
N=270						

#### 4.5.11 other factors affecting performance of manufacturing firms

The respondents were asked to suggest other factors that affect performance of their firm. Based on the responses, the following factors were identified as highlighted in the table below. From table 4.20 it was noted the most considered predictor of performance was government policies given by 21.3%. The second most considered factor on performance was top management support given by 17.4% followed by lack of expertise given 11.4%. The least considered predictor of performance was the existing competition given by 4.5%.

**Table 4.20: Factors affecting performance of manufacturing firms**

<b>Factors</b>	<b>Frequency</b>	<b>Percentage</b>
Lack of motivation of employees	14	10.6
Top management support	23	17.4
Government policies	28	21.3
Adoption of technology	9	6.8
Prevailing competition	6	4.5
Lack of expertise	15	11.4
Organizational culture	12	9.1
Availability of needed resources	14	10.6
Type of investment decisions	11	8.3
<b>Total</b>	<b>132</b>	<b>100</b>

## 4.6 Factor Analysis for Independent and Dependent Variables

Factor analysis was used to summarize data to be more manageable without losing any important information and therefore making it easier to test hypothesis (Field, 2009). Kaiser (1974) noted that factor loading values that are greater than 0.4 should be accepted and values below 0.4 should lead to correction of more data to help researcher to determine the values to include. In this study, all the items with values of 0.4 and above were adopted.

### 4.6.1 Factor Analysis for Agile Supply Chain Strategy

The findings in Table 4.21 indicate the factor loadings of items measuring agile supply chain strategy. From the results, all the items had values more than 0.4 and therefore they were accepted. None of the items was dropped.

**Table 4.21: Factor analysis; agile supply chain strategy**

<b>Indicators of Agile supply chain strategy</b>	<b>Factor loading</b>
We are able to quickly meet changes in requirements in delivery times from our customers	0.684
We are able to respond to changes in quantities as requested by our customers	0.556
We are able to deliver products to various customer locations	0.820
We have capacity to fulfill high orders and urgent orders	0.493
We always meet customer volumes as ordered	0.637
We respond quickly to customers' requirements and enquiries	0.731
We are always willing to provide solution our suppliers and customers	0.597

### 4.6.2 Factor Analysis for Risk-Hedging Supply Chain Strategy

The findings in Table 4.22 indicate the factor loadings of items measuring risk hedging supply chain strategy. From the results, all the items except one had values more than 0.4 and therefore they were accepted. The item with a value less than 0.4 was dropped.



**Table 4.22: Factor analysis; Risk-Hedging Supply Chain Strategy**

<b>Indicators</b>	<b>Factor loading</b>
We usually keep safety stock	0.504
We don't suffer stock outs	0.794
We contract many suppliers for supply	0.669
We establish long term relationships with suppliers	0.680
We develop our suppliers' capacity	0.540
We have established quality requirements in our processes	0.563
We ensure compliance to quality requirements	0.598
We share our quality standards with our suppliers	0.325

#### **4.6.3 Factor Analysis for Postponement Supply Chain Strategy**

The findings in Table 4.23 indicate the factor loadings of items measuring postponement supply chain strategy. From the results, all the items except one had values more than 0.4 and therefore they were accepted. The item with a value less than 0.4 was dropped.

**Table 4.23: Factor analysis; Postponement Supply Chain Strategy**

<b>Indicators</b>	<b>Factor loading</b>
We only buy raw materials or supplies when demand requirements are known	0.642
We delay purchase of materials or supplies until the last possible time	0.343
We delay final product manufacture or assembly activities until customer orders have been received	0.729
We delay final product manufacture or assembly activities until the last possible time	0.544
We delay deliveries until customer orders are received	0.419
We store our parts/products at distribution points closer to the customer	0.760

#### 4.6.4 Factor Analysis for Lean Supply Chain Strategy

The findings in Table 4.24 indicate the factor loadings of items measuring lean supply chain strategy. From the results, all the items had values more than 0.4 and therefore they were accepted. None of the items was dropped.

**Table 4.24: Factor analysis; Lean Supply Chain Strategy**

<b>Indicators</b>	<b>Factor loading</b>
We reduce any kind of waste	0.584
We make sure they is minimal or no idle time in ma	0.760
Our labor is fully utilized	0.750
We keep zero inventories	0.518
We keep minimum inventories as possible	0.714
We always seek continuous improvement in our products	0.580
We review our manufacturing processes regularly to identify areas for improvement	0.673

#### 4.6.5 Factor Analysis for Environment Uncertainties

The findings in Table 4.25 indicate the factor loadings of items measuring environment uncertainties. From the results, all the items had values more than 0.4 and therefore they were accepted. None of the items was dropped.

**Table 4.25: Factor analysis; Environment Uncertainties**

<b>Indicators</b>	<b>Factor loading</b>
Suppliers' delivery timelines are unpredictable sometimes	0.682
We experience unexpected raw material shortages	0.529
There are new products entering the market from competitors	0.788
There are changes in customers tastes and preferences	0.571
There are changes in technology regularly	0.773
We experience high rate of product innovations from competitors	0.695
There is uncertainty on accessibility of the latest technology	0.414

#### **4.6.6 Factor Analysis for Performance of the Firm**

The findings in Table 4.26 indicate the factor loadings of items measuring performance of the firm. From the results, all the items had values more than 0.4 and therefore they were accepted. None of the items was dropped.

**Table 4.26: Factor analysis; Performance of the Firm**

<b>Indicators</b>	<b>Factor loading</b>
We get regular complains from our customers	0.597
We get regular compliments from our customers	0.653
We effectively fulfill the requirements of the customers	0.710
We respond to customer enquiries timely	0.782
Our customers have been increasing over time	0.605
Our firm is profitable	0.833
Profit margin for the firm has increased over the years	0.702
Profit margins have stagnated	0.552
Our products are available in the market	0.674
Distributors are ordering more items	0.413
Our products are highly competitive in the market	0.625

## 4.7 Diagnostic Tests Results

Prior to inferential analysis, several diagnostic tests were conducted. The purpose of running the tests was to ensure that the data series was not biased, which would result to wrong estimations. The tests included multicollinearity, normality, heteroscedasticity, and auto-correlation tests.

### 4.7.1 Multicollinearity Test

The study tested multicollinearity between independent variables using VIF. A value of 1 indicates that there is no correlation between independent variables. VIFs between 1 and 5 suggest that there is a moderate correlation, but it is not severe enough to warrant corrective measures. VIFs greater than 10 represent critical levels of multicollinearity. The findings in Table 4.27 reveal individual VIF values less than 10. Further, the overall VIF value of 4.04 was less than 10. This implied that there was no multicollinearity between the independent variables.

**Table 4.27: Multicollinearity test**

Variables	Tolerance	VIF
Agile Supply Chain Strategy	0.23	4.37
Risk-Hedging Supply Chain Strategy	0.23	4.30
Postponement Supply Chain Strategy	0.24	4.11
Lean Supply Chain Strategy	0.30	3.38
<b>Overall</b>	<b>0.25</b>	<b>4.04</b>

### 4.7.2 Normality Test

To test the normality of the data, Shapiro-Wilk test was conducted where a P value (Sig. value) greater than 0.05 showed that data is normally distributed. On the other hand, a P value less than 0.05 it indicates data is not normally distributed. The results in Table 4.28 indicate that the significance value for all the variables was greater than

0.05. This led to conclusion that data representing each of the variables was normally distributed.

**Table 4.28: Normality Test using Shapiro-Wilk**

	<b>Statistic</b>	<b>df</b>	<b>Sig.</b>
Performance of the firm	0.981	202	0.497
Agile Supply Chain Strategy	0.983	202	0.116
Risk-Hedging Supply Chain Strategy	0.986	202	0.137
Postponement Supply Chain Strategy	0.977	202	0.112
Lean Supply Chain Strategy	0.979	202	0.125
Environment Uncertainties	0.979	202	0.325

#### 4.7.3 Heteroscedasticity Test

Heteroscedasticity tested by correlating standardized predicted values with standardized residual values. Results in Table 4.29 indicate that the correlation between standardized predicted and residual values was not statistically significant (P value of 0.245>0.05). This implied that the assumption of homoscedasticity was satisfied. Hence, there was no heteroscedasticity in the data.

**Table 4.29: Heteroscedasticity Test**

		<b>Standardized Predicted</b>	<b>Standardized Residual</b>
	Pearson		
Standardized Predicted	Correlation	1.000	-0.082
	Sig. (2-tailed)		0.245
	Pearson		
Standardized Residual	Correlation	-0.082	1.000
	Sig. (2-tailed)	0.245	
	N	202	202

#### 4.7.4 Auto-correlation Test

The test of auto-correlation test was done using Durbin-Watson. The Durbin Watson test reports a test statistic, with a value from 0 to 4, where; 2 is no autocorrelation, 0 to <2 is positive autocorrelation (common in time series data), >2 to 4 is negative autocorrelation (less common in time series data). A rule of thumb is that test statistic values in the range of 1.5 to 2.5 are relatively normal. Values outside of this range could be cause for concern. Results in Table 4.30 reveal a Durbin-Watson value of 1.589 implying that the null hypothesis of no autocorrelation was accepted and thus residuals were not auto-correlated.

**Table 4.30: Durbin-Watson test of Auto-correlation**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	DurbinWats on
1	.856a	0.733	0.727	0.18716	1.589

a Predictors: (Constant), X4, X3, X2, X1

b Dependent Variable: Y

#### 4.8 Correlation Analysis

This section provides results on the correlation between the independent variables – agile supply chain strategy (X1), risk-hedging supply chain strategy (X2), postponement supply chain strategy (X3), lean supply chain strategy (X4) and dependent variable – firm performance (Y). The correlation analysis was used to determine the relationship between the variables in terms of strength and direction. Table 4.31 shows the findings.

The findings reveal that agile supply chain strategy had a strong positive and significant association with firm performance ( $r = .652$ ,  $P = .000$ ) at 5% level of significance. This implied that improvement in agile supply chain strategy is significantly connected with increase in firm performance. The results agreed with Ambe (2012) who established that agile supply chain strategy was significant in influencing firm performance.

The results also indicate that risk-hedging supply chain strategy had a strong positive and significant association with firm performance ( $r = .699$ ,  $P = .000$ ). This implied that improvement in risk-hedging supply chain strategy is significantly connected with increase in firm performance. The study agreed with Birhanu, Lanka and Rao (2014) findings that adoption of risk hedging supply chain strategy enhances competitiveness of businesses and the market position against their rivals.

Further, the outcome shows that postponement supply chain strategy had a strong positive and significant association with firm performance ( $r = .651$ ,  $P = .000$ ). This implied that improvement in postponement supply chain strategy is significantly connected with increase in firm performance. The study findings were consistent with Nyaoga, Magutu and Aduda (2015) assertion that postponement supply chain strategy significantly influenced firm performance.

In addition, the findings demonstrate that lean supply chain strategy had a strong positive and significant association with firm performance ( $r = .679$ ,  $P = .000$ ). This implied that improvement in lean supply chain strategy is significantly connected with increase in firm performance. The results were similar to Bruce, Daly and Towers (2014) observation that lean approaches lead to enhanced performance.

**Table 4.31: Correlation Results**

		Y	X1	X2	X3	X4
Y	Pearson Correlation	1				
	Sig. (2-tailed)					
X1	Pearson Correlation	.652**	1			
	Sig. (2-tailed)	.000				
X2	Pearson Correlation	.699**	.653**	1		
	Sig. (2-tailed)	.000	.000			
X3	Pearson Correlation	.651**	.659**	.631**	1	
	Sig. (2-tailed)	.000	.000	.000		
X4	Pearson Correlation	.679**	.672**	.635**	.669**	1
	Sig. (2-tailed)	.000	.000	.000	.000	

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

## 4.9 Univariate Regression Analysis

This section provides univariate regression results on the relationship between agile, risk hedging, postponement, lean supply chain strategies and performance of manufacturing firms in Kenya. The section further presents the findings on the moderating effect of environmental uncertainties on the relationship between supply chain strategies and performance of the firm.

### 4.9.1 Effect of Agile Supply Chain Strategy on Performance of Manufacturing Firms

The regressions results are presented in Table 4.32. The model summary results indicate that separately, agile supply chain strategy explains 56.5% ( $R^2 = .565$ ) of the total variations in the performance of manufacturing firms. The ANOVA results reveal an F statistic of 259.921 and reported P value of 0.000. The P value being less than the alpha value ( $P < .05$ ), the proposed model is therefore statistically significant (good fit) in predicting the dependent variable.

Further, the regression of coefficient findings indicate that agile supply chain strategy had a positive and significant effect on firm performance ( $\beta = 0.602$   $P < .000$ ). This implied that a change in agile supply chain strategy by one unit would result to change in performance of manufacturing firms by 0.602 units. The findings are consistent with those of Ambe (2012) who established that agile supply chain strategy was significant in influencing firm performance. Similarly, studies such as (Bakkappa, Metri & Sahay, 2009; Purvis, 2010; Sendil, 2015; Tarafdar & Qrunfleh, 2017; Bakkappa, Metri & Sahay, 2009) concluded that agile supply chain strategy was a significant determinant of firm performance.

Model;

$$\text{Firm Performance} = 0.934 + 0.602 \text{ Agile supply chain strategy}$$



**Table 4.32: Regression Model: Agile Supply Chain Strategy and Firm Performance**

Mode		Unstandardized		Standardized		
		Coefficients		Coefficients		
1		B	Std. Error	Beta	t	Sig.
1	(Constant)	.934	.091		10.261	.000
	X1	.602	.037	.752	16.122	.000
	R Squared	.565				
	Adjusted R Squared	.563				
	F statistic	259.921				
	P value	.000				

a Dependent Variable: Y

Following the introduction of moderating variable (environmental uncertainties); the results in 4.33 indicate that agile supply chain strategy when interacted with environmental uncertainties explains 30% of the total variations in performance of manufacturing firms. A comparison between the R square without moderation and R square with moderation reveal that the R square declined from 56.5% to 29.5%, implying that environmental uncertainties had a negative moderating effect on the relationship between agile supply chain strategy and performance of manufacturing firms in Kenya. This means that environmental uncertainties significantly lower the effect of agile supply chain strategy on firm performance.

Model;

$$Firm\ Performance = 1.684 + 0.129\ Agile\ supply\ chain\ strategy * Environmental\ Uncertainties$$

**Table 4.33: Regression Model with Moderation**

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	1.684	.079		21.436	.000
X1.M	.129	.014	.543	9.149	.000
R Square	0.295				
Adj. R Square	0.292				
F statistic	83.703				
P value	0.000				

#### **4.9.2 Effect of risk hedging Strategy on Performance of Manufacturing Firms**

The regressions results are presented in Table 4.34. The model summary results indicate that separately, risk hedging supply chain strategy explains 63.8% ( $R^2 = .638$ ) of the total variations in the performance of manufacturing firms. The ANOVA results reveal an F statistic of 352.857 and reported P value of 0.000. The P value being less than the alpha value ( $P < .05$ ), the proposed model is therefore statistically significant (good fit) in predicting the dependent variable.

Further, the regression of coefficient findings indicate that risk hedging supply chain strategy had a positive and significant effect on firm performance ( $\beta = 0.675$   $P < .000$ ). This implied that a change in risk hedging supply chain strategy by one unit would result to change in performance of manufacturing firms by 0.675 units. The study supported Birhanu, Lanka and Rao (2014) findings that adoption of risk hedging supply chain strategy enhances competitiveness of businesses and the market position against their rivals. Kouvelis, Wu and Xiao (2019) found that the correlation of cash flow risks of supply chain partners significantly affects the hedging decisions of firms via impacts on production efficiencies. In addition, Kii and Jagongo (2017) established a positive relationship between hedging practices and performance of listed firms.

Model;

$$\text{Firm Performance} = 0.816 + 0.675 \text{ Risk Hedging Supply Chain Strategy}$$

**Table 4.34: Regression Model: Risk Hedging Supply Chain Strategy and Firm Performance**

Model	Unstandardized		Standardized		
	B	Std. Error	Beta	t	Sig.
1 (Constant)	.816	.084		9.671	.000
X2	.675	.036	.799	18.784	.000
R Squared	.638				
Adjusted R Squared	.636				
F statistic	352.857				
P value	.000				

a Dependent Variable: Y

Following the introduction of moderating variable (environmental uncertainties); the results in 4.35 indicate that risk hedging supply chain strategy when interacted with environmental uncertainties explains 34% of the total variations in performance of manufacturing firms. A comparison between the R square without moderation and R square with moderation reveal that the R square declined from 64% to 33.5%, implying that environmental uncertainties had a negative moderating effect on the relationship between risk hedging supply chain strategy and performance of manufacturing firms in Kenya. This means that environmental uncertainties significantly lower the effect of risk hedging supply chain strategy on firm performance.

Model;

$$\text{Firm Performance} = 1.629 + 0.145 \text{ Risk Hedging Supply Chain Strategy} * \text{Environmental Uncertainties}$$

**Table 4.35: Regression Model with Moderation**

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	1.629	.077		21.080	.000
X2.M	.145	.014	.579	10.034	.000
R Square	0.335				
Adj. R Square	0.331				
F statistic	100.671				
P value	0.000				

#### **4.9.3 Effect of Postponement Supply Chain Strategy on Performance of Manufacturing Firms**

The regressions results are presented in Table 4.36. The model summary results indicate that separately, postponement supply chain strategy explains 56.4% ( $R^2 = .564$ ) of the total variations in the performance of manufacturing firms. The ANOVA results reveal an F statistic of 258.594 and reported P value of 0.000. The P value being less than the alpha value ( $P < .05$ ), the proposed model is therefore statistically significant (good fit) in predicting the dependent variable.

Further, the regression of coefficient findings indicate that postponement supply chain strategy had a positive and significant effect on firm performance ( $\beta = 0.572$ ,  $P < .000$ ). This implied that a change in postponement supply chain strategy by one unit would result to a change in performance of manufacturing firms by 0.572 units. The study findings were consistent with Nyaoga, Magutu and Aduda (2015) assertion that postponement supply chain strategy significantly influenced firm performance. Świerczek (2010) also found that postponement strategies influenced manufacturing performance in supply. Further, Boone, Craighead and Hanna (2017) revealed a

significant increase in the number of postponement research efforts, many of which at least partially addressed past challenges noted in previous research.

Model;

$$\text{Firm Performance} = 1.044 + 0.572 \text{ Postponement Supply Chain Strategy}$$

**Table 4.36: Regression Model: Postponement Supply Chain Strategy and Firm Performance**

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	T	Sig.
1 (Constant)	1.044	.084		12.361	.000
X3	.572	.036	.751	16.081	.000
R Squared	.564				
Adjusted R Squared	.562				
F statistic	258.594				
P value	.000				

a Dependent Variable: Y

Following the introduction of moderating variable (environmental uncertainties); the results in 4.37 indicate that postponement supply chain strategy when interacted with environmental uncertainties explains 29.8% of the total variations in performance of manufacturing firms. A comparison between the R square without moderation and R square with moderation reveal that the R square declined from 56.4% to 29.8%, implying that environmental uncertainties had a negative moderating effect on the relationship between postponement supply chain strategy and performance of manufacturing firms in Kenya. This means that environmental uncertainties significantly lower the effect of postponement supply chain strategy on firm performance.

Model;

$$\text{Firm Performance} = 1.710 + 0.128 \text{ Postponement Supply Chain Strategy} * \text{Environmental Uncertainties}$$

**Table 4.37: Regression Model with Moderation**

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	1.710	.075		22.696	.000
X3.M	.128	.014	.546	9.222	.000
R Square	0.298				
Adj. R Square	0.295				
F statistic	85.049				
P value	0.000				

#### **4.9.4 Effect of Lean Supply Chain Strategy on Performance of Manufacturing Firms**

The regressions results are presented in Table 4.38. The model summary results indicate that separately, lean supply chain strategy explains 60.7% ( $R^2 = .607$ ) of the total variations in the performance of manufacturing firms. The ANOVA results reveal an F statistic of 309.110 and reported P value of 0.000. The P value being less than the alpha value ( $P < .05$ ), the proposed model is therefore statistically significant (good fit) in predicting the dependent variable.

Further, the regression of coefficient findings indicate that lean supply chain strategy had a positive and significant effect on firm performance ( $\beta = 0.583$   $P < .000$ ). This implied that a change in lean supply chain strategy by one unit would result to a change in performance of manufacturing firms by 0.583 units. The results were similar to Bruce, Daly, Towers (2014) conclusion that lean approaches lead to enhanced performance. Daud and Zailani (2011) established that demand collaboration, sales and operation planning, inventory management practices, waste

and value-added activities are the most influence lean supply chain practices for lean performances. Afonso and Cabrita (2015) concluded that lean supply chain measurement system increases the chance for success because it enables managers to see areas where supply chain performance can be improved, so they can focus their attention, and obtain higher levels of performance. Further, Mwangangi and Achuora (2019) established a significant positive relationship between Lean Supply chain and Organizational Performance. However, the findings disagreed with those of Cox, Chicks and Palmer (2017) who found that majority of UK pig supply chain respondents who were the first to adopt lean approaches did not receive the expected business enhancement.

Model;

$$\text{Firm Performance} = 0.883 + 0.583 \text{ Lean Supply Chain Strategy}$$

**Table 4.38: Regression Model: Lean Supply Chain Strategy and Firm Performance**

Model	Unstandardized		Standardized Coefficients		
	B	Std. Error	Beta	T	Sig.
1 (Constant)	.883	.086		10.224	.000
X4	.583	.033	.779	17.582	.000
R Squared	.607				
Adjusted R Squared	.605				
F statistic	309.110				
P value	.000				

a Dependent Variable: Y

Following the introduction of moderating variable (environmental uncertainties); the results in 4.39 indicate that lean supply chain strategy when interacted with environmental uncertainties explains 33% of the total variations in performance of manufacturing firms. A comparison between the R square without moderation and R

square with moderation reveal that the R square declined from 60.7% to 33%, implying that environmental uncertainties had a negative moderating effect on the relationship between lean supply chain strategy and performance of manufacturing firms in Kenya. This means that environmental uncertainties significantly lower the effect of lean supply chain strategy on firm performance.

Model;

$$\text{Firm Performance} = 1.638 + 0.129 \text{ Lean Supply Chain Strategy} * \text{Environmental Uncertainties}$$

**Table 4.39: Regression Model with Moderation**

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	1.638	.077		21.195	.000
X4.M	.129	.013	.574	9.920	.000
R Square	.330				
Adj. R Square	.326				
F statistic	98.401				
P value	0.000				

#### 4.10 Multiple Regression without Moderation Results

Having separately established the existence of a positive and significant effect of the independent variables on the dependent variable, it was paramount to determine how a combination of the four variables affects performance of manufacturing firms. A multiple linear regression analysis was therefore carried out to test the relationship between variables. The independent variables were regressed on the dependent variable. The findings are shown in Table 4.40.

The model summary results indicate that all the four independent variables jointly explain 73.3% ( $R^2 = .733$ ) of the total variations in the performance of manufacturing



firms. This implied that jointly, the independent variables are strong determinants of firm performance. The ANOVA results reveal an F statistic of 135.01 and reported P value of 0.000. The *P* value being less than the alpha value ( $P < .05$ ), the proposed model is therefore statistically significant (good fit) in predicting the dependent variable.

The regression of coefficient results indicated that agile supply chain strategy ( $\beta_1 = 0.134$ ,  $P = .031$ ); risk hedging supply chain strategy ( $\beta_2 = 0.224$ ,  $P = .001$ ); postponement supply chain strategy ( $\beta_3 = 0.159$ ,  $P = .006$ ); and lean supply chain strategy ( $\beta_4 = 0.229$ ,  $P = .000$ ) had a positive and significant effect on performance of manufacturing firms. Based on the coefficient values, when all the variables are combined in one model, the most significant predictor of firm performance is lean supply chain strategy, followed risk hedging supply chain strategy, followed by postponement supply chain strategy and lastly agile supply chain strategy.

The findings imply that lean supply chain strategy contribute significantly towards performance of manufacturing firms. The findings supported Jajja et al. (2016) research that showed a beneficial connection between the strategic focus of a company's supply chain (lean and responsive) and main provider practices (quality, cost efficiency, distribution, and flexibility), which in turn has a beneficial effect on company results (operational, quality, market, and economic). Sillanpaa (2014) also noted that lean principles of the supply chain minimize production, inventory and transportation costs in the supply chain.

The results also imply that risk hedging supply chain strategy is a significant determinant of manufacturing firms' performance. The study supported Birhanu, Lanka and Rao (2014) findings that adoption of risk hedging supply chain strategy enhances competitiveness of businesses and the market position against their rivals.

The findings further imply that postponement supply chain strategy is a significant contributor of manufacturing firms' performance. The study findings were consistent with Nyaoga, Magutu and Aduda (2015) assertion that postponement supply chain strategy significantly influenced firm performance. Additionally, the results imply that agile supply chain strategy enhances firm performance. The findings are

consistent with those of Ambe (2012) who established that agile supply chain strategy was significant in influencing firm performance.

The overall Model;

$$\text{Firm performance} = 0.581 + 0.134 \text{ agile supply chain strategy} + 0.224 \text{ risk hedging supply chain strategy} + 0.159 \text{ postponement supply chain strategy} + 0.229 \text{ Lean supply chain strategy}$$

**Table 4.40: Regression of coefficient Results**

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	.581	.079		7.357	.000
	X1	.134	.062	.167	2.172	.031
	X2	.224	.065	.264	3.463	.001
	X3	.159	.057	.209	2.803	.006
	X4	.229	.051	.306	4.522	.000
	R Squared	.733				
	Adj. R Squared	.727				
	F statistic	135.013				
	P value	.000				

a Dependent Variable: Y

#### 4.11 Multiple Regression with Moderation Results

Following the introduction of moderating variable (environmental uncertainties); the findings in Table 4.41 indicate that supply chain strategies when interacted with environmental uncertainties explains 34.6% of the total variations in performance of manufacturing firms. A comparison between the R square without moderation and R square with moderation reveal that the R square declined from 73.3% to 34.6%, implying that environmental uncertainties had a negative moderating effect on the relationship between supply chain strategies and performance of manufacturing firms

in Kenya. This means that environmental uncertainties significantly lower the effect of supply chain strategies on firm performance.

**Table 4.41: Regression Model with Moderation**

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	1.605	.079		20.275	.000
X1.M	-.010	.046	-.041	-.210	.834
X2.M	.064	.049	.257	1.312	.191
X3.M	.033	.042	.143	.788	.432
X4.M	.055	.038	.246	1.469	.143
R Squared	0.346				
Adj. R Squared	0.333				
F statistic	26.063				
P value	0.000				

#### 4.12 Hypotheses Testing Results

The first null hypothesis ( $H_{01}$ ) predicted that agile supply chain strategy has no effect on the performance of manufacturing firms in Kenya. The computed  $P$ -value as shown in Table 4.32 was 0.000 at 95% confidence level implying that agile had a significant effect on the performance of manufacturing firms. The null hypothesis was therefore rejected.

The second null hypothesis ( $H_{02}$ ) predicted that risk hedging supply chain strategy has no effect on the performance of manufacturing firms in Kenya. The computed  $P$ -value as shown in Table 4.34 was 0.000 at 95% confidence level implying that risk hedging supply chain strategy had a significant effect on the performance of manufacturing firms. The null hypothesis was therefore rejected.

The third null hypothesis ( $H_{03}$ ) predicted that postponement supply chain strategy has no effect on the performance of manufacturing firms in Kenya. The computed  $P$ -

value as shown in Table 4.36 was 0.000 at 95% confidence level implying that postponement supply chain strategy had a significant effect on the performance of manufacturing firms. The null hypothesis was therefore rejected.

The fourth null hypothesis ( $H_{04}$ ) predicted that lean supply chain strategy has no effect on the performance of manufacturing firms in Kenya. The computed  $P$ -value as shown in Table 4.38 was 0.000 at 95% confidence level implying that lean supply chain strategy had a significant effect on the performance of manufacturing firms. The null hypothesis was therefore rejected.

The fifth null hypothesis ( $H_{05}$ ) predicted that environmental uncertainties have no effect on the effect of supply chain strategies on the performance of manufacturing firms in Kenya. The computed  $P$ -value as shown in Table 4.41 was 0.000 at 95% confidence level implying that environmental uncertainties had a significant moderating effect on the effect of supply chain strategies on the performance of manufacturing firms in Kenya. The null hypothesis was therefore rejected.

The findings were consistent with those of Linn and Maenhout (2019) who found that the global rice supply chain performance is significantly impacted by the planning and control uncertainty and the climate uncertainty. Similarly, Farooque, Suhail and Faisal (2017) established that uncertainties in supply chains interfere with their performance and managing uncertainties and risks to reduce this interference is a costly affair. Further, Kinyua (2015) study revealed that the performance and growth of SME's is influenced by changing technologies, increased operational costs and the power of competitors' strategies. Additionally, Singh (2020) found that environmental uncertainty has a negative impact on firm financial performance.

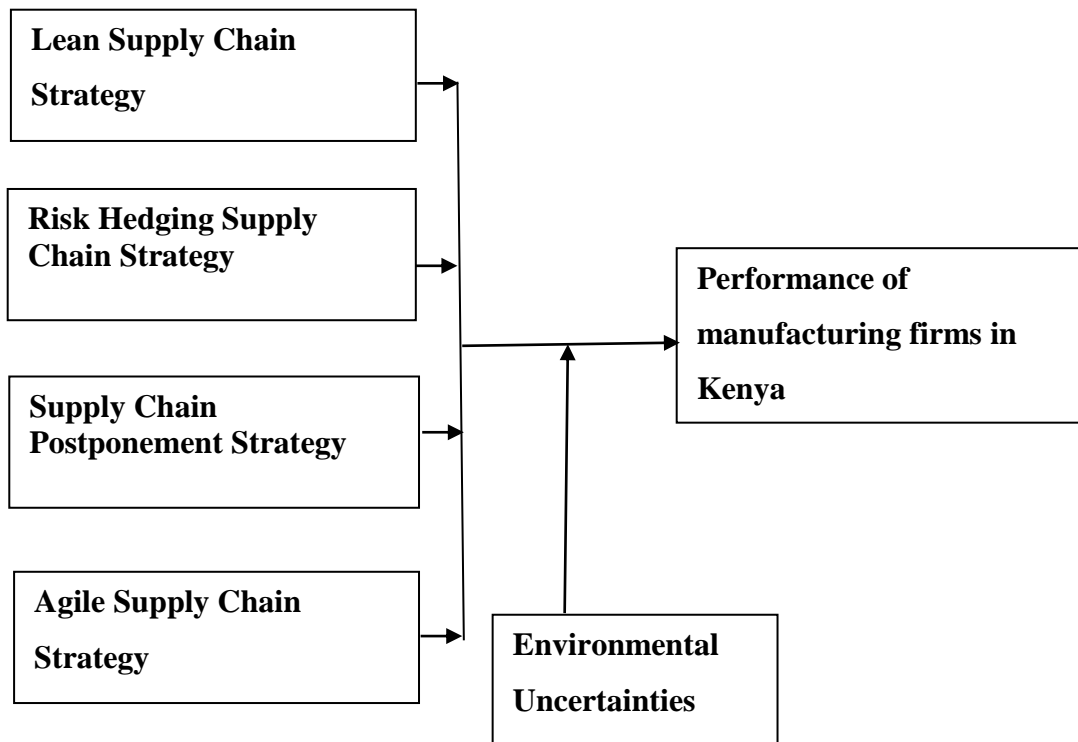
The hypotheses testing results are summarized in Table 4.42.

**Table 4.42: Hypothesis Testing Results**

<b>No</b>	<b>Hypothesis</b>	<b>P value</b>	<b>Decision</b>
H01	Agile supply chain strategy has no effect on performance of manufacturing firms in Kenya.	0.000<0.05	Rejected
H02	Risk hedging supply chain strategy has no effect on performance of manufacturing firms in Kenya.	0.000<0.05	Rejected
H03	Postponement supply chain strategy has no effect on performance of manufacturing firms in Kenya.	0.000<0.05	Rejected
H04	Lean supply chain strategy has no effect on performance of manufacturing firms in Kenya.	0.000<0.05	Rejected
H05	Environmental uncertainties has no effect on effect of supply chain strategies on the performance of manufacturing firms in Kenya.	0.000<0.05	Rejected

#### **4.13 Revised Conceptual Framework or Optimal Model**

A revised conceptual framework was developed based on regression findings in Table 4.35. No variable was dropped since all the variables were significant. The variables were arranged in order of significance as follows; lean supply chain strategy, followed by risk hedging supply chain strategy, followed by postponement supply chain strategy and lastly agile supply chain strategy. The revised conceptual framework is presented in Figure 4.1.



**Independent Variables      Moderating Variable      Dependent Variable**

**Figure 4.1: Revised Conceptual Framework**

## **CHAPTER FIVE**

### **SUMMARY, CONCLUSION AND RECOMMENDATIONS**

#### **5.1 Introduction**

This chapter provides a summary, conclusion and recommendations of the study. The presentation is done in line with the objectives of the study. The study sought to determine the effect of supply chain strategies on the performance of manufacturing firms in Kenya.

#### **5.2 Summary of the Major Findings**

This section summarizes the findings obtained in chapter four in line with the study objectives.

The overall objective of this study was to investigate the effect of supply chain strategies on performance of manufacturing firms in Kenya. The study particularly sought to determine the effect of agile supply chain strategy on performance of manufacturing firms in Kenya, to establish the effect of risk hedging supply chain strategy on performance of manufacturing firms in Kenya, to determine the effect of postponement supply chain strategy on performance of manufacturing firms in Kenya, to establish the effect of lean supply chain strategy on the performance of manufacturing firms in Kenya and lastly to determine the moderating effect of environmental uncertainties on the effect of supply chain strategies and performance of manufacturing firms in Kenya.

##### **5.2.1 Agile Supply Chain Strategy**

The first objective of the study was to examine the effect of agile supply chain strategy on the performance of manufacturing firms in Kenya. Based on the descriptive findings, majority of the respondents observed that manufacturing firms have embraced agile supply chain strategy. Further, it was noted that the most adopted strategy was responsiveness to customer's requirements and enquiries with  $\bar{x} = 3.8$  followed by strategy on ability to deliver products to various customer locations

with  $\bar{x} = 3.7$  and closely followed by strategies on ability to quickly meet changes in customer requirements for delivery and willingness to provide solution to both customers and suppliers with  $\bar{x} = 3.6$  each.

From open ended responses, the respondents noted that flexibility of process and procedures at 24.6%, manufacturing capacity at 18.5% and resources availability are fundamental factors that determine agility of a supply chain in that order. The least considered factor was employees' empowerment at 4.9%.

The correlation results indicated that agile supply chain strategy had a strong positive and significant association with performance of manufacturing firms with an  $r = .652$ . The regression results revealed that separately and when combined with other strategies, agile supply chain strategy has a positive and statistically significant effect on performance of manufacturing firms. Based on the regression results, the null hypothesis that agile supply chain strategy has no effect on the performance of manufacturing firms in Kenya was rejected.

### **5.2.2 Risk Hedging Supply Chain Strategy**

The second objective of the study was to establish the effect of risk hedging supply chain strategy on the performance of manufacturing firms in Kenya. Based on the descriptive findings, majority of the respondents noted that manufacturing firms have adopted the use of risk hedging supply chain strategy. Based on the findings it was noted that the most adopted strategy was development of suppliers with  $\bar{x}$  of 3.9. The second most sought after strategy was ability to avoid stock outs given by  $\bar{x}$  of 3.7 which was followed by strategy on establishment of quality requirements in their processes with  $\bar{x}$  of 3.6.

From open ended responses, setting up of risk mitigation measures, quality assurance and control and frequent stock taking were the three most critical factors in determining the effectiveness of risk hedging supply chain strategy given by 33.5 percent, 18.9 percent and 15.7 percent respectively. The least considered factor was contract management with a percentage of 4.3.



The correlation results indicated that risk hedging supply chain strategy had a strong positive and significant association with performance of manufacturing firms given by  $r = .699$ . The regression results revealed that separately and when combined with other strategies, risk hedging supply chain strategy has a positive and statistically significant effect on performance of manufacturing firms. Based on the regression results, the null hypothesis that risk hedging supply chain strategy has no effect on the performance of manufacturing firms in Kenya was rejected.

### **5.2.3 Postponement Supply Chain Strategy**

The third objective of the study was to determine the effect of postponement supply chain strategy on the performance of manufacturing firms in Kenya. Based on the descriptive findings, majority of the respondents cited that manufacturing firms have adopted the use of postponement supply chain strategy. In particular the three most sought strategies include delay of final products manufacture or assembly, delay of deliveries until customer orders are received and storage of products or parts at distribution points closer to the customer with  $\bar{x}$  of 3.9, 3.9 and 3.8 respectively.

From open ended responses, the respondents observed the three most predictor of postponement strategy were level of product customization, fluctuations in demand and variations in customer requirements given by 27.7 percent, 13.5 percent and 13 percent respectively. The least considered factor was logistics systems efficiency at 3.2 %

The correlation results indicated that postponement supply chain strategy had a strong positive and significant association with performance of manufacturing firms with an  $r = .651$ . The regression results revealed that separately and when combined with other strategies, postponement supply chain strategy has a positive and statistically significant effect on performance of manufacturing firms. Based on the regression results, the null hypothesis that postponement supply chain strategy has no effect on the performance of manufacturing firms in Kenya was rejected.

#### **5.2.4 Lean Supply Chain Strategy**

The fourth objective of the study was to establish the effect of lean supply chain strategy on the performance of manufacturing firms in Kenya. Based on the descriptive findings, majority of the respondents observed that manufacturing firms have embraced the use of lean supply chain strategy. The particular three most adopted sub-strategies were utilization of labor fully, elimination of idle machine time and continuous improvement of their products given by  $\bar{x}$  of 3.8, 3.7 and 3.6 respectively. The least adopted strategy was keeping zero inventories given by  $\bar{x}$  of 2.5.

From open ended responses, several factors including process and procedures improvement, demand collaboration with customers, focus on quality, use of just in time, continue improvement, company culture, sales planning and employees support in order of most considered to least considered.

The correlation results indicated that lean supply chain strategy had a strong positive and significant association with performance of manufacturing firms with an  $r = .679$ . The regression results revealed that separately and when combined with other strategies, lean supply chain strategy has a positive and statistically significant effect on performance of manufacturing firms. Based on the regression results, the null hypothesis that lean supply chain strategy has no effect on the performance of manufacturing firms in Kenya was rejected.

#### **5.2.5 Environmental Uncertainties**

The fifth objective of the study was to determine the moderating effect of environmental uncertainties on the effect of supply chain strategies on the performance of manufacturing firms in Kenya. From descriptive results, majority of the respondents noted that manufacturing firms experience environmental uncertainties related to demand, supply and technology. The three most considered activities were unpredictable supplier timelines, unexpected raw material shortages and regular changes in customers' tastes and preferences given by  $\bar{x}$  of 4.3, 3.8 and 3.8 respectively.

The regression results revealed that environmental uncertainties have a significantly negative moderating effect on the relationship between supply chain strategies and performance of manufacturing firms. A comparison of R square without moderation and one with showed a decline from 73.3 % to 34.6 %, implying a negative moderating effect. The null hypothesis that environmental uncertainties do not moderate the relationship between supply chain strategies and performance of manufacturing firms in Kenya was rejected.

### **5.3 Conclusion**

Based on the findings for objective one, the study concluded that agile supply chain strategy had a positive and statistically significant effect on performance of manufacturing firms in Kenya. The study identified that responsiveness to customer requirements and enquiries and flexibility of procedures and processes as key contributors to agile supply chain strategies.

From the findings for objective two, the study concluded that risk hedging supply chain strategy had a positive and statistically significant effect on performance of manufacturing firms in Kenya. The study established development of suppliers and establishment of risk mitigation measures as essentials risk hedging supply chain strategies.

In reference to the findings for objective three, the study concluded that postponement supply chain strategy had a positive and statistically significant effect on performance of manufacturing firms in Kenya. The study established delay of final product assembly or manufacture and the level of product customization as critical postponement strategies.

According to the findings for objective four, the study concluded that lean supply chain strategy had a positive and statistically significant effect on performance of manufacturing firms in Kenya. The study established utilization of labor and demand collaboration as key lean supply chain strategies.

In line with the findings for fifth objective, the study concluded that environmental uncertainties had a significantly negative moderating effect on relationship between agile supply chain strategy, risk hedging supply chain strategy, postponement supply chain strategy, lean supply chain strategy and performance of manufacturing firms in Kenya. The study established that unpredictability of suppliers' delivery times and unexpected changes in customer tastes and preferences and regular technological changes as key contributors to environmental uncertainties.

#### **5.4 Recommendations**

The study recommendations are in line with the objectives, findings and conclusions of the study.

The study recommends that firms should be fully responsive to customer orders for instance by incorporating electronic data interchange to communicate seamlessly with customers. Similarly firms should deploy more machinery and equipment in production or processing to ensure flexibility to handle any order any time.

The study recommends firms should particularly formulate strategies to develop their suppliers such as collaborative product development, specifications sharing and development, capacity building, order cycle time reduction, training and empowerment and on-time product delivery Manufacturing firms should formulate a policy on risk management which will help the organization to identify risks, prevent risks and have corrective measures in case of risk occurrence.

The study recommends that manufacturing firms should delay final product assembly or manufacture in order to take advantage of economies of scale in consolidation. Manufacturing firms should implement a policy on regular product customization to keep abreast changing requirements of the customer.

The study recommends that manufacturing firms should conduct demand forecast, eliminate machine idle time and full utilization of labor to minimize inventories wastage and obsolescence.

The findings established those environmental uncertainties had a significantly negative moderating effect on the relationship between agile supply chain strategy, risk hedging supply chain strategy, postponement supply chain strategy, lean supply chain strategy and performance of manufacturing firms in Kenya. This study therefore recommends that manufacturing firms should regularly scan the environment for possible threats and uncertainties through pestle analysis and swot analysis. The management should implement a policy on regular environmental scanning for possible threats and opportunities and mitigation measures to take.

### **5.5 Areas for Further Research**

The study sought to establish the effect of supply chain strategies on the performance of manufacturing firms in Kenya. Future studies could focus on supply chain strategies and performance in other sectors such as service sector. In addition, the study focused on four supply chain strategies (agile supply chain strategy, risk hedging supply chain strategy, postponement supply chain strategy, and lean supply chain strategy), which accounted for 73% of variations in the dependent variable. Future studies could consider other strategies influencing the 27%. The study focused on environmental uncertainties as the moderator, future studies can consider other moderators such ICT (Information, communication and technology), legal framework, government regulation e.t.c. Further, other areas for consideration for further research can also use different research designs and data collection instruments possibly triangulation.

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## APPENDICES

### Appendix I: Letter of Introduction

Dear Sir/ Madam

#### **RE: REQUEST FOR AUTHORIZATION**

I am student at Jomo Kenyatta University Agriculture and Technology (JKUAT) pursuing degree of Doctor of Philosophy in Supply Chain Management. As part of the requirement for award of the degree I am undertaking research *effects of supply chain strategies (agile supply chain strategy, risk hedging supply chain strategy, postponement supply chain strategy and lean supply chain strategy) on the performance of manufacturing firms in Kenya*. I am kindly seeking your assistance in collecting the necessary information from Supply Chain Manager, Supply chain Head, Supply Chain Director or Procurement Manager in your organization. The responses will be treated with utmost confidentiality and will solely be used for academic purposes.

I will highly appreciate your consideration. Thanking you in advance.

Yours faithfully,

Karani Anthony Muriithi

## **Appendix II: Questionnaire**

**INSTRUCTION:** Please answer all the questions honestly and comprehensively by putting a tick (√) or numbers in the appropriate box that closely matches your view. Kindly also write where necessary in the space provided.

**NB:** This information will be used strictly for academic purposes only and will be treated with utmost confidentiality. Thanking you as you partake in the research.

In case you would want a copy of the findings, kindly put only your email address to ensure anonymity below;

Email Address:

### **PART A: Background Information**

1. For how long has your organization been in existence?

- a) Under 5 years [   ]
- b) 6-10 years    [   ]
- c) 11-15 years   [   ]
- d) Over 16 years [   ]
- e) More than 20 years [   ]

2. For how long have you worked in the organization?

- a) Under 5 years [   ]
- b) 6-10 years    [   ]
- c) 11-15 years   [   ]
- d) Over 16 years [   ]
- e) More than 20 years [   ]

3. Indicate the Type of manufacturing sector in which your company falls (tick as appropriate)

- a) Metal & Allied [   ]

- b) Pharmaceuticals & medical equipment [   ]
- c) Textile & Apparels [   ]
- d) Building, mining & construction [   ]
- e) Food & Beverage [   ]
- f) Chemical & Allied [   ]
- g) Energy, electrical & electronics [   ]
- h) Plastic & Rubber [   ]
- i) Timber, Wood products and Furniture [   ]
- j) Leather [   ]
- k) Motor Vehicle & Accessories [   ]
- l) Paper and Board [   ]

4. How many employees are in your organization

1-10 [   ]    11-50 [   ]    51- 100 [   ]    Above 100 [   ]

**PART B**

**Agile Supply Chain Strategy**

5. Kindly indicate the extent to which you agree with the following statements concerning agile supply chain strategy of your firm. Where SA= Strongly Agree, A=Agree, UD= Undecided, D =Disagree, SD= Strongly Disagree. Tick appropriately on the spaces provided.

Statements	SA	A	UD	D	SD
<b>Delivery Flexibility</b>					
a) We are able to quickly meet changes in requirements in delivery times from our customers					
b) We are able to respond to changes in quantities as					

requested by our customers					
c) We are able to deliver products to various customer locations					
<b>Manufacturing Capacity</b>					
d) We have capacity to fulfill high orders and urgent orders					
e) We always meet customer volumes as ordered					
<b>Responsiveness</b>					
f) We respond quickly to customers' requirements and enquiries					
g) We are always willing to provide solution our suppliers and customers					

9. Please suggest other factors that affect agile supply chain strategy of your firm

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**PART C**

**Risk-Hedging Supply Chain Strategy**

10. Kindly indicate the extent to which you agree with the following statements concerning risk hedging supply chain strategy in your firm. Where SA= Strongly Agree, A=Agree, UD= Undecided, D =Disagree, SD= Strongly Disagree. Tick and write appropriately on the spaces provided.

<b>Risk hedging supply chain strategy Indicators</b>	<b>SA</b>	<b>A</b>	<b>UD</b>	<b>D</b>	<b>SD</b>
<b>Safety Stock</b>					
a) We usually keep safety stock					
b) We don't suffer stock outs					
<b>Suppliers Management</b>					
c) We contract many suppliers for supply					
d) We establish long term relationships with suppliers					
e) We develop our suppliers' capacity					
<b>Quality</b>					
f) We have established quality requirements in our processes					
g) We ensure compliance to quality requirements					
h) We share our quality standards with our suppliers					

11. Please suggest other factors affecting risk hedging supply chain strategy in your firm.....

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## PART D

### Postponement Supply Chain Strategy

12. Kindly indicate the extent to which you agree with the following statements concerning Postponement supply chain strategy in your firm. Where SA= Strongly Agree, A=Agree, UD= Undecided, D =Disagree, SD= Strongly Disagree. Tick and write appropriately on the spaces provided.

Statements	SA	A	UD	D	SD
<b>Purchasing postponement</b>					
a) We only buy raw materials or supplies when demand requirements are known					
b) We delay purchase of materials or supplies until the last possible time					
<b>Manufacturing postponement</b>					
c) We delay final product manufacture or assembly activities until customer orders have been received					
d) We delay final product manufacture or assembly activities until the last possible time					
<b>Delivery postponement</b>					
e) We delay deliveries until customer orders are received					
f) We store our parts/products at distribution points closer to the customer					

13. Please suggest other factors affecting postponement supply chain strategy in your firm performance

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**PART E**

**Lean Supply Chain Strategy**

14. Kindly indicate the extent to which you agree with the following statements concerning lean supply chain strategy of your firm. Where SA= Strongly Agree, A=Agree, UD= Undecided, D =Disagree, SD= Strongly Disagree. Tick and write appropriately on the spaces provided.

<b>Lean Supply Chain Indicators</b>	<b>SA</b>	<b>A</b>	<b>UD</b>	<b>D</b>	<b>SD</b>
<b>Waste Minimization</b>					
a) We reduce any kind of waste					
b) We make sure they is minimal or no idle time in machine					
c) Our labor is fully utilized					
<b>Zero Inventories</b>					
d) We keep zero inventories					
e) We keep minimum inventories as possible					
<b>Continuous Improvement</b>					
f) We always seek continuous improvement in our products					
g) We review our manufacturing processes regularly					

to identify areas for improvement					
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20. Please suggest other factors affecting lean supply chain strategy in your firm

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## PART F

### Environment Uncertainties

21. Kindly indicate the extent to which you agree with the following statements concerning environmental uncertainties in your firm. Where SA= Strongly Agree, A=Agree, UD= Undecided, D =Disagree, SD= Strongly Disagree. Tick and write appropriately in the spaces provided.

Statement	SA	A	UD	D	SD
<b>Supply Uncertainty</b>					
a) Suppliers delivery timelines are unpredictable sometimes					
b) We experience unexpected raw material shortages					
<b>Demand Uncertainty</b>					
c) There are new products entering the market from competitors					
d) There are changes in customers tastes and preferences					
<b>Technology Uncertainty</b>					
e) There are changes in technology regularly					
f) We experience high rate of product innovations from competitors					
g) There is uncertainty on accessibility of the latest technology					

## PART G

### Performance of the Firm

#### Customer satisfaction

22. Kindly indicate the extent to which you agree with the following statements concerning customer satisfaction in your firm. Where SA= Strongly Agree, A=Agree, UD= Undecided, D =Disagree, SD= Strongly Disagree. Tick and write appropriately in the spaces provided.

Statement	SA	A	UD	D	SD
a) We get regular complains from our customers					
b) We get regular compliments from our customers					
c) We effectively fulfill the requirements of the customers					
d) We respond to customer enquiries timely					
e) Our customers have been increasing over time					

#### Profitability

23. Kindly indicate the rate at which revenue/income has increased in your firm over the last three years.

Indicator	0-20%	21-40%	41-60%	61-80%	81-100%
2016					

<b>2017</b>					
<b>2018</b>					

24. Kindly indicate the rate at which operational costs has increased in your firm over the last three years.

<b>Indicator</b>	<b>0-20%</b>	<b>21-40%</b>	<b>41-60%</b>	<b>61-80%</b>	<b>81-100%</b>
<b>2016</b>					
<b>2017</b>					
<b>2018</b>					

25. Kindly indicate the extent to which you agree with the following statements concerning profitability in your firm. Where SA= Strongly Agree, A=Agree, UD= Undecided, D =Disagree, SD= Strongly Disagree. Tick and write appropriately in the spaces provided.

<b>Statement</b>	<b>SA</b>	<b>A</b>	<b>UD</b>	<b>D</b>	<b>SD</b>
a) Our firm is profitable					
b) Profit margin for the firm has increased over the years					
c) Profit margins have stagnated					

## Market Share

26. Kindly indicate the rate of average growth in market share of your firm in the last three years

% Market Share Growth	2016	2017	2018
0-5%			
6-10%			
11-15%			
16-20%			
21-25%			
Above 25%			

27. Kindly indicate the extent to which you agree with the following statements concerning market share in your firm. Where SA= Strongly Agree, A=Agree, UD= Undecided, D =Disagree, SD= Strongly Disagree. Tick and write appropriately in the spaces provided.

Statement	SA	A	UD	D	SD
a) Our products are available in the market					
b) Distributors are ordering more items					
c) Our products are highly competitive in the market					

28. Please suggest other factors that affect the performance of your firm.....  
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THANK YOU FOR PARTICIPATING IN THE STUDY.

### Appendix III: List of Manufacturing Firms

NO	NAME	LOCATION
	<b>Building, Mining and Construction</b>	
1.	Twyford Ceramics Ltd	Nairobi
2.	Space and Style Ltd	Nairobi
3.	Reliable concrete works Ltd	Nairobi
4.	Kisumu Concrete Products	Kisumu
5.	Malindi Saltworks Ltd	Mombasa
6.	National Cement Ltd	Ruiru
7.	East African Portland Cement Company	Athi River
8.	Glenn Investments Ltd	Nairobi
9.	Kenya Builders and Concrete Ltd	Nairobi
10.	African Diatomite Industries	Nakuru
11.	Boyama Building Materials	Nairobi
	Chemical and Allied	
12.	Carbacid (CO <sub>2</sub> ) Ltd	Nairobi
13.	BOC Kenya Ltd	Nairobi
14.	Bayer East Africa	Nairobi
15.	Deluke Inks Ltd	Nairobi
16.	Crown Paints Kenya Ltd	Nairobi

17.	Central Glass Industries	Nairobi
18.	HB Fuller Kenya Ltd	Nairobi
19.	Enviro Hub Holdings Ltd	Nairobi
20.	Eastern Chemicals Industries	Mombasa
21.	Inter consumer Products Ltd	Nairobi
22.	Hychem Hygiene & Health Care Solutions Ltd	Nairobi
23.	Haco Tiger Brands East Africa	Nairobi
24.	Ken Nat Ink & Chemicals Ltd	Nairobi
25.	Jumbo Mattress Industries Ltd	Kisumu
26.	Kaolin Crowners Company Ltd	Kericho
27.	Pan Africa Chemicals Ltd	Kisumu
28.	Mea Ltd	Nairobi
29.	Murphy Chemicals (E.A)	Nairobi
30.	Rumorth EA Ltd	Nairobi
31.	Revolution Stores Ltd	Nairobi
32.	Procter & Gamble East Africa Ltd	Nairobi
33.	Synergy Gases (K) Ltd	Mombasa
34.	Super Foam Ltd	Ruiru
35.	Sanvoks Industries Ltd	Machakos

36.	Twiga Chemical Industries	Nairobi
37.	Syngenta East Africa	Nairobi
	Energy, Electrical & Electronics	
38.	African Cables Ltd	Nairobi
39.	Alternative Energy Systems Ltd	Thika
40.	Aucma Digital Technologies Africa Ltd	Nairobi
41.	Kenya Petroleum refineries Ltd	Mombasa
42.	Kenwest Cables Ltd	Nairobi
43.	Holman Brothers E.A Ltd	Nairobi
44.	Nationwide Electrical industries Ltd	Nairobi
45.	Mustak East Africa	Nairobi
46.	Kenya Power Co. Ltd	Nairobi
47.	Premier Solar Solutions Ltd	Nairobi
48.	Phillips East Africa	Nairobi
49.	Optimum Lubricants	Nairobi
50.	Solimplex Africa Ltd	Nairobi
51.	Siera Cables	Nairobi
52.	Rioka Industries	Nakuru
53.	Synergy Pro	Nairobi



54.	Steam Plant Ltd	Kiambu
55.	Specialised Power Systems	Nairobi
56.	Soline East Africa Ltd	Naivasha
	<b>Food &amp; Beverage</b>	
57.	Al-Mahra Industries Ltd	Nairobi
58.	Agriner Agricultural Development	Nairobi
59.	Afrimac Nut Company	Nairobi
60.	Agricultural & Veterinary Supplies Ltd	Eldoret
61.	Bakex Millers Ltd	Thika
62.	Bakers Corner Ltd	Nairobi
63.	Aviano East African Ltd	Nairobi
64.	Arkay Industries Ltd	Eldoret
65.	Bakhresa Grain Milling (K) Ltd	Mombasa
66.	Bdelo Ltd	Nairobi
67.	Belat Enterprises	Machakos
68.	Broadway Bakery Ltd	Thika
69.	Buuri Millers Enterprises	Meru
70.	Butali Sugar	Webuye
71.	Burton and Bamber Company Ltd	Nairobi

<b>72.</b>	Brookside Dairy Ltd	Ruiru
<b>73.</b>	Chemelil Sugar Company Ltd	Muhoroni
<b>74.</b>	CentroFood Industries Ltd	Thika
<b>75.</b>	Capel Food Ingridients	Nairobi
<b>76.</b>	C. Dormans Ltd	Nairobi
<b>77.</b>	Caffe Del Duca Ltd	Thika
<b>78.</b>	Diamond Industries Ltd	Mombasa
<b>79.</b>	Del Monte Kenya Ltd	Thika
<b>80.</b>	Crown Beverages Ltd	Mombasa
<b>81.</b>	Coffee Agriworks Ltd	Nairobi
<b>82.</b>	Chirag Kenya Ltd	Nairobi
<b>83.</b>	Eldoret Grains	Eldoret
<b>84.</b>	Edible Oils Products	Nairobi
<b>85.</b>	East African Seed Co. Ltd	Nairobi
<b>86.</b>	East African Breweries Ltd	Nairobi
<b>87.</b>	General Mills East Africa Ltd	Mombasa
<b>88.</b>	Frutarom Kenya Ltd	Nairobi
<b>89.</b>	FrigoKen Ltd	Nairobi
<b>90.</b>	Farmers Choice Ltd	Nairobi

<b>91.</b>	Excel Chemicals Ltd	Nairobi
<b>92.</b>	Green Forest Foods Ltd	Nairobi
<b>93.</b>	Gonas Best Ltd	Machakos
<b>94.</b>	Golden Africa Kenya Ltd	Machakos
<b>95.</b>	Glacier Products Ltd	Nairobi
<b>96.</b>	Githunguri Dairy Farmers Co-operative Society	Kiambu
<b>97.</b>	Jetlak Foods Ltd	Ruiru
<b>98.</b>	James Finlay Kenya Ltd	Kericho
<b>99.</b>	Jambo Biscuits (K) Ltd	Nairobi
<b>100.</b>	Highlands Mineral Water Co. Ltd	Nyeri
<b>101.</b>	Kenafriic Industries Ltd	Nairobi
<b>102.</b>	Kapa Oil Refineries Ltd	Nairobi
<b>103.</b>	Jungle Group	Thika
<b>104.</b>	Kisii Bottlers Ltd	Kisii
<b>105.</b>	Kinangop Dairy Ltd	Kinangop
<b>106.</b>	Kibos Sugar	Kibos, Kisumu
<b>107.</b>	Kevian Kenya Ltd	Nairobi
<b>108.</b>	Keroche Industries	Naivasha
<b>109.</b>	Luma Stores & Suppliers Enter. Ltd	Machakos

110.	Menengai Oil Refeneries	Nakuru
111.	May Feeds Kenya Ltd	Thika
112.	Mastermind Tobacco (K) Ltd	Nairobi
113.	Manji Food Industries Ltd	Nairobi
114.	Mumias Sugar Co. Ltd	Mumias
115.	New Kenya Cooperative Creameries Ltd	Nairobi
116.	Nestle Kenya Ltd	Nairobi
117.	Nairobi Bottlers Ltd	Nairobi
118.	Patco Industries	Nairobi
119.	Proctar & Allan (E.A) Ltd	Nairobi
120.	Pristine International Ltd	Nairobi
121.	Platinum Distillers Ltd	Machakos
122.	Pembe Flour Mills	Nairobi
123.	Premier Food Industries	Nairobi
124.	Pwani Oil Products Ltd	Mombasa
125.	Tropical Heat Ltd	Nairobi
126.	Mini Bakeries Ltd	Nairobi
127.	Mafuko Industries Ltd	Meru

#### **Leather and Footwear**

128.	Athi River Tanneries Ltd	Athi River
129.	Bata Shoe Co (K) Ltd	Limuru
130.	Leather Industries of Kenya Ltd	Thika
<b>Metal and Allied</b>		
131.	Allied East Africa Ltd	Nairobi
132.	Alloy Steel Castings Ltd	Nairobi
133.	Ashut Engineers	Nairobi
134.	Kaluworks Ltd	Mombasa
135.	Elite Tools Ltd	Nairobi
136.	Steel wool (Africa)	Machakos
137.	Orbit Engineering Ltd	Nairobi
138.	Red Oak Ltd	Nairobi
139.	Sufuria World Ltd	Kiambu
140.	Eco- Steel Africa	Nairobi
141.	Nampak Kenya Ltd	Thika
142.	Prime Steel Ltd	Nairobi
143.	Top Steel Kenya Ltd	Nairobi
144.	Laminate Tubes Industries	Eldoret

<b>145.</b>	Devki Steel Mills Ltd	Nairobi
<b>146.</b>	Athi River Steel Plant Ltd	Nairobi
<b>147.</b>	City Engineering Works Ltd	Nairobi
<b>148.</b>	Heavy Engineering Ltd	Nairobi
<b>149.</b>	Davis & Shirtliff Ltd	Nairobi
<b>150.</b>	Kenya General Industries Ltd	Mombasa
<b>151.</b>	Eldoret Farm Machinery	Eldoret
<b>152.</b>	Fit Tight Fasteners Ltd	Nairobi
<b>153.</b>	Mabati Rolling Mills Ltd	Athi River
<b>154.</b>	Corrugated Sheets Ltd	Mombasa
<b>155.</b>	Silver Spread Hardwares Ltd	Meru
<b>156.</b>	Tononoka Steel Ltd	Nairobi
<b>157.</b>	Napro Industries	Nairobi
<b>158.</b>	Standard Rolling Mills Ltd	Mombasa
<b>159.</b>	Kenya General Industries	Mombasa
<b>160.</b>	GZI Kenya Ltd	Nairobi
<b>161.</b>	Buhler Ltd	Kiambu

**Motor Vehicle and Accessories**

<b>162.</b>	Skyline Holdings Ltd	Nairobi
<b>163.</b>	Foton East Africa	Nairobi
<b>164.</b>	Associated Battery Manufacturers (E.A) Ltd	Nairobi
<b>165.</b>	Auto Industries Ltd	Nairobi
<b>166.</b>	Mutsumoto Company Ltd	Nakuru
<b>167.</b>	Simba Caetano Formula	Nairobi
<b>168.</b>	Scania East Africa	Nairobi
<b>169.</b>	Honda Motorcycles Kenya Ltd	Nairobi
<b>170.</b>	Banbros Ltd	Machakos
<b>171.</b>	Spring tech (K) Ltd	Mombasa
<b>172.</b>	Turaco Ltd	Nakuru
<b>173.</b>	Global Motors Centre Ltd	Mombasa
<b>174.</b>	Kenya Vehicle Manufacturers Ltd	Thika
<b>175.</b>	Impala Glass Industries Ltd	Nairobi
<b>176.</b>	Toyota Tshusho East Africa Ltd	Nairobi
<b>177.</b>	Bhachu Industries Ltd	Nairobi
<b>178.</b>	CICA Motors	Nairobi
<b>179.</b>	Sohansons Ltd	Nairobi

<b>180.</b>	Labh Singh Harnam Singh Ltd	Nairobi
	<b>Paper and Board</b>	
<b>181.</b>	East African Paper Mills	Thika
<b>182.</b>	Green Pencils Ltd	Kiambu
<b>183.</b>	Adpak International Ltd	Nairobi
<b>184.</b>	Standard Group Ltd	Nairobi
<b>185.</b>	Prime Cartons Ltd	Nairobi
<b>186.</b>	General Printers Ltd	Nairobi
<b>187.</b>	ASL Packaging Ltd	Nairobi
<b>188.</b>	Bag & Envelope Converters Ltd	Nairobi
<b>189.</b>	Highland Paper Mills Ltd	Eldoret
<b>190.</b>	Chandaria Industries Ltd	Nairobi
<b>191.</b>	Twiga Stationers & Printers Ltd	Nairobi
<b>192.</b>	Colour Packaging Ltd	Nairobi
<b>193.</b>	Box Pak Ltd	Machakos
<b>194.</b>	D.L Patel Press (Kenya) Ltd	Nairobi
<b>195.</b>	Capitol Printers	Nairobi
<b>196.</b>	International Paper & Board Supplies Ltd	Nairobi
<b>197.</b>	Economic Industries	Nairobi



198.	Rodwell Press Ltd	Nairobi
199.	Mega Pack(K) Ltd	Nairobi
200.	Ellams Products	Nairobi
201.	Kul Graphics	Nairobi
202.	Paper Bags Ltd	Nairobi
203.	Elite Offset Ltd	Nairobi
204.	Colour Print Ltd	Nairobi
	<b>Pharmaceutical and Medical Equipment</b>	
205.	Skylight Chemicals Ltd	Nairobi
206.	Pharm Access Africa Ltd	Nairobi
207.	Benmed Pharmaceuticals Ltd	Nairobi
208.	Beta Healthcare International Ltd	Nairobi
209.	Regal Pharmaceuticals	Nairobi
210.	Kam Industries Ltd	Nairobi
211.	Medivet Products Ltd	Nairobi
212.	Bio Pharma Ltd	Nairobi
	<b>Plastic and Rubber</b>	
213.	Techno-Plast Ltd	Nairobi
214.	Sameer Africa Ltd	Nairobi

<b>215.</b>	King Plastic Industries	Nairobi
<b>216.</b>	Nakuru Plastics	Nakuru
<b>217.</b>	Acme Containers Ltd	Kiambu
<b>218.</b>	Jumbo Quality Products	Athi River
<b>219.</b>	Plastic & Rubber Industries Ltd	Nairobi
<b>220.</b>	Afro Plastics (K) Ltd	Nairobi
<b>221.</b>	Shiv Enterprises (E) Ltd	Eldoret
<b>222.</b>	Top Pak Ltd	Ruiru
<b>223.</b>	Mombasa Polythene Bags Ltd	Mombasa
<b>224.</b>	Bobmil Industries	Nairobi
<b>225.</b>	Flair Kenya Ltd	Nairobi
<b>226.</b>	Malplast Industries Ltd	Nairobi
<b>227.</b>	Elgon Kenya Ltd	Nairobi
<b>228.</b>	Jamlam Industries Ltd	Nairobi
<b>229.</b>	Rubber Products Ltd	Nairobi
<b>230.</b>	DynaPlas Ltd	Nairobi
<b>231.</b>	General Plastics Ltd	Nairobi
<b>232.</b>	Coast Polythene	Mombasa
<b>233.</b>	Premier Industries Ltd	Nairobi

234.	Nairobi Plastics Ltd	Nairobi
235.	Jumbo Chem (K) Ltd	Nairobi
236.	Complast Industries Ltd	Nairobi
237.	Darsham Plastic Ltd	Kisumu
238.	Kenpoly Manufacturers Ltd	Nairobi
239.	Kentainers Ltd	Nairobi
240.	PolyFlex Industries Ltd	Nairobi
241.	SilPack Industries Ltd	Nairobi
242.	Sanpac Africa Ltd	Machakos
	<b>Textiles and Apparels</b>	
243.	Kenya Tents Ltd	Nairobi
244.	Manchester Outfitters Ltd	Nairobi
245.	Supra Textiles Ltd	Nairobi
246.	Omega Apparels Ltd	Nakuru
247.	Spinners & Spinners Ltd	Ruiru
248.	Africa Apparels EPZ Ltd	Nairobi
249.	Hanitex (EPZ) Ltd	Mombasa
250.	Kikoy Co. Ltd	Nairobi
251.	Adpack Ltd	Athi River

252.	Kenya Trading EPZ Ltd	Athi River
253.	Midco Textiles (EA) Ltd	Nairobi
254.	Dharamshi & CO Ltd	Nairobi
255.	Global Apparels Ltd	Machakos
256.	Bedi Investments Ltd	Nakuru
257.	Insight Kenya	Nairobi
258.	Leena Apparels Ltd	Mombasa
259.	Thika Cloth Mills Ltd	Nairobi
260.	Ashton Apparel EPZ Ltd	Nairobi
261.	Tulips Collections Ltd	Nakuru
262.	Royal Garment Industries EPZ Ltd	Athi River
	<b>Timber, Wood and Furniture</b>	
263.	Turea Ltd	Ruiru
264.	Rai Plywoods (Kenya) Ltd	Eldoret
265.	Budget Furniture Ltd	Nairobi
266.	Shamco Industries Ltd	Nairobi
267.	Fine Wood Works Ltd	Nairobi
268.	Newline Ltd	Nairobi
269.	Shayona Timber Ltd	Nakuru

**270.** Furniture International Ltd

Nairobi

**Source: Kenya Association of Manufacturers (KAM, 2018)**