SUPPLY CHAIN INNOVATION AND FORECASTING ACCURACY IN CEMENT MANUFACTURING FIRMS IN KENYA

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DECLARATION

I, the undersigned, declare that this research project is my original work and has not been submitted for a degree in this or any other university.

Signature……..……Date…….....……

Noel Kitoipei Taiyiai

D61/77777/2015

SUPERVISOR

This research project has been submitted for examination with my approval as the university supervisor.

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I would also like to thank the school of business for the opportunity granted to me to pursue this study and this will open up further studies on Supply chain innovation and forecasting accuracy in cement manufacturing firms in Kenya.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

CPFR	Collaborative Planning Forecasting and Replenishment
QRIS	Quick response inventory system
RFID	Radio Frequency Identification
SCM	Supply Chain Management
SKU	Stock Holding Units
SPSS	Statistical Package for Social Sciences
UK	United Kingdom
VMI	Vendor Management Inventory

ABSTRACT

Supply chain innovation has become the basis upon which organizations seek to gain advantage in the increasingly competitive environment. Based on the management dilemma facing the cement manufacturing firms in Kenya, as well as the gaps in knowledge from the foregoing studies, there was need for a research on the impact of supply chain innovation on forecast accuracy in the cement manufacturing firms in Kenya. As a result, the current study is guided by the general question: What is the impact of supply chain innovation on forecasting accuracy in the Local cement manufacturing companies? The questions guiding the study were: which are the supply chain innovation approaches adopted by the cement producing firms in Kenya? What is the impact of supply chain innovation on forecasting accuracy in the Kenya's cement producing firms in Kenya? Descriptive design was used; the study population constituted the 8 Kenya's cement manufacturing firms as at December 2017. Semi-Structured questionnaires were used to collect primary data. Data analysis was done using descriptive statistic and inferential analysis and presented in form of charts and Tables. Data analysis entailed calculation of the mean and standard deviation for the scores. Regression analysis was done and significance of the beta factors interpreted at 5% level of significance. The study determined that if change independent variables were each zero, demand forecasting can be 1.298. However, a unit change in vendor managers inventory would lead to increase in business performance by a factor of 0.237, unit change in collaborative planning can to an boost in demand forecasting by a 0.231 and a unit change in cross docking through supply chain innovation can lead to growth in demand forecasting by of 0.239. The study was limited to three independent variables. Recommendations include provision of support from management in terms of financial support to the innovations as well as focused staff training.

CHAPTER ONE: INTRODUCTION

1.1 Introduction

Supply chain management is dynamic with new trends always emerging In this regard supply chain innovation has become the basis upon which organizations seek to gain advantage in the increasingly competitive environment (Singh, Arora, & Mishra, 2014). According to Chen and Yin (2010) supply chain innovation is a practice where organizations develop new systems and process to make their inbound and outbound logistical processes more effective, efficient, and economical. Some of the supply chain innovation practices include VMI, collaborative planning and cross docking (Singh, Arora, & Mishra, 2014).

Due to the variations in level of demand from time to time, coupled with perishability of certain commodities, forecasting accuracy is a vital concept in the field of Supply Chain Management. Demand dynamism, therefore, makes supply chain innovation a necessity. Scholars such as Barlas and Gunduz (2011) emphasizing the need for accurate demand analysis and projection for effective and efficient supply chain. Chen and Yin (2010) define forecasting accuracy as the degree of precision of the integral processes involving methodical projection of future need for a product or service by the current and future clients of an organization, underpinned by their ability to buy.

1.1.1 Supply Chain Innovation

Companies must be ready to change which is difficult but necessary successful change is supposed to lead to cost reduction through proper controls and redesigning work processes. In order to enhance productivity firms should be innovative in in terms of new products as

well as emerging practices .Among these trends are, collective planning, forecasting and replenishment, RFID, VMI and Cross docking inventory. Vendor VMI also known as quick Response inventory system (QRIS) is system of distribution in which the manufacturer monitors inventory at the distribution or retail outlet. It involves various activities like determination suitable order quantities, management of right product portfolio.

Data at is received at the vendors computer electronically without any manual entry required which reduces the lead time and vendor recording errors. CPFR is defined as a collaboration a number of members of a supply chain collectively develop plans for their activities like promotion and demand forecasts, which provides the guidance for the determination of output and stock replenishments. The major objective is to match supplies and demands through an exchange of data between the supply chain partners in order to eliminate bottlenecks in meeting expectations. Cross docking is a Logistical practice customers' demand popularized by the Walmart involving unloading materials from an incoming mode of transport and loading the materials directly into outbound mode with little or no storage between them. RFID is communication technology using electromagnetic waves to interchange data linking two points like a terminal and a product, or any other object. To facilitate identification and tracking device a chip and an antenna, is embedded or attached to an item.

1.1.2 Forecasting Accuracy

Accurate projection of demand is an important subject in the wider supply chain management theme. Forecasting accuracy is the extent to which actual events deviate from

the projected situation .An effective demand forecasting system applying suitable demand forecasting models should be in a position to identify any type of systematic patterns without manual intervention. In house business decisions like marketing campaigns price adjustments and product mix changes directly influence demand. Should such planned changes not be reflected in a forecasting model, then the entire process ought to be redefined before addressing forecast accuracy.

Having an idea about when the accuracy of forecast accuracy is likely to be poor makes it easy to perform a risk analysis of the consequences of over- and under forecasting so as to make appropriate business decisions (Hyndman& Koehler, 2005). The need for predictable forecast behavior also requires a lot of care when adopting new forecasting methods, like various machine learning algorithms. Thus, periodic serious forecasting errors can be very harmful to organizational performance, especially when the planning process configured with a set tolerance level of uncertainty.

This also reduces the confidence the demand planners has in the forecast calculations, which can significantly compromise the efficiency of work (Coleman & Swanson, 2004).Some of the forecasting accuracy measurement techniques include: forecast biases that is the difference between forecast and actual sales; mean absolute deviation (MAD) a forecasting metric, that shows the size of an error on average, is inherent in a forecasting model. Mean absolute percentage error (MAPE) is similar to MAD but expresses the forecast error in relation to. It is an indicator of degree deviation of a forecasts from the actual demand. It is the most common forecasting metric in demand planning (Tsay, 2002).

This study adopted the forecast bias as a measure of the forecasting accuracy due to its ease of use.

1.1.3Supply Chain Innovation and Forecasting Accuracy

Companies require total transformation by incorporating innovative approaches in their operations (Watson et al., 2014). This would be achieved through suppressing expenses and redesign of production processes. Accurate demand forecasting is a critical subject in the wider supply chain management theme, with intermittent demand further complicating the issue (Hua et al., 2006).This proposition has attracted considerable support from others such as Li, Song, and Reagan (2006) who posit that forecasting accuracy is indeed important in inventory planning, more so under long procurement lead times and dynamic environment. A nomenclature has been developed by Boylan et al. (2008) with respect to the dimensions of forecasting accuracy. According to this perspective, categorizing stockholding unit (SKU) is necessary and applying the most suitable forecasting methods in each category. The first dimension involves forecasting for intermittent demand which involves infrequent demand occurrences (Laudon et al., 2010).

The second dimension comprises forecasting for products that move slowly whose demand on average in a given period is low, normally caused by occasional demand, limited average demand or both. The third dimension according to Laudon et al. (2010) entails forecasting for erratic demand, whose levels are highly variable. The other dimension involves forecasting for a lumpy demand, which is usually intermittent in nature, and

highly variable whenever it occurs. Finally, for clumped demand which is characteristically intermittent, but constant whenever it occurs.

1.1.4 Cement Manufacturing Companies in Kenya

Any organization operating in Kenya and whose core business is the production of cement and associated products is a "cement manufacturing firm" (Dyer & Blair, 2017). Domestic demand for cement, has increased significantly in response to the growth of the Kenyan economy since 1984. On the other hand the capacity of existing cement production plants had reached its limit where they were not able to meet increasing local demand in the beginning of the twenty first century (Dyer & Blair, 2017). This is more so because by the year 2000, there were only two cement manufacturing firms in Kenya.

There have however been new entrants into the industry, increasing the total number of cement manufacturing firms to eight by the end of the year 2017 (Dyer & Blair, 2017). Against this turn of events, demand appears to have been outstripped by supply. In light of this, supply chain managers in these organizations have the challenge of developing and sustaining effective and efficient supply chain, thereby making innovation and forecasting accuracy inevitable.

1.2 Research Problem

Supply chain management is constantly changing and there are always new approaches (Singh, Arora, & Mishra, 2014). Supply chain innovation has changed how companies manage their supply chains. Empirical evidence from various parts of the world, including Hua, Zhang, Yang, and Tan (2007) and Kimaiyo and Ochiri (2014) demonstrate that supply chain innovation impacts forecasting accuracy. This is because the organizations keep

reinventing their supply chain systems and processes to keep with the projected quantity and quality demand.

The study draws motivation from the supply-demand dynamisms in the cement market in Kenya. The Scheme of Testing and Inspection for Certification of 43 Grade Portland Cement (2005) states that cement has lower shelf life and should be used within three months effective manufacturing date. Therefore, cement producers ought to constantly forecast demand and develop supply chain innovations to maintain an efficient process.

According to the Dyer and Blair (2017) industry report, the number of cement manufacturing firms increased from six in 2013 to eight in 2017 representing a three year Compound Annual Growth Rate (CAGR) in installed grinding capacity of 17.1%. This was against a forecasted three year Aggregate industry demand increase of 8.1% over a similar period. Accordingly, it was projected that supply would over-strip demand significantly over the next three years; hence the need for supply chain innovations for efficiency. The number of cement manufacturing firms in Kenya continues to increase, with preliminary indications that there could be more entrants into the industry. This situation has further been abated by the cheap imports from Asia that have notoriously found their way into the country (Dyer & Blair, 2017).

Against the backdrop of intense competition among players in the industry, supply chain innovation and forecasting accuracy have become significant determinants of success. A study by Hua, Zhang, Yang, and Tan (2007) focused on new methods of forecasting irregular demand for inventories of spare parts in the processing firms in China. The study

revealed that the method used produced reliably accurate forecasts of demand than exponential smoothing, Croston's method and Markovian bootstrapping method.

The study however focused on the petrochemical industry in China, being an economically advanced economy than that of Kenya. Focusing on the methods of forecasting intermittent demand in the United Kingdom (UK) with the aid of big set of data from the United Kingdom Airforce, Teunter and Duncan (2009) determined that periodical forecasting error indices were not suitable for irregular demand, though they were consistently and widely used in literature. Nonetheless, this study explored only one dimension of forecasting, that is intermittent demand, with other dimensions including clumped demand forecasting remaining uninvestigated.

A study by Oballa, Waiganjo, and Wachiuri (2015) looked at the influence of supply chains manager on performance of Kenyan health institutions. The study showed that investment in inventory and the accuracy of inventory records positively influence on organizational performance while shrinkage of inventory have a negatively effects organizational performance. However, the outcome variable in the study was organizational performance, and not forecasting accuracy. An investigation by Kimayo and Ochari (2014) focused on the influence of management of inventory on of Local processing entities a case of the New KC C.

Quantitative data was processed using descriptive statistics and inferential statistics. The study established that holding stocks and ordering costs had the capability to increase the

performance of a firm, reduction of costs helped in the preparation of employees and achievement of profitability. This study focused on one organization, hence its findings cannot be generalized on the cement manufacturing firms.

Based on the management dilemma facing the cement manufacturing firms in Kenya, as well as the gaps in knowledge from the foregoing studies, there was need for a study on supply chain innovation and forecasting accuracy in the cement manufacturing firms in Kenya. As a result, the current study is guided by the general question: What is the impact of supply chain innovation on forecasting accuracy in the Kenya's cement producers in? The questions guiding the study were: What are the supply chain innovation approaches adopted by the cement producing in Kenya? What is the impact of supply chain innovation on forecasting accuracy in the cement manufacturing firms in Kenya?

1.3 Research Objectives

The key objective of the study was to determine the impact of supply chain innovation on forecasting accuracy in the cement manufacturing firms in Kenya.

The specific study objectives were:

i. To identify the supply chain innovation approaches adopted by the Kenya's producing cement firms.
ii. To establish effect of supply chain innovation on forecasting accuracy in the cement producing firms in Kenya.

1.4 Value of the Study

Boards and management teams of the 8 cement manufacturing firms in Kenya would gain significant insight that could provide direction on judicious management of inventory against the backdrop of oversupply. As a spillover effect, the findings of the current study would avail key lessons for the success and best practices among other manufacturing firms that are faced with similar management dilemma in Kenya.

The study would provide key data for the development of relevant policies not only for the cement manufacturing industry but for the entire sector. The Ministry in charge of housing in Kenya, and all other policy organs would utilize the data from the research in decision making since it would assist in developing evidence-based policies for the achievement of the Vision 2030, the Big Four agenda, and the sustainable development goals in Kenya.

The findings will be important to management science Scholars especially supply chains and operations management in furthering research in their areas. The postulations of demand-based inventory management and contingency theories would find empirical backing in regard to the relationship between inventory management and forecasting accuracy. The investigation would also add to the existing body of empirical literature on the association between the two concepts, leading to build up of the knowledge pool in management science.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The chapter comprises a presentation on the empirical and theoretical literature on supply chain innovation, forecasting accuracy, and related concepts. The literature review has been undertaken critically to bring out the areas of consensus, inconsistencies, and hence the justification for the current study. From the literary synthesis, a conceptual framework has been developed to envisaging a relationship between the study variables.

2.2 Theoretical Foundations

Based on the predictions of demand-based inventory management and contingency theories by Kot et al. (2011) and Fiedler (1964) respectively, the study endeavored to establish the impact of supply chains innovation on forecasting accuracy in the cement producing companies in Kenya. The demand-based inventory management theory postulates that key to the reduction of supply chain costs is the production and distribution of the forecasted demand, supported by innovative approaches. Contingency theory, on the other hand, states that the supply chain innovation vary from between organizations going by the type of demand typical of the firm's products and services.

2.2.1 Demand-Based Inventory Management Theory

According to the demand driven inventory management theory, efficient management of supply chains comprises the enhancement of the highest quality of vendor management inventory and minimization of the supply chain costs (Yadav, 2014). The theory holds that the characteristic reason behind constantly increasing supply chain expenses is the excess

inventory levels in the entire the chain, hence the need for innovative supply chain designs. Organizations, therefore, normally develop innovative techniques of supply chain management to enhance effectiveness, efficiency, and economy. Others such as Vledder et al. (2015) argue that the starting point in supply chain innovation normally lies in the forecasting of demand through market projection. Building on the earlier postulations of Kot et al. (2011) other theorists including Vledder et al. (2015) laid emphasis on the considerable significance of time series during forecasting process.

They argue that any delay or variance would have significant influence on the level of accuracy of the forecasts made for the future periods. Therefore, accurate sales data and acknowledging the environmental dynamics determine the quality of the forecast, and hence more utilitarian supply chain innovation. The various models of forecasting under conditions of data constancy suggested by Kot et al. (2011) include moving averages and exponential smoothing or, in the case of inconsistencies of data, models such as time series with trend analyses. The prediction of this theory is that supply chain innovation and forecasting accuracy are related. The weakness of this theoretical model is that it places much emphasis on the quantitative characteristics of the supply chain, and places less premium on the human factors on the relationship between supply chain innovation and forecasting accuracy.

2.2.2: Contigency Theory

The theory holds states relationship between variables is dependent on the situational outlook. Haldersson, Herbert and Thage (2003) argue that the variations in output variable are assumed to represent performance resulting from variations in the input measures. Hence, supply chain innovation can be determinants of forecasting accuracy.

Therefore, changes in demand dynamics are hypothetically related to the type of innovation thus the efficacy of the innovation. Of importance, according to this theory, of supply chain innovation includes determining the current and future needs for all kinds of inbound and outbound inventory to ensure the safety of supplies, and avoid other losses caused by deterioration, pilferage, waste, and obsolescence. Cole, Badi and Langly (2003) argued that the type and level of demand can spur an organization to reinvent its supply chain to match the changes.

The transfer of materials as they pass through stages of the production of the operation is also vital and ought to be designed with the market dynamics in mind (Miller, 2010). The prediction of contingency theory is that supply chain innovation and forecasting accuracy are related (Snyder, 2011). As is the case with most theoretical arguments, the limitation of contingency theory is that it does not provide empirical evidence on the relationship between supply chain innovation and forecasting accuracy. The current study would, therefore, test the prediction of contingency theory in light of the relationship between supply chain innovation and forecasting accuracy in cement manufacturing firms in Kenya.

2.3 Dimensions of Supply Chain Innovation

Firms ought to make difficult changes in order to thrive and survive. Its success calls for a reduction of costs by controlling expenses and redesigning work processes To enhance productivity they need to innovate.. Among the innovations are VMI, Collaborative planning forecasting and replenishment, Cross docking and RFDI (Singh, Arora, & Mishra, 2014). Vendor management inventory (VMI) also known as quick Response inventory system (QRIS) is system of distribution whereby the manufacturer (vendor) monitors and manages the inventory at the distribution or retail outlet. It involves various activities like determination suitable order quantities, management of right product portfolio.

Data at is received at the vendors computer electronically without any manual entry required which reduces the lead time and vendor recording errors. CPFR is defined as a collaboration a number of members of a supplies chains collaboratively develop plans some activities like promotion joint forecasting which helps in the determination of output and replenishing processes. The major aim of CPFR is to match supply to demand through data interchange between the supply chain partners in order to eliminate bottlenecks in meeting customers demand. Cross docking is a Logistical practice popularized by the Walmart involving unloading materials from an incoming mode of transport and loading the materials directly into outbound mode with little or no storage between them. RFID is communication module using electromagnetic waves to transfer data between two points like a terminal and an object to facilitate identifying and tracking an object device a chip and an antenna, is embedded or attached to a product.

Collaborative planning occurs where a number of supply chain partners plan some activities jointly. The term CPFR was coined in 1995, in a joint project involving project between Wal-Mart. Warner-Lambert, Benchmarking partners, SAP and Manugistics CPFR aims to is to match supply and demand among the partners in the chain through information sharing so as to remove any barriers to effectively meeting consumer demands and reduce inventory costs. Edler & Georghiou (2007).

Cross docking is a Logistical practice popularized by Walmart that involves offloading materials from an incoming mode of transportation and loading them directly into outbound mode with minimal or no storage, in between. The vendor's ship inventory to distribution centers in quantities that have been pre packed according to the requirements of every store where storage takes place. Vendors avoid the need for storage and prepare ordering replenishments. The inventory is collected or directly moved from the inbound dock to the outbound docks without any the need for storage or preparation of order replenishment (Keely et al., 2002).

2.4 Dimensions of Forecasting Accuracy

Depending on the selected metric, aggregation level, and horizon of forecasting, different results on forecast accuracy for the same set of data can be obtained. In order to analyze forecasts and monitor development of forecasting accuracy over time, it is important to understand the basic characteristics commonly used metrics of forecast accuracy (Hyndman& Koehler, 2005).The number of forecast accuracy metrics is infinite , but a majority of them are variants of the following : forecasting bias, mean deviation (MAD), and mean percentage error (MAPE) Tsay, (2002).

Forecast bias is the difference between a forecast and sales turnover, normally in percentage form. The mean absolute deviation (MAD) shows the size of an error, on average, is inherent in a forecasting model. Mean absolute percentage error (MAPE) is similar to MAD metric, but expresses the forecasting error in relation to the volume of sales. Basically, it indicates the amount of deviation of a forecast away from the actual demand. Indeed probably the most commonly used forecasting metric in demand planning (Coleman & Swanson, 2004). This study would adopt the forecast bias as a measure of the forecasting accuracy due to its ease of use.

2.5Empirical Studies

Prior studies have attempted to determine the relationship between supply chain innovation and forecasting accuracy. Singh, Arora, and Mishra (2014) studied the emerging trends in supply chain innovation, comparing Indian and Chinese firms. This was an exploratory study, hence it used qualitative methods.

The study determined that Chinese firms were using more innovative supply chain techniques, even though this could be influenced also by the infrastructural advantages of China compared to India. The linkage between supply chain innovation and forecasting accuracy was not within the scope of the study thus there is a gap to be filled by this study. From the European Union (EU), Edler and Georghiou (2007) did a study on public procurement innovation, and its relationship with demand level. This was synthesis of various empirical studies from various EU countries. The study concluded that most public institutions in the EU region were increasingly adopting innovative procurement methods.

This was exclusive in-depth literature review hence no data was collected nor analyzed. This study also assumed homogeneity of the EU countries. The current study utilized primary data, and was done in a developing nation. Others such as Keely et al. (2002) studied the supply chain innovations for managing demand variability among selected firms in Ohio, United States of America. The study established that under conditions of more demand variability, firms tended to adopt more innovative methods in the supply chain management. This was a study in the USA, a more techno-innovation savvy nation. The current study would bring experiences from Kenya.

Focusing on the methods of forecasting intermittent demand in the United Kingdom (UK) utilizing data from the British Airforce, Teunter and Duncan (2009) determined ordinary periodical forecasting error metrics were unsuitable for irregular demand, even if they were constantly and widely used. Nonetheless, this study explored only one dimension of forecasting, that is intermittent demand, with other dimensions including clumped demand forecasting remaining uninvestigated.

The current study modelled all the dimensions of demand, including the intermittent demand type to enhance content validity of the findings. A study by Ha, Zang, Yong, and Tun (2007) focused on new approaches of forecasting irregular demand for inventories of spare parts in the processing industries in China. Using data some of forty types of spare parts from a Chinese petrochemical company, the study revealed that the used mode used produced reliably accurate forecasts of demand than compared to the exponential

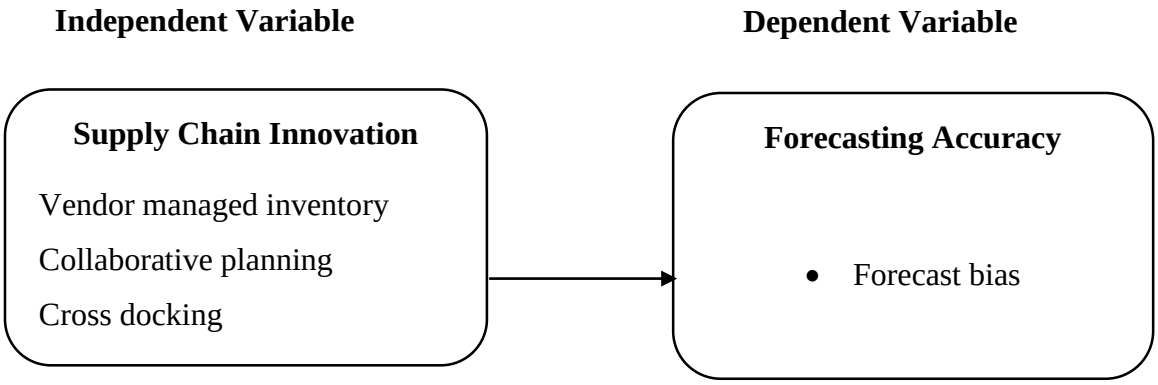
smoothing, Crston's and Markovian bootstrapping method. The study however focused on the petrochemical industry in China, being an economically advanced economy than that of Kenya. The current study would fill the gap since it focused on the Kenyan context.

Luh, Song, and Regan (2005) investigated the forecasting updates in the manufacturing firms in China. The study developed biddable limits on the optimum minimum stock levels and used them to develop a general class of heuristic solutions. The study identified necessary but sufficient conditions for the short sighted policy optimality. The study focused on all manufacturing firms in China which is a more advanced economy. The current study would fill the gap since it focused on the Kenyan context. A study by Lee (2002) focused on strategies for aligning supply chain with demand un-certainties. The study concluded that some unknown characteristics require supply chain strategies with initiatives and innovations that can provide a competitive advantage for a firm. Since this was a case study, its results cannot apply to other firms which are heterogeneous in nature.

2.6 Conceptual Model

The conceptual framework in Figure 2.1 depicts a relationship between supply chain innovation and forecasting accuracy. The independent variable according to the framework is supply chain innovation, while the dependent variable is forecasting accuracy. Various dimensions of supply chain innovation have been modelled in the framework based on their consistent use among the scholars in the field of Supply Chain Management; one forecasting accuracy metric has, however, been used due to its ease of application, and that is the forecast bias metric.

Figure 2.1 Conceptual Model



Source: Author (2018)

The dimensions of supply chain innovation modelled in the conceptual framework in Figure 2.1 have been drawn from Singh, Arora, and Mishra (2014), while the forecasting accuracy constructs have been adopted from Coleman and Swanson (2004). The conceptual framework also envisages relationship between each of the supply chain innovation constructs and forecasting accuracy.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the study design, population, data collection and the analysis of data.

3.2 Research Design

The approach used to guide a research to ensure that it addresses the study problem, is called design three forms of research design exist, namely: descriptive design; causal design; and exploratory design. This study used descriptive cross-sectional design. Kothari (2004) defines descriptive study design as that which entails a phenomena description or of attributes related to a subject population. This design has been chosen due to its consistency with determination of association between variables, quantitative data, and regression analysis.

3.3 Population of the Study

Population is a large collection of elements, objects or individuals forming the study focus (Cooper et al., 2006). The elements must be having similar observable characteristic. The target population of this study comprised the eight cement manufacturing firms in Kenya as shown in Appendix II. Since all the elements in the population were included in the study, this was a census survey. A census survey has been chosen because the universe is relatively small and sampling would make no practical sense. According to Kothari (2004), there is no need for sampling when the population of the study is reasonably small.

3.4 Data Collection

The Primary data was collected with the aid of structured research questionnaires sources. Mugenda and Mugenda (2003), and Cooper et al. (2006) agree that a structured questionnaire is appropriate for a descriptive design. Descriptive statements in a rating scale were presented to the respondents, on which they were expected to rate the level to which they perceive specific sentiments as descriptive of their compensation and performance circumstances. The tool had 5-point likert scale within the continuous scale: "no extent" (1) to "very great extent" (5).

The questionnaire was structured into three Sections: Section A gathered data on the demographics of the respondent, Section B collected data on supply chain innovation, while Section C collected data on demand forecasting. The questionnaire was then administered to the head of supply chain function, or its equivalent of each firm. Four other respondents were identified from each company, namely: the heads of sales, vendor management inventory, systems or their equivalents. The four types of respondents were deemed suitable since supply chain management, innovation, demand management, and forecasting were most applicable in their units/departments. This brought the total number of respondents for each firm to four, hence a total of 40 respondents for the entire survey.

3.5 Data Analysis

Data analyses entailed quantitative analyses which were undertaken through descriptive statistics and regression analysis. Descriptive statistics showed data distribution using measures of central tendency and dispersion. Multiple regression model was used to bring

out the relationship between the each of the supply chain innovation dimensions and forecasting accuracy as stated in the objective of the study. This data analysis was done using SPSS version 20. The regression model was presented below:

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

Where,

Y= Forecasting accuracy, measured by forecast bias, and expressed as a ratio.

X1= Composite score for supply vendor management inventory

X2= Composite score for supply collaborative planning

X3= Composite score for supply cross docking

β1…….β4=Beta coefficients of variables *i*the measure of the change in Y associated with a t change in X. β_0 = Regression constant; while ε –refers to the expected error that is assumed to be associated with the variables; the coefficient of determination (R-Square) obtained gave the explanatory power of the model while the correlation coefficient (Beta factor) for each of the four independent measures gave the nature and extent of relationship with the dependent variable. The interpretation of the outcome was at 5% significance level. The p-values were then interpreted for significance.

3.6 Summary of Research Methodology

Table 3.1 comprises a summary of the research methodology. The methodology was anchored on the objectives of the study, with the choice of data collection, and analysis methods based on the research questions and objectives.

Table 3.1 Summary of Research Methodology

Research Objective	Data Collection Method	Analytical Method
To identify the supply chain innovation approaches adopted by the cement manufacturing firms in Kenya	• Primary data on supply chain innovation to be collected using 5-point Likert scale questionnaire	Descriptive statistics
To establish the effect of supply chain innovation on forecasting accuracy in the cement manufacturing firms in Kenya	• Primary data on supply chain innovation to be collected using 5-point likert scale questionnaire	Regression analysis

CHAPTER FOUR: DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This chapter comprises the interpretation and presentation of the study findings. It presents the response rate, demographic data, and the study findings based on the research objectives. Descriptive and inferential statistics form the basis for discussion of the study findings.

4.2 Rate of Response

The sample size was 32 respondents out of which 24 completed and returned the questionnaires constituting a 75 percent response rate. This rate of sufficed for the researcher to draw reasonable conclusions from the study. Mugenda and Mugenda (1999) stated that a response rate of 50 percent is adequate for analysis and reporting; 60 percent is good and 70 percent and above is excellent. On these grounds the response rate was found to be excellent.

Table 4.1: Response Rate

Questionnaire	**Frequency**	**Percentage**
Filled and Returned	24	75
Unreturned	8	25
Total	**32**	**100**

Source: (Research)

4.3 Demographic Information

The respondents were asked to indicate the following demographic data: department/position in the organization; length of service in the current organization; and level of education. The responses were as shown below.

4.3.1 Department of the Respondent

The respondents gave information about their department in the organization as shown in Figure 4.1 below.

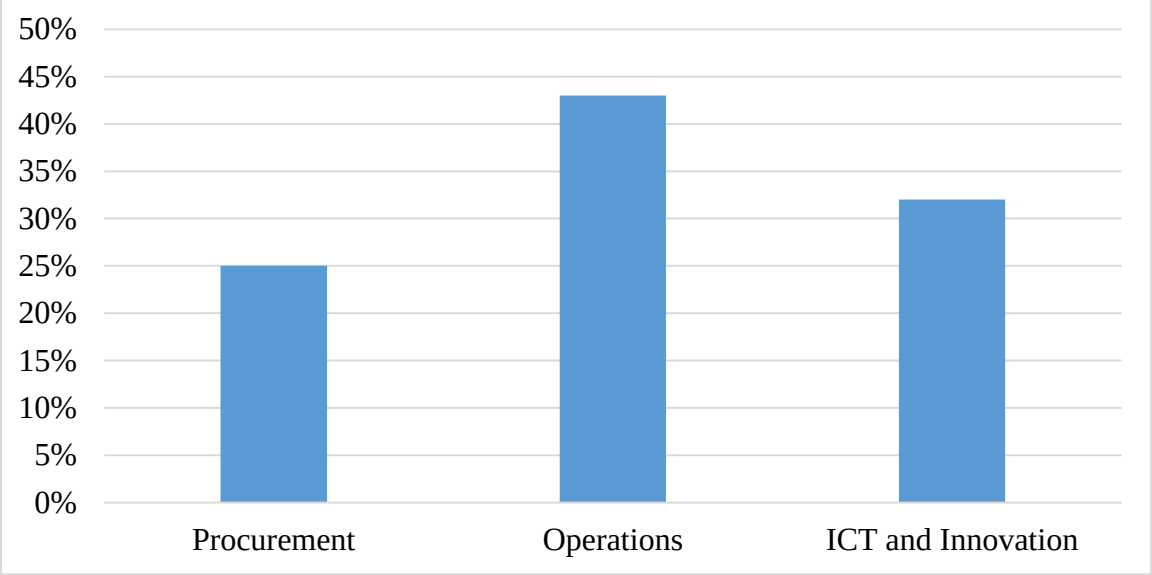


Figure 4.1 Department of the Respondent

Source: (Research)

From Figure 4.1 above, most of the respondents were from operations department, representing 43%, followed by Information Communication, and Technology (ICT) and Innovation, representing 32% of the respondents, then procurement department representing, 25% of the respondents.

4.3.2Experience in Current Organization

The respondents gave information about their experience in the organization as shown in Figure 4.2 below.

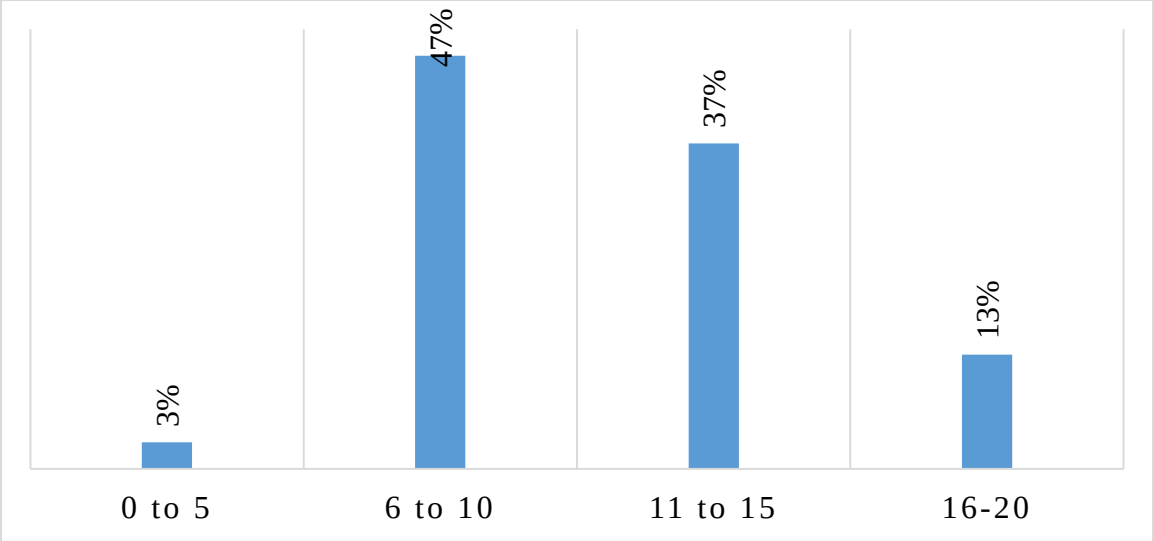


Figure 4.2: Departments of the Respondents

Source: Research Findings

From Figure 4.2 above, most of the respondents had been in the current organization between 6 to 10 years cumulatively, representing 47%. 37% of the participants had been in the current organization for a cumulative period of between 11- 15 years. Only 3% of participants had been in the current organization for between 0 to 5 years. The translation is a large number of the respondents had sufficient knowledge of their current organizations since they had been there for at least 6 years, hence would offer useful data on the research question.

4.3.3Experience in Current Position

The respondents gave information about their experience in the current position as shown in Figure 4.3 below.

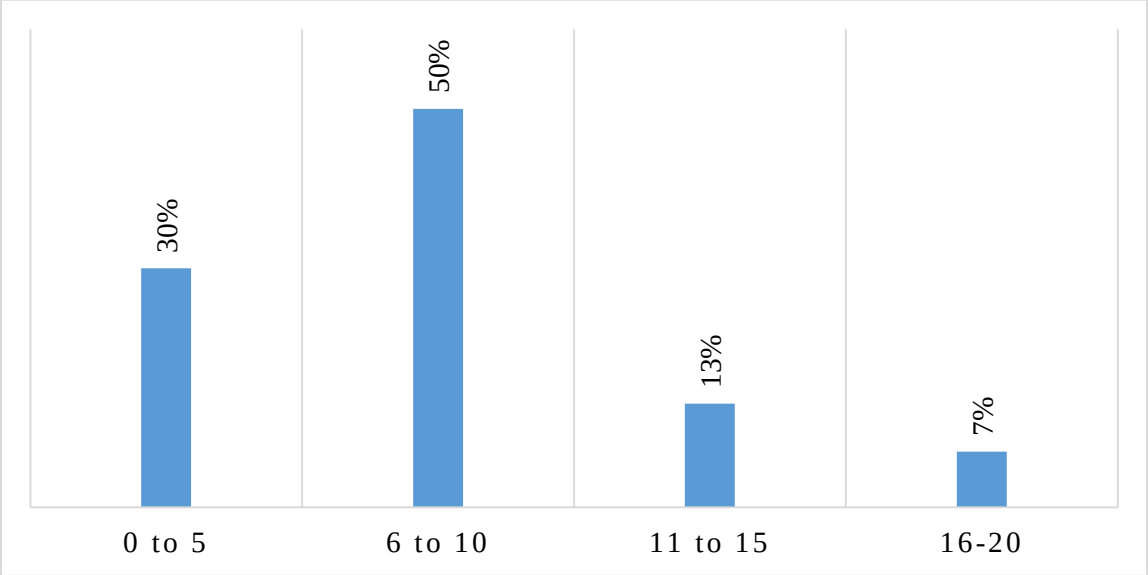


Figure 4.3: Experience in Current Position of the Respondents
Source: Research Findings

From Figure 4.3 above, majority of the participants had been in the current position between 6 to 10 years cumulatively. 30% of the respondents had been in the current position for a cumulatively between 0 to 5 years. Only 7% of respondents have been in the current organization for a period of between 16 to 20 years. This means that most of the respondents had sufficient knowledge of their roles since they had been there for at least 6 years, hence would offer useful data on the research question.

4.3.4 Education Level of the Respondents

The respondents gave information about their cumulative experience in the current organization as shown in diagram 4.4 below.

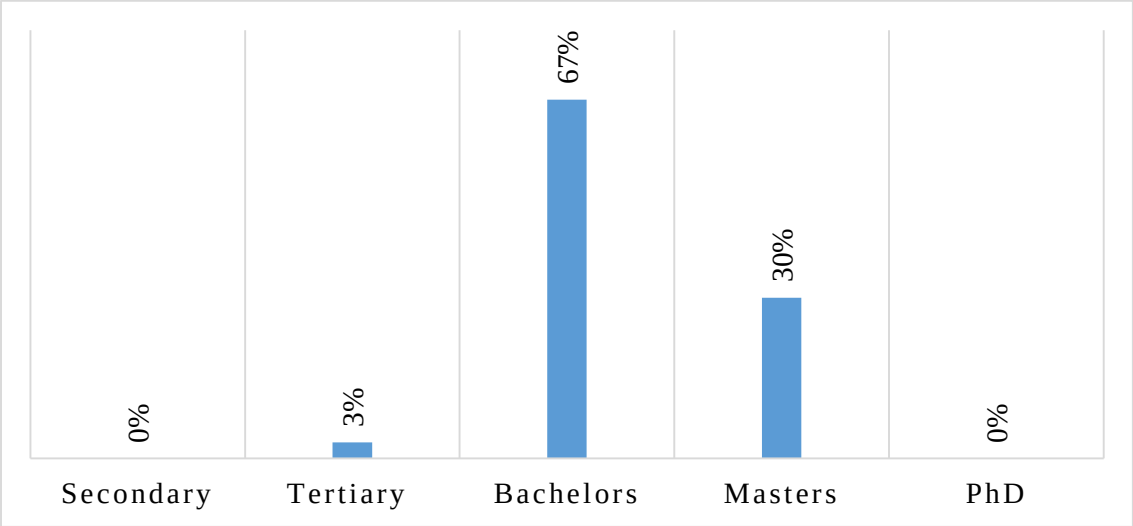


Figure 4.4 Level of Education of the Respondents

Source: Research Findings

From Figure 4.5 above, a larger percentage of the participants had Bachelors' degree, representing 67% of the respondents. A further 30% had Masters' degree, while 3% had Diploma qualifications. None of the respondents had a maximum of PhD nor secondary education. From the foregoing, the respondents had sufficient qualifications, hence could respond to the questionnaire without direct intervention of the researcher.

4.4 Respondents' Perceptions on Supply Chain Innovation

The study endeavored to establish the influence of supply chain innovation on demand forecasting in the cement manufacturing firms in Kenya. The structured questionnaire, with a 5 point likert scale was used to collect data. The central tendency of the responses was measured using the mean, while dispersion was measured using the standard deviation. The mean measured the extent to which the responses were centered about one point on the scale, while standard deviation measured the degree to which the responses were dispersed from the mean. The statistics are as shown in Tables 4.2, 4.3, and 4.4 below.

Table 4.2 Respondents' Perceptions on Vendor Inventory Management

Vendor Inventory Management	Mean	Standard Deviation
My company's inventory management system is integrated with that of some distributors and/or vendors	3.933	0.145
My company regularly monitors the distributor/vendor's inventory movement through an integrated system	3.132	0.382
My company replenishes inventory guided by the vendor management inventory system	3.146	0.233
Aggregate Score	**3.404**	**0.233**

Source: Research Findings

From Table 4.2 a large no of the respondents were neutral on the application vendor inventory management practices in their firms. However, most of the majority concurred that their companies' inventory management systems were integrated with that of some distributors and/or vendors. This is because it attracted the most favorable response,

demonstrated by highest mean of 3.933, and smallest standard deviation of 0.145. In this regard, this indicator of vendor inventory management had the most consistent scores.

Table 4.3 Respondents' Perceptions on Collaborative Planning

Collaborative Planning	Mean	Standard Deviation
My company collaborates with vendors on various promotional activities	3.984	0.225
My company collaborates with distributors on various promotional activities	3.376	0.281
My company occasionally undertakes joint ventures with members of the downstream value chain	3.537	0.332
My company occasionally undertakes joint ventures with members of the up stream value chain	3.984	0.225
Aggregate Score	**3.72**	**0.266**

Source: Research Findings

From Table 4.3 above, the respondents tended to agree to most of the statements on collaborative planning in their organizations. This is because all the statements attracted the mean close to 4.000. The most favorable responses were on both collaborative promotion activities, and joint venture activities with members of the upstream. These responses each had a mean of 3.984, and the lowest standard deviation of 0.225.

Table 4.4 Respondents' Perceptions on Cross Docking

Cross Docking	Mean	Standard Deviation
My company occasionally performs simultaneous off-loading and on-loading of consignment to avoid inventory holding	3.288	0.394
My company avoids holding inventory as much possible	3.537	0.332
Aggregate Score	**3.412**	**0.363**

Source: Research Findings

From Figure 4.4 above, the respondents tended to be neutral on the cross docking practices in their organizations. However, most respondents tended to concur that their organizations avoided stock-holding as much as possible through cross docking strategy. The overall score for cross docking was close to neutral as shown by the aggregate mean score of 3.412.

4.5 Respondents' Perceptions on Demand Forecasting

The study endeavored to establish the level of demand forecasting in each cement manufacturing firm in Kenya. A structured questionnaire, with a 5 point likert scale were used to collect data. The central tendency of the responses was measured using the mean, while dispersion was measured using the standard deviation. The mean measured the extent to which the responses were centered about one point on the scale, while standard deviation measured the degree to which the responses were dispersed from the mean. The statistics are presented Table 4.5 below.

Table 4.5 Respondents' Perceptions on Demand Forecasting

Scale	Mean	Standard Deviation
My organization did not meet the sales unit projections in the latest performance review	3.672	0.236
My organization reported a wide deviation between the planned versus actual sales revenue in the last performance review	3.363	0.196
My organization is considering using a different demand forecasting strategy to enhance accuracy	3.762	0.197
If our demand forecasting strategies were more accurate, we would not experience dead-stock	3.552	0.17
If our demand forecasting strategies were more accurate, we would reduce warehousing costs	3.672	0.236
Average Score	**3.604**	**0.207**

Source: Research Findings

From Table 4.5 above, the respondents tended to agree to most of the statements on demand forecasting as s indicated by the mean of 3.604 and standard deviation of 0.207. The most favorable score was that the organizations considered using a different demand forecasting strategy to enhance accuracy, with the mean of 3.604. However, the least favorable score was on the deviation between panned versus actual sales. The aggregate score on demand forecasting perceptions was 3.604, and standard deviation of 0.207.

4.6Regression Analysis

The study purposed was to determine the impact of supply chain innovation on forecasting accuracy of cement manufacturing firms in Kenya. Various inferential statistics were interpreted in light of the study objectives. R^2 was used to measure the proportion of

demand forecasting explained by each of the dimensions of supply chain innovation. The beta factors were used to measure the correlation between each of the dimensions of supply chain innovation, and demand forecasting of the cement producing companies in Kenya. The significance of the beta factors was interpreted at 5% level of significance.

4.6.1Vendor Management Inventory and Demand Forecasting

Table 4.4: Model SummaryI

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.889	.790	.736	.22462

Adjusted R squared or coefficient of determination indicates the variation in the dependent variable due to changes in the independent variable(s). From the above table, adjusted R squared was 0.736 indicating an existence of variation of 73.6% in demand forecastingdue to changes in vendor management inventoryat 95% confidence level . This proves 73.6% changes in demand forecastingcould be attributed to variations in vendor management inventory. R shows the relationship between the study variables, from the findings there was a strong and positive correlation between the study variables of 0.889.

Table 4.5: Analysis of VarianceI

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1.293	1	.431	3.814	.001[b]
	Residual	37.968	29	.113		
	Total	39.261	30			

The ANOVA statistics, the regression model had a fit with the data ($F=3.814$, $P < 0.05$). This is an indication that vendor management inventory had a significant influence on demand forecasting, at 5% level of significance, since the p-value was 0.1%, which was less than 5%.

Table 4.6: Coefficients I

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.508	1.131		1.333	.001
	Vendor Management Inventory	.481	.228	0.203	2.110	.002

As shown in table 4.6 beta coefficient was significant ($\beta = 0.481$, $t = 2.110$, $P < 0.05$). This implies that for every unit change in identity there was 48.1% increase in performance. The above table, the regression equation was:

$$\mathbf{Y = 1.508 + 0.481X_1}$$

it was sown from the equation that if there were no changes in vendor management inventory, demand forecasting will 1.508. However, a single change in vendor management inventory will result to growth in demand forecasting by 0.481. At 5% level of significance in conversation was found to significantly influence demand forecasting. The significance level was 0.1%, which was less than 5% threshold.

4.6.2 Collaborative Planning and Demand Forecasting

Table 4.7: Model Summary II

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.788[a]	.621	.604	.06210

Adjusted R squared indicates variation in the dependent variable resulting from changes in the independent variable(s), The findings findings in the indicate the value of adjusted R squared as0.604 an indicating that there was change of 60.4% on demand forecastingdue to changes in vendor management inventoryat 95% level of confidence .

This adjusted R square indicates a 60.4% variation in demand forecastingcould be accounted for by the changs in vendor management inventory through supply chain innovation. R shows the relationship between the study variables, from the findings shown in the table above there was a strong positive correlation between the study variables by 0.788.

Table 4.8: Analysis of VarianceII

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Residual	2.844	1	0.711	4.903	.001[b]
	Regression	10.875	29	0.145		
	Total	13.719	30			

Critical Value =2.0196 (F-Distribution Table)

The ANOVA statistics had a significance level of 0.1% showing that the data is ideal for making a conclusion as the value of significance (p-value) is less than 5%.

The F critical at 5% significance level was 2.0196. Since F calculated (4.903) is greater than the F critical; the overall model was significant. It indicates that Vendor managed inventory significantly influenced demand forecasting.

Table 4.9: Coefficients II

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	Constant	1.445	0.453		3.190	.002
	Vendor Management Inventory	0.421	0.145	.297	2.903	.003

From the data in the above table the established regression equation was

$Y = 1.445 + 0.421\ X_2$

From the above regression equation, it was revealed that if there were no changes in vendor management inventory, demand forecasting will be 1.445. However, a unit change in vendor management inventory would results to a surge in demand forecasting by 0.421. At 5% level of significance in collaborative planning through supply chain innovation was found to significantly influence demand forecasting. The significance level for the beta factor was 0.2% which was below the 5% threshold.

4.6.3 Cross Docking and Demand Forecasting

Table 4.10: Model Summary III

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.881[a]	.776	.724	.01121

Adjusted R squared is an index of variation in the dependent variable caused by changes in the predictor variable(s), The findings show ,the value of adjusted R squared was 0.724 indicating that that there was variation of 72.4% on demand forecasting caused by changes in cross docking through supply chain innovation at 95% level of confidence This shows that 72.4% changes in demand forecastingcould be explained by changes in cross docking through supply chain innovation. R shows the correlation between the study variables, The findings shown in the table above there was a strong positive correlation between the study variables as shown by 0.881.

Table 4.11: Analysis of VarianceIII

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Residual	2.844	1	0.745	4.726	.001[b]
	Regression	10.875	29	0.167		
	Total	13.719	30			

Critical Value =2.0196 (F-Distribution Table)

From the ANOVA statistics above had a significance level of 0.1% that shows that the data is ideal for making a conclusion since the value of significance (p-value) is less than 5%. The F critical at 5% significance level was 2.0196 since F calculated (4.716) is greater than the F critical; this proves that the overall model was significant an indication that cross docking through supply chain innovation significantly influenced demand forecasting.

Table 4.12: Coefficients III

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	Constant	1.213	0.453		3.190	.002
	Cross docking	0.532	0.197	.014	2.701	.005

From the data in the above Table the regression equation was

$Y = 1.213 + 0.532\ X_3$

From the above regression equation, reveals that if without changes in cross docking through supply chain innovation, demand forecasting would be at 1.213. However, a unit change in cross docking through supply chain innovation will result to a surge in demand forecasting by a factor of 0.532. At 5% significance level in cross docking through supply chain innovation was found to significantly influence demand forecasting. The significance level for the beta factor was 0.2% which was below the 5% threshold.

4.6.4 Vendor Management Inventory, Collaborative Planning, Cross Docking, and Demand Forecasting

Table 4.12: Model SummaryIV

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.808(a)	.653	. 633	.69440

Adjusted R squared indicates the variation in the dependent variable resulting from changes in the independent variables. From the findings in the above table the value of adjusted R squared was 0.633. this indicates that there was change of 63.3% on demand forecasting resulting from changes in VMI, Collaborative planning, and cross docking uses of supply chain innovation at 95% confidence interval. This shows that 63.3% changes in demand forecastingcould be explained by changes in vendor management inventory, collaborative planning, and cross docking. R the relationship between the study variables, The findings show that there was a strong positive correlation between the study variables as shown by 0.808.

Table 4.13: ANOVAIV

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	0.813	3	0.271	3.045	.021[b]
	Residual	2.759	200	0.089		
	Total	3.572	203			

From the ANOVA statistics in Table above, the processed data had a significance level of 2.1% which shows that the data is ideal for making a conclusion on the population's parameter since the value of significance (p-value) is less than 5%. The F critical at 5% level of significance was 2.0196 since F calculated (3.045) is greater than the F critical; this shows that the overall model was significant. This indicates that VMI, inventory, collaborative planning, and cross docking significantly influenced demand forecasting.

Table 4.14: CoefficientsIV

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	Constant	1.298	.453		2.865	.006
	Vendor Management Inventory	.237	.160	.198	2.479	.012
	Collaborative Planning	.231	.126	.245	3.834	.001
	Cross Docking	.239	.145	.008	2.065	.023

$p<0.05$, dependent variable; demand forecasting

From the data in the above table the regression equation was;

$$\mathbf{Y = 1.298 + 0.237\ X_1 + 0.231\ X_2 + 0.239\ X_3}$$

From the above regression equation it was revealed that if change in VMI, collaborative planning, and cross docking were each zero, demand forecasting will be 1.298. However,

a unit change in vendor management inventory would lead to increase in business performance by a factor of 0.237, unit change in collaborative planning would result to a surge in demand forecasting by a factor of 0.231 and a unit change in cross docking through supply chain innovation will result to an increase in demand forecasting by a factor of 0.239. At 5% level of significance, VMI, collaborative planning, and cross docking of supply chain innovation were each found to significantly influence demand forecasting.

4.7 Discussion of Findings

The study has a relationship with both theoretical and prior empirical studies. The postulations of demand based inventory management, and contingency theories both have predictions on the relationship between supply chain innovation and demand forecasting. Previous empirical studies have also been examined, based on their objectives, and major findings. The current study adduced evidence in support of and against the selected theoretical and empirical literature.

4.7.1 Relationship with Theory

According to the demand based inventory management theory, efficient management of supply chains comprises the enhancement of the highest quality of vendor management inventory and minimization of the supply chain costs (Yadav, 2014). The theory holds that the characteristic cause of constantly increasing supply chain costs is the excessive inventory levels throughout the chain, hence the need for innovative supply chain designs. Organizations, therefore, normally develop innovative techniques of supply chain management to enhance effectiveness, efficiency, and economy. Others such as Vledder et

al. (2015) argue that the starting point in supply chain innovation normally lies in the forecasting of demand through market projection. Building on the earlier postulations of Kot et al. (2011) other theorists including Vledder et al. (2015) laid emphasis on the considerable significance of time series during forecasting process. The current study has brought to the fore empirical evidence in support of the postulations of demand based inventory management theory since it has determined that each of the selected supply chain innovation dimensions significantly influenced demand forecasting in the cement manufacturing firms in Kenya.

Contingency theory holds that the relationship between variables is dependent on the situational outlook. Halldorsson, Herbert and Tage (2003) argue that variations in output variable are regarded as representing performance resulting from variations in the input measures. Hence, supply chain innovation can be determinants of forecasting accuracy.

Therefore, changes in demand dynamics are hypothetically related to the type of supply chain innovation, in other words, the efficacy of the innovation. The importance, according to this theory, of supply chain innovation includes determining the present and future needs for all types of inbound and outbound stock to ensure the safety and security of supplies, avoid deterioration, pilferage, waste, and obsolescence. Coyle, Bardi and Langley (2003) argue that the type and level of demand can spur an organization to reinvent its supply chain to match the changes. The current study has also brought to the fore empirical evidence in support of the postulations of demand based inventory management theory

since it has determined that each of the selected supply chain innovation dimensions significantly influenced demand forecasting in the cement manufacturing firms in Kenya.

4.7.2 Relationship with Empirical Literature

The findings of this study are comparable with those of prior investigations. Keely et al. (2002) studied the supply chain innovations for managing demand variability among selected firms in Ohio, United States of America. The study established that under conditions of more demand variability, firms tended to adopt more innovative methods in the supply chain management. The current study has adduced empirical evidence in support of the postulations of demand based inventory management theory since it has determined that each of the selected supply chain innovation dimensions significantly influenced demand forecasting in the cement manufacturing firms in Kenya.

Focusing on the methods of forecasting intermittent demand in the United Kingdom (UK) using data from the United Kingdom Airforce, Teunter and Duncan (2009) determined that the ordinary periodical forecasting error metrics were not suitable for intermittent demand, even though they were consistently and widely used in literature. The current study has adduced empirical evidence in support of the postulations of demand based inventory management theory since it has determined that each of the selected supply chain innovation dimensions significantly influenced demand forecasting in the cement manufacturing firms in Kenya.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter comprises a presentation summary of the study findings, conclusion and recommendations based on the findings. The summary, conclusion and recommendations have been made in accordance with the objectives, methodological approach, findings, and limitations of the current study.

5.2 Summary of Findings

The study used descriptive design to determine the influence of supply chain innovation on demand forecasting in cement manufacturing firms in Kenya. The study determined that if change in VMI, collaborative planning, and cross docking were each zero, demand forecasting will be 1.298. However, a unit change in vendor management inventory would lead to increase in business performance by a factor of 0.237, unit change in collaborative planning would result to an increase in demand forecasting by a factor of 0.231 and a unit change in cross docking through supply chain innovation will result to an increase in demand forecasting by a factor of 0.239. At 5% level of significance, VMI, collaborative planning, and cross docking of supply chain innovation were each found to significantly influence demand forecasting.

5.3 Conclusions

Cement manufacturing firms contribute significantly in the growth of infrastructure hence there is need for supply chain innovations and forecasting accuracy among the key stakeholders.

Cement manufacturing firms should put more resources in innovation so as to have competitive advantage and to put more resources in terms of finances for research and development in supply innovation because it has a positive impact on demand forecasting.

The study has determined that VMI, collaborative planning, and cross docking were significant determinants of demand forecasting. Accordingly, the findings of the study agrees with a few studies including Keely et al. (2002). The study has also adduced evidence in support of demand based inventory management, and contingency theories in management.

5.4 Recommendations for the study

The study has unearthed valuable information about the influence of supply chain innovation on demand forecasting. It has particularly determined that VMI, collaborative planning, and cross docking were significant determinants of demand forecasting. This means that attempts to enhance demand forecasting accuracy should pay attention to supply chain innovation. Therefore, there is need for the top management team of the various firms surveyed to revisit the support for supply chain innovation in the various departments. In

particular, management should provide enough financial and policy support as well as relevant supply chain innovation training to all staff all staff.

The study also recommends more collaboration among the players in the economy to enhance the capacity of the cement manufacturing firms. This will enhance firm competitiveness against the backdrop of increased competition in the sector. A lobbying body containing all cement manufacturers as members should be formed to execute the collaboration and to enhance research and development in supply chain innovation among many stakeholders, thus the management and staff.

5.5 Limitations

There was a limitation on the number of innovations to research on there are a number of innovations but we managed to narrow down to three

Several limitations were encountered in the course of this study. Some respondents were uncooperative in filling the questionnaires; this limitation was mitigated by invoking a conversation with the respondent's first to make them at ease. This strategy was used also to reduce the risk of the respondents giving socially-correct responses.

Some respondents also took longer than expected time to fully complete the questionnaire; the researcher however ensured questionnaire submission was done early enough to allow significant time for completion. Early preparation of questionnaires and pre-testing of the same also helped the researcher time for analysis and presentation.

5.6 Implications of the Study on Practice Policy and Theory

The study suggests the findings for the development of policies that will be geared towards increasing the competitive advantage and manufacturing planning of the cement manufacturing firms in Kenya. The Ministry of Trade and Industrialization should apply the study results in decision making since it would assist in developing well-informed policies geared towards the achievement of the Vision 2030, the Big Four agenda (especially on the affordable housing pillar), and the sustainable development goals in Kenya.

The study also recommends that the academics in the field of operations management, should consider using the empirical evidence adduced to further their research interests. Theorists should also consider the findings of this study to find further empirical foundation in light of the linkages between supply chain innovation and demand forecasting. By so doing, further studies in other contexts, including public, private, manufacturing, and service would develop.

Finally, the researchers recommendations are that the top management team of various cement manufacturing companies need to use the findings for guidance in making necessary changes in their various functional units to enable them enhance innovation and reduce out-bound logistical costs. Specifically because the study findings have drawn important lessons for success and best practices for the cement industry sustainability against the backdrop of increasing industry competition.

5.7 Recommendations for Further Research

The researcher recommends further studies as follows: A study should be carried out on same concepts but involving a pool of all possible and available supply chain innovations. The new approach will capitalize on the gap created on the pool of supply chain innovation; the current study having used only three of them. If possible, the new approach should also incorporate moderating and intervening variables. The assumption behind the inclusion of moderating and intervening variables is to establish the change on the correlation coefficient.

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APPENDICES

Appendix I: Questionnaire

SECTION A: DEMOGRAPHIC DATA

1. Name of the Organization (Optional)_____
2. Your position in the Organization _____
3. Number of years worked in organization?

   Below 3 years [ ]

   4-6 years [ ]

   7-10 years [ ]

   More than 10 years [ ]

4. For how many years have you worked in the current position?

   Below 3 years [ ]

   4-6 years [ ]

   7-10 years [ ]

   More than 10 years [ ]

5. What is your highest level of education?

   First Degree [ ]

Masters [ ]

   PhD [ ]

   Other Please specify _____

SECTION B: SUPPLY CHAIN INNOVATION

6. Below are different statements about supply chain innovation in your organization. Please express your opinion as to the level of **agreement** with each of the statements. Use a scale of 1-5 where: *1-no extent; 2-small extent; 3-moderate extent; 4- large extent; 5-very large extent*.

Scale	**1**	**2**	**3**	**4**	**5**
Vendor Management Inventory					
My company's inventory management system is integrated with that of some distributors and/or vendors					
My company regularly monitors the distributor/vendor's inventory movement through an integrated system					
My company replenishes inventory guided by the vendor management inventory system					
Collaborative Planning					
My company collaborates with vendors on various promotional activities					
My company collaborates with distributors on various promotional activities					

My company occasionally undertakes joint ventures with members of the downstream value chain					
My company occasionally undertakes joint ventures with members of the up stream value chain					
Cross Docking					
My company occasionally performs simultaneous off-loading and on-loading of consignment to avoid inventory holding					
My company avoids holding inventory as much possible					

SECTION C: DEMAND FORECASTING

7. Below are different statements about demand forecasting in your organization. Please express your opinion as to the level of **agreement** with each of the statements. Use a scale of 1-5 where: *1-no extent; 2-small extent; 3-moderate extent; 4- large extent; 5-very large extent*.

Scale	**1**	**2**	**3**	**4**	**5**
Forecast Bias					
My organization did not meet the sales unit projections in the latest performance review					
My organization reported a wide deviation between the planned versus actual sales revenue in the last performance review					
My organization is considering using a different demand forecasting strategy to enhance accuracy					
If our demand forecasting strategies were more accurate, we would not experience dead-stock					
If our demand forecasting strategies were more accurate, we would reduce warehousing costs					

THANK YOU

Appendix II: List of Cement Manufacturing Firms in Kenya

S/NO	Company
1	Bamburi Cement Limited
2	Mombasa Cement Limited
3	East Africa Portland Cement Company
4	Savannah Cement Limited
5	ARM Cement Limited
6	National Cement Limited
7	Dangote Group
8	La Farge Group

Source: Kenya Association of Manufacturers (2017)