SUPPLY CHAIN ANALYTICS AND OPERATIONAL PERFORMANCE OF CEMENT MANUFACTURING FIRMS IN KENYA

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STUDENT'S DECLARATION

I, the undersigned, declare that this is my original work and has not been submitted to any university for academic credit

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This project has been presented for examination with my approval as the appointed supervisor.

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DEDICATION

I dedicate this project to my family and my supervisors. I have acquired a wealth of knowledge during my time at the university.

ACKNOWLEDGEMENT

I wish to thank The Almighty God for giving me the gift of life to write this work. I wish to express my gratitude to my supervisor Mr. Michael Chirchir for his professional guidance and motivation that enabled me to compile this project. I wish to extend my gratitude to my classmates whose presence offered me psychological motivation and the need to learn more.

Finally, I thank my family for supporting me throughout my studies at the various levels and their unconditional love to me is my greatest strength.

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ABBREVIATIONS & ACRONYMS

BA	Business Analytics
DMR	Data Management Resources
ERP	Enterprise resource Planning
IPR	IT- based supply chain planning resources
KAM	Kenya Association of Manufacturers
ORs	Organizational Resources
PCC	per Capital Consumption
PMR	Performance management resources
RBV	Resource based View
RFID	Radio Frequency Identification
ROA	Return on Assets
ROI	Return on Investments
SCA	Supply chain analytics
SCOR	Supply Chain Operations Reference model
TQM	Total Quality Management

ABSTRACT

There have been limited empirical studies that have left a research gap on supply chain analytics and operational performance in manufacturing firms. This study attempted to investigate the influence of supply chain analytics on operational performance in cement manufacturing firms in Kenya. Specific objectives were to establish the supply chain analytics used by cement manufacturing firms in Kenya and to establish the relationship between supply chain analytics and operational performance of cement manufacturing firms in Kenya. The study adopted descriptive research design in order to investigate and understand the application of supply chain analytics in cement manufacturing firms in Kenya. The study used descriptive statistics and inferential statistics. The researcher used a census survey research design. This involved collection of standardized information from the population under study. The target population for this study was 7 cement manufacturing firms in Kenya. Out of the focus population of study questionnaires were mainly administered through electronic mail and few visits were made in search for respondents that resulted in a response rate of 95.24%. Primary data was collected for this study. The major findings of the study on supply chain analytics used by cement manufacturing firms in Kenya revealed supply chain analytics techniques are greatly implemented and establishing the relationship between supply chain analytics and operational performance revealed that that data management greatly affects firm operational performance. Specific limitations of the study were that the researcher aimed at drawing information from 21 respondents. However only 20 respondents participated and therefore led to the conclusion that the results may have been different if there was 100% participation and Time was also a major constraint. There is also need for further research to focus on the critical success factors in the adoption of best supply chain analytics models. The conclusion drawn from the research was that supply chain analytics greatly affect operational performance.

CHAPTER ONE: INTRODUCTION

1.1Background of the Study

Firms are under heavy pressure to improve supply chain planning and performance due to competition and uncertainty in the global environment. Manufactures have adopted different kinds of innovative technological and process-based solutions to obtain and sustain competitive advantage edge over their competitors. In supply chain management, there is a growing interest in business analytics, also known as supply chain analytics (SCA). SCA refers to the use of data and quantitative tools and techniques to improve operational performance (Davenport and O'dwyer 2011, O'dwyer and Renner, 2011). This is often indicated by the following metrics: order fulfillment and flexibility.

SCA is a combination of three sets of data and IT-enabled SCM resources, which is referred to as Data Management Resources (DMR), IT-based Supply Chain Planning Resources (IPR) and Performance Management Resources (PMR). Firms acquire and use various IT and Organizational Resources (ORs) in these three aspects of SCA (Davenport, Harris, and Morison, 2010). Firms use diverse analytical and IT resources for acquiring, storing and retrieving data. DMR includes IT-related resources for example RFID and ERP) and analytical capabilities for example mathematical optimization techniques) for data acquisition and management. Also, different software tools (or IPR), from less sophisticated to more advanced, are used for supply chain planning in manufacturers.

A number of companies globally like Proctor & Gamble and Wal-Mart are reported to have successfully implemented SCA, this have significantly enhanced operational efficiency through use of data analytical information technology tools for supply chain decisions and cost savings. Supply chain analytics is not a new concept (Davenport and O'dwyer, 2011);

this is because various quantitative techniques and modeling methods have long been used in manufacturing firms (Shapiro 2000; Kusiak 2006; Trkman et al. 2010). The recent surge of interest in SCA is accompanied by new challenges and opportunities in both business and information technology (IT) environments. These challenges include issues arising from managing large amounts of data for example data availability and data quality and dealing with environmental uncertainties (Huner, et al., 2011; Lavalle, et al., 2011; Manyika, et al., 2011).

1.1.1 Supply Chain Analytics

SCA is a combination of IT-enabled resources for manufacturing-related data management, supply chain planning, and data-driven process and quality improvement. It is a data-driven, analytical decision making approach to SCM supported by IT resources for data management, supply chain planning and evidence-based management methodologies. These IT-enabled resources would include enterprise IT infrastructure (e.g., ERP, RFID) and analytical methods for data management, technologies embedding optimization and predictive analytics (e.g., mathematical programming) for supply chain planning, and data-driven supply chain organizational resources (e.g., statistical process control, Six Sigma) for improving manufacturing processes and performance.

Analytics, in general, does not refer to a particular technology, method, or practice (Davenport, et al., 2010, Trkman, et al., 2010, Turban, et al., 2011). Rather, it is a combination of multiple IT-enabled resources, which includes both IT assets and organizational resources, helping the use of "data, analytical IT, and fact-based management methodologies" (Davenport and Harris, 2007) in decision making.

SCA reflects a broad interest in leveraging the business value of supply chain data and harnessing the power of various analytical technologies and methods. Top performing companies are better at utilising their data for business planning and execution (Kiron, et al., 2011; Lavalle, et al., 2011) and this has led to the increase in supply chain integration and visibility (Viswanathan and Sadlovska, 2010; O'dwyer and Renner, 2011). In general, academic research expects the benefits of analytics in supporting supply chain operations (Trkman, et al., 2010; Davenport and O'dwyer, 2011). Manufacturers have used statistical modelling and optimization (Turban and Sepehri, 1986; Shapiro 2000; Chellappa, Sambamurthy, and Saraf 2010; Davenport and O'dwyer, 2011) to help deal with supply chain problems (e.g. inventory optimization) on an ad hoc basis. However, the role that SCA plays, regarding both supply and demand factors, is growing in importance and deserves more thorough investigation.

1.1.2 Operational Performance

Firm performance is measurement against standard or prescribed indicators of effectiveness, efficiency, and environmental responsibility such as, cycle time, productivity, waste reduction, and regulatory compliance. It has been long debated issue on how to measure firm performance and over the years but in traditional economic theory major emphasis on market power and industry structure as determinants of firm performance (Kiron, et al., 2011). Financial and non-financial measures are used to measure firm's operational performance. The financial measures are, return on assets (ROA), market share, Return on Investment (ROI), Operating Profit of Firm, growth rates in domestic and export sales growth. Similar measures are used by previous researcher.

Similarly, the non-financial measures of performance include management's perceptions of productivity, profitability, market share, and customer satisfaction relative to competitors. The possibility of using non-financial performance measures was suggested by Dess and Robinson if the accurate objective measures are unavailable. Subjective measures of performance have been used by several researchers (Chin, 2010).

1.1.3 Cement Manufacturing Firms in Kenya

In Kenya, there are seven cement manufacturing firms namely: Bamburi Cement Limited, Rhino Cement Foundation, East African Portland Cement Company, Mombasa Cement Company, Savanna Cement, Athi River mining Ltd and National cement company Ltd. Apparently, more than 90% of all cement manufacturers in Kenya today are located within Machakos County and mainly in Athi River. With a ready market, Nairobi and Machakos among many other adjacent towns in Kenya, there is really no doubt that cement companies in this part of Kenya will always continue to flourish (KAM, 2013).

The cement industry has some distinctive characteristics. It is capital intensive and energy intensive (Faisal, et al., 2009). International Cement Review (2011) magazine reveals that there are 149 cement producing nations in the world, with M/s Holcium and M/s Lafarge being the leading cement companies in the world in terms of capacity and sales. United States Geological survey (2014) indicates that in the year 2013, global cement production was 4.0 billion tonnes of cement with China being the world's largest cement producer, having produced 2.3 billion tons in the year 2013, accounting for 58% of the world's production. In Africa, Egypt leads with an annual cement production of 46 million tons, accounting for 1.2% of the world's production in the year 2013. According to Standard Investment Bank (2013) report, the East African countries; Kenya, Uganda and Tanzania

combined produced 9.6 million tons of cement in the year 2013 accounting for 0.24% of the world's production. Kenya produced 5.2 million tons of cement same period of time, accounting for 54% of the total cement production in East Africa.

Recently, Kenya has experienced a tremendously growth which has led to increased commercial construction boom as a result of increased foreign investment, and extensive government and donor-funded spending on the country's mega infrastructure projects. As a result, per capita consumption (PCC) of cement increased at an average rate of 10.7% to 83.9 (Kgs) in 2011 from 50.0 Kgs in 2006 despite relative stagnation in annual population growth. The rapid demand for cement has heightened the need for quality management practices to ensure compliance of quality rules and regulations in order to provide quality goods and services to the customers (Dyer and Blair Bank, 2012). In an article, Ndetto (2014) stated that "quality management practices play a pivotal role in enhancing financial performance of cement manufacturing firms. According the Kenya Association of Manufacturers (KAM) report, most cement manufacturing firms are ISO certified and adhere to the professional set standards and regulations on quality issues. The implementation of supply chain analytics in most manufacturing firms in Kenya is done by managers who ensure a lean and efficient staff, strategic quality supply chain management.

1.2 Research Problem

Leading Manufacturing firms reported the flow of over 100 gigabytes of data through the firm's supply chain network on a given day in 2009 (Economist, 2010). The opportunity to gain competitive advantage may thus arise from how firms manage data (Forslund and Jonsson, 2007). Another major challenge for firms is the increasing uncertainty in both demand and supply sides of their firms. Dealing with demand and supply uncertainty by

means of proper supply chain operational performance has been a major theme in many recent SCM studies (Olivia and Watson, 2011). In response to those challenges SCA has been proposed as a promising approach to better manage data, utilize IT resources and prepare for effective operational performance. According to McMahon (2001), supply chain analytics is capable of positively influencing operational performance. This is in agreement with Nazirn (2006) findings which established that supply chain analytics is positively related to operational performance.

As competitive efforts are put in place supply chain analytics is key to ensuring organization goals are met. Cement manufacturing firms are focusing on becoming more efficient and effective in their manufacturing methods in order to meet market demand and handle uncertainties in the business environment. Some cement manufacturing firms have adopted supply chain analytics activities but it's not yielding the best results In Kenya. There is a relationship between SCA practices and operational performance although much has not been discussed in Kenya (Charan ,*et al.*, 2008). This makes this study timely and relevant.

Ketchen, (2008) conducted a study on best supply chain analytics practices and firm performance, the study found that the best supply chains analytics leverage strategic value chain management, agility, adaptability, and alignment not simply to create low costs, but also to maximize the total value added to the customer. Sahay and Ranjan, (2008) researched on real time business intelligence in supply chain analytics and found that enhancing effectiveness and efficiency of supply chain analytics using a business intelligence approach is a critical component in a company's ability to achieve its competitive advantage. Trkman and McCormack, (2010), conducted a study on the impact of business analytics on supply chain performance and the study

found that the existence of a statistically significant relationship between analytical capabilities and performance.

Maring'u, (2015), conducted a study on supply chain management practices and operational performance of mega agribusiness firms in Nairobi City County. Found that adoption of strategic supply chain management systems enhances agribusiness organizations performance. Aosa, (1992), conducted a study on supply chain management practices and performance of cement companies in Kenya. Found that supply chain management practices had influence on the organizational performance. Osoro, (2015) researched on factors affecting performance of supply chain systems in the petroleum industries in Kenya and found out that oil companies need to implement supply chain systems as a continuous process to achieve sustainability in the supply chain processes.

Following the above studies there was no study that was specific on value chain management versus supply chain analytics. This leads to the knowledge gap that this study attempts to fill. The objective was to answer the following questions: what are the supply chain analytics used by cement manufacturing firms in Kenya? What is the effect of supply chain analytics on operational performance of cement manufacturing firms in Kenya?

1.3 Research Objectives

i. To determine the supply chain analytics used by cement manufacturing firms in Kenya.
ii. To establish the relationship between supply chain analytics and operational performance of cement manufacturing firms in Kenya.

1.4 Value of the Study

The findings of this study was useful to manufacturing firms since it will provide insights on the importance of practicing quality management practices in manufacturing firms to achieve financial performance of firms.

Kenya Association of manufacturers and other policy makers will also benefit from this study as the findings will inform the setting up policies that ensure that manufacturing firms comply with quality practices to provide quality services and improve their financial performances.

In academia, this study was resourceful in providing more information on the various quality management practices adopted by firms. The study will also serve as a point of reference to researchers interested in similar and other related topics.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter reviewied the theoretical review pertaining to supply chain analytics. The chapter also reviewied the empirical literature concerned with supply chain analytics and operational performance of cement firms in Kenya.

2.2 Theoretical Literature Review

Several theories offer insights into the rationale underlying SCA. This section discusses resource based view (RBV) and resource dependence theories.

2.2.1 Resource-Based View

The resource-based view (RBV) holds that resources vary across firms and differences in resource levels that persist over time enable firms to sustain competitive advantage (Penrose 1959, Wernerfelt 1984, Barney 1991). Under RBV, various technological and organizational practices can be considered for acquiring sustained competitive advantage. For instance, organizational knowledge, managerial skills, backend integration, technology, and manufacturing facilities are viewed as manufacturer resources (Dong, 2009). Also, diverse SCM-related activities and practices (supply management practices, environmental management practices) are considered important resources for improving operational performance (Narasimhan and Schoenherr 2012, Blome, *et al.*, 2013).

IT is often viewed as a firm resource in the RBV framework (Barney, 1991, Wade and Hulland, 2004) to create sustained competitive advantage (Barney, 1991). Recent studies have studied the role of other resources as complementarities in the effects of IT on firm performance (Powell and Dent-Micallef 1997, Tippins and Sohi 2003, Wade and Hulland 2004, Jeffers, *et al.*, 2008, Kohli and Grover, 2008). Specifically, IT becomes an effective

firm resource when it is complemented by other resources or practices (Powell and Dent-Micallef 1997, Tippins and Sohi 2003, Nevo and Wade, 2010). In this study firm resources (e.g., IT) are used to conceptualize SCA as a source of sustainable competitive advantage. To test the relationship between different SCA-related resources, and to predict their impact on supply chain planning satisfaction and operational performance.

2.2.2. Resource Dependence Theory

Resource dependence theory takes the view that a business relationship is a social exchange of critical resources with mutual dependency among the exchange partners. Thus, the survival and growth of firms largely depend on the ability to secure critical resources from the external environment (Casciaro & Piskorski, 2005). But according to Transaction cost analysis (TCA) every transaction has a cost. These costs are incurred for adaptation, performance evaluation and safeguarding, and are associated with uncertainty, opportunism, and transaction specific assets (TSAs) invested in the relationship (Williamson, 1996; Rindfleisch & Heide, 1997). Transaction specific assets refer to the assets specialized to service the particular needs of the exchange parties (Williamson, 1996). Firms invest in TSAs in order to create additional value from an exchange above what standard product and service offerings can do (Ghosh and John, 1999).

Resource dependence theory and transaction cost analysis depart from different points of view (sociology and new institutional economics, respectively), they have something in common. While resource dependence theory focuses on ex ante mutual dependence between exchange partners due to critical resources, transaction cost analysis assumes that two parties are initially independent but develop bilateral dependence ex post due to relationship specific assets invested over the course of the relationship (Heide, 1994 ; Casciaro & Piskorski,

2005). Despite these different views, however, both theories recognize the existence of interdependency between exchange partners and the importance of securing valued resources from environmental and behavioral uncertainty (Heide, 1994).

Combining the resource and transaction cost perspectives into a strategic point of view, Ghosh & John (1999) proposed a governance value analysis (GVA) framework that links resources, positioning strategy, TSAs and governance. They argue that a firm creates potential market value through a unique positioning and can claim those values through a competitive advantage based on firm-specific resources. In an effort to achieve competitive advantage in the market, firms align themselves with exchange partners (i.e., customers and suppliers) and create joint values, such as cost reduction and/or value addition, through investments in TSAs. In this study resource dependence theory was supplemented with concepts from systems theory. The concept comprise of an IT assets and an organizational resource (OR) in a relationship (Nevo and Wade 2011, P.405), postulates IT assets as a potential resource for competitive advantage.

2.3 Supply Chain Analytics

Among SCA, the ones considered in this paper are Data Management Resources (DMR), IT-based Supply Chain Planning Resources (IPR) and Performance Management Resources (PMR). These are discussed next.

2.3.1 Data Management Resources (DMR)

Data has long been recognized as a critical asset for organizations (Marchand, *et al.*, 2000). The information processing view asserts that "the greater the uncertainty of the task, the greater the amount of information that has to be processed between decision makers during

task execution in order to achieve a given level of performance" (Galbraith, 1974). Thus, data management becomes critical for firm performance and IT serves as the infrastructure for data capture, manipulation, and redistribution (Fairbank, *et al.*, 2006).

DMR represents the firm's IT resources for such activities as data acquisition, storage, and retrieval. For example, ERP is an IT resource and serves as an integrated, single-instance database for efficient data management providing integrated data for manufacturing planning and control (Su and Yang, 2010). Analytic techniques and methods can also be used to generate important manufacturing data or master data (lead time, batch size). Data management is an important dimension in the quality/process management literature (Flynn, *et al.*, 1994, Nair 2006, Kaynak and Hartley, 2008).

2.3.2 IT-based Supply Chain Planning Resources (IPR)

IPR represents the *IT resources* embedding various optimization and predictive analytics, such as mathematical programming, simulation, statistical analysis and machine learning algorithms. These analytic techniques and methods are invaluable means for supply chain planning activities, such as master production planning, material requirements planning, and capacity planning (Kreipl and Pinedo 2004, Stadtler 2005, Vollmann, *et al.*, 2005, Hendricks, *et al.*, 2007).

Supply chain planning software (e.g., Advanced Planning Scheduling) embeds these analytics and also has the capability of accessing large data stores (Dehning, *et al.*, 2007). DMR is important for IPR since the data become inputs for supply chain planning. In general, the more sophisticated those technologies are, the more such analytic methods and data access capabilities are embedded (Singh, 2003).

2.3.3 Performance Management Resources (PMR)

While IPR is primarily used for supply chain planning; our use of PMR refers to the firm's resources focusing on closing the gap between planning and execution, through monitoring and correcting manufacturing processes and performance. This is another key area where analytical methods (and technologies) can have positive impacts (Houghton, *et al.*, 2004, Yang, *et al.*, 2007, Turban, *et al.*, 2011). PMR enables analytical thinking and fact-based management. These resources are data-driven SCM practices (Kannan and Tan, 2005), often combined with performance metrics (Schroeder 2008), data visualization of quality problems (Zu, *et al.*, 2008), and analytical methods (Scheuermann, *et al.*, 1997).

PMR becomes an integral component for SCA, since these organizational resources help monitor supply chain execution, control performance variability, and improve the quality of planning and execution. These resources have been extensively surveyed in the literature (Rungtusanatham 2001, Shah and Ward 2003, Holweg 2007, Shah and Ward 2007, Schroeder 2008, Zu, *et al.*, 2008), but with no focus on their data oriented, analytical aspects.

2.4 Supply Chain Analytics and Operational Performance

Supply chain analytics are being increasingly used in SCM. Improving SC performance has become a continuous process that requires an analytical performance measurement system (Dionne & Kempf, 2011). Moreover, the use of SCA aids a knowledge enterprise by promoting efficiency within an organization, particularly by using analytical methods to provide valuable decision-making knowledge to minimize operating costs and accurately forecast market trends (Forslund & Jonsson, 2007). Companies with more mature SC practices, i.e. improved BA capabilities, are thus reducing their costs faster and achieving higher profit margins than their less mature peers (Kreipl & Pinedo, 2004). Moreover, higher

levels of SCM practice such as a higher level and quality of information sharing can lead to an enhanced competitive advantage and improved performance (Benton & Maloni, 2005).

Due to this complexity SCs often turns to software to streamline and standardize operations. The implementation of a decision support system can provide a distinct competitive advantage.

However, careful implementation is needed to fully realize the potential of such a system (Kreipl & Pinedo, 2004). The success of such IT investment is thus not self-assured; the main challenge is how to best utilize the data provided by the software. Many organizations that already have systems in place to collect data and gather information often land themselves in a situation where they do not have a suitable approach to put their vast data and information into use for strategic decision making (Dionne & Kempf, 2011). It is also critical that the organization constantly evaluate its models to ensure their predictive validity. Updating the models when necessary provides profound knowledge about the changes in the underlying conditions that affect the performance (Forslund & Jonsson, 2007.).

As shown, the potential positive impact of BA on SC performance is well established; however, the potential ways and moderating influences of this impact are not so well understood. Most previous research papers have used SCM as an umbrella term to analyze this impact. Yet it should not be forgotten that SCM is quite a broad term and encompasses the integration of organizational units and business processes along a SC to coordinate materials, information and financial flows in order to fulfill customer demands (Kreipl & Pinedo, 2004). SCM is therefore still largely eclectic with little consensus on its

conceptualization and can basically encompass every business activity in a company. In this sense, a more precise reference is needed to analyze the impact of BA.

Since SCOR has been widely employed for SC optimization in recent years, it was used as a framework for our study. SCOR has often been recognized as a systematic approach to identifying, evaluating and monitoring supply chain performance. In the SCOR model, a balanced performance measurement system at multiple levels, covering four core SC processes (Plan, Source, Make, Deliver, and later Return was also added), was developed (Dionne & Kempf, 2011). SCOR is supposed to be the most promising model for SC strategic decision-making (Benton & Maloni, 2005). It provides a common SC framework, standard terminology and metrics that can be used for evaluating, positioning and implementing SC processes (Forslund & Jonsson, 2007.). The choice of SCOR also reflects the fact that SC analytics include planning, sourcing, making and delivery (Kreipl & Pinedo, 2004) which corresponds to the SCOR areas.

Ketchen, et al., (2008) conducted a research on best supply chain analytics practices and operational performance they found that the best supply chains analytics leverage strategic value chain management, agility, adaptability, and alignment not simply to create low costs, but also to maximize the total value added to the customer. They further suggested that firms should ensure consistency in performance across supply chain management aspects such as strategic sourcing, logistics management, supply chain information system and relational management. The shortcoming of the study was that the researcher's main focus was on supply chain analytics and so their approach was lacking as it focused only on the need to maximize speed.

Sahay and Ranjan, (2008) researched on real time business intelligence in supply chain analytics found out that enhancing effectiveness and efficiency of supply chain analytics using a business intelligence approach is a critical component in a company's ability to achieve its competitive advantage. The paper focused on the necessity to revisit the traditional BI concept that integrates and consolidates information in an organization in order to support firms that are service oriented and seeking customer loyalty and retention. The shortcoming of the study was that the researcher used business intelligence approach which is a critical component in a company's ability to achieve competitive advantage.

Trkman and McCormack, (2010) conducted a study on the impact of business analytics on supply chain performance. The paper investigated the relationship between analytical capabilities in the plan, source, make and deliver area of the supply chain and its performance using information system support and business process orientation as moderators. Structural equation modeling employed a sample of 310 companies from different industries from the USA, Europe, Canada, Brazil and China. Found out that the existence of a statistically significant relationship between analytical capabilities and performance. The shortcoming of the study was that the moderation effect on information systems support was considerably stronger than the effect on business process orientation.

Maring'u, (2015), conducted a study on supply chain management practices and operational performance of mega agribusiness firms in Nairobi City County. Found that adoption of strategic supply chain management systems enhances agribusiness organizations performance. Specific objective was to establish the effect of supply chain management practices on performance in agribusiness organizations in Nairobi County and to establish the challenges of supply chain management practices faced by agribusiness organizations. The researcher used a census survey

research design. The shortcoming of the study was although considerable research into agro food and agro industrial supply chains in Africa is now available; there exists a literature gap on Kenyan agribusiness supply chain performance particularly Nairobi County.

Mahulo, (2015), conducted a study on supply chain management practices and performance of cement companies in Kenya. Found that supply chain management practices had influence on the organizational performance. The study adopted a cross-sectional design and was guided by the following objective: to establish the relationship between supply chain management practices and performance of cement companies in Kenya. Both primary and secondary data was utilized in the study. The primary data was collected using semi structural questionnaire while secondary data was obtained from the annual financial reports of the respective companies. The shortcoming of the study was that, a study of this magnitude should have included a survey of a sizeable number of firms.

Osoro, (2015) researched on factors affecting performance of supply chain systems in the petroleum industries in Kenya. The Paper highlighted the challenge affecting performance of supply chain systems. The findings of the paper confirm that oil companies need to implement supply chain systems as a continuous process to achieve sustainability in the supply chain processes. The methodology used was analytical data after collection from the sample size targeted by the researcher in which in depth literature review is done to highlight how companies can incorporate performance of supply chain tools in their supply chain systems. The shortcoming of the study was that the researcher focused on financial performance measures at the expense of forecasting accuracy

2.5 Challenges In The Implementation of SCA

Challenges that are encountered in the implementation of SCA include issues arising from managing large amounts of data (e.g. data availability and data quality) and dealing with environmental uncertainties (Handfield and Nichols, 2004; Liberatore and Luo, 2010; Huner, et al., 2011; Lavalle, et al., 2011; Manyika, et al., 2011). First, IT-based innovations have generated and captured 'more data while also changing the nature of businesses' (Kohli and Grover, 2008). For instance, a leading consumer goods firm (Li & Fung) reported the flow of over 100 gigabytes of data through the firm's supply chain network on a given day in 2009 (Economist, 2010). The opportunity to gain competitive advantage may thus arise from how firms manage data (Vosburg and Kumar, 2001; Forslund and Jonsson, 2007; Oliva and Watson, 2011).

Another major challenge for businesses is the increasing uncertainty in both demand (e.g. consumer market) and supply sides of their businesses. Dealing with demand and supply uncertainty by means of proper supply chain planning has been a major theme in many recent SCM studies (Oliva and Watson, 2011; Demirkan and Delen, 2012).

In response to those challenges, SCA has been proposed as a promising approach to better manage data, utilize IT resources and prepare for effective supply chain planning (Handfield, 2006; Davenport, Harris, and Morison, 2010; Davis-Sramek, Germain, and Iyer, 2010; Viswanathan and Sadlovska, 2010). This new generation of analytic tools can develop a firm's IT and data management capabilities to enhance planning and improve operational performance (Kohli and Grover, 2008; Shapiro, 2010; Mithas, Ramasubbu, and Sambamurthy, 2011). It is suggested that firms can use SCA from data acquisition (e.g. RFID) and repository (e.g. ERP) technologies to improve supply chain planning through IT-

enabled planning and scheduling systems (Davenport and O'dwyer, 2011; O'dwyer and Renner, 2011).

2.6 Summary of the Literature Review and Knowledge gaps

The table below summarizes empirical literature review. It gives the author(s), the study, major findings, shortcomings and knowledge gaps.

Table 2.1: Summary of L.R and Knowledge Gaps

Scholar	Study	Major findings	Shortcomings and knowledge gaps	How the study will address knowledge gaps
Ketchen et al. (2008),	Best supply chain analytics and operational performance.	Best supply chains analytics leverage strategic value chain management, agility, adaptability, and alignment not simply to create low costs, but also to maximize the total value added to the customer.	The researcher's main focus was on supply chain analytics and so their approach was lacking as it focused only on the need to maximize speed.	The researcher should expand focus to across supply chain management aspects such as strategic sourcing, logistics management, supply chain information system and relational management.
Sahay and Ranjan, (2008)	Real time business intelligence in supply chain analytics	The effectiveness and efficiency of supply chain analytics using a business intelligence approach.	The researcher used business intelligence approach which is a critical component in a company's ability to achieve competitive advantage.	Researcher should focus on the necessity to revisit the traditional BI concept that integrates and consolidates information in an organization in order to support firms that are service oriented and seeking customer loyalty and retention
Trkman and McCormack, (2010),	Impact of business analytics on supply chain performance	Found out that the existence of a statistically significant relationship between analytical capabilities and performance.	The moderation effect on information systems support was considerably stronger than the effect on business process orientation.	Further research is needed to identify the factors that influence information processing needs.

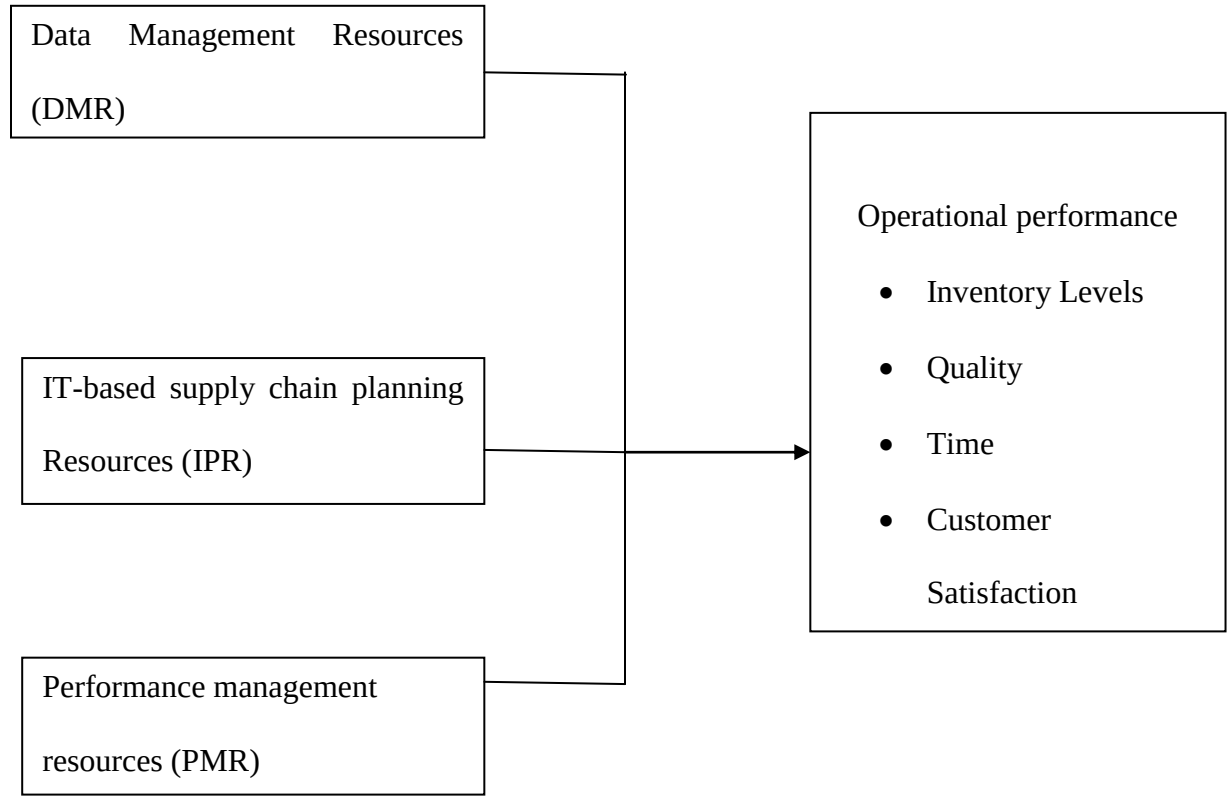
Maring'u, (2015)	Supply chain management practices and operational performance of mega agribusiness firms in Nairobi City County.	Adoption of the strategic supply chain management systems enhances agribusiness organizations performance	Although considerable research into agro food and agro industrial supply chains in Africa is now available; there exists a literature gap on Kenyan agribusiness supply chain performance particularly Nairobi County.	Use of effective, credible and trusted new information and supply systems with key constituencies for better results
Mahulo, (2015)	Supply chain management practices and performance of cement firms in Kenya	Found that supply chain management practices had influence on the organizational performance	A study of this magnitude should have included a survey of a sizeable number of firms.	To extend the research not only on cement industry but across the other sectors to increase investment in current supply chain management and improvement to build their core competencies
Osoro, (2015)	Factors affecting performance of supply chain systems in the petroleum industries in Kenya.	Oil companies need to implement supply chain systems as a continuous process to achieve sustainability in the supply chain processes.	The researcher focused on financial performance measures on the expenses of forecasting accuracy.	The researcher should embrace the use of current trends such as timeliness forecasting, proactive stock level management, IT, just In Time delivery and e-procurement.

2.7 Conceptual Framework

The conceptual framework illustrates the dependent and independent variables. The dependent variable in this study is operational performance. The independent variable includes IT- based supply chain planning resources, Data management resources and performance management resources.

Supply Chain Analytics

Figure 2.1: Conceptual Model



Independent variable **Dependent variable**

Source: Researcher (2016)

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the research methodology that was used in conducting the study. This are the research design, target population, sampling design and sample size, data collection procedures and instrument, determination of reliability and validity as well as data analysis techniques.

3.2 Research Design

A descriptive research was used in this study. According to Donald and Pamela (2006), a descriptive study deals with the what, how and who of a phenomenon which is the concern for this study. The study specifically tried to ascertain the SCA on operational performance of cement manufacturing industries in Kenya. The study sought to find out the challenges faced in the implementation of SCA. Thus descriptive research design is appropriate.

3.3 The Population

The population of this study was cement manufacturing companies in Kenya, which are seven in number. These are Bamburi Cement, East Africa Portland Cement, Savanna Cement, ARM Africa Cement, Mombasa Cement, Lafarge Group, National Cement (appendix iii). Since the population of the study is small, a census was carried out.

3.4 Data Collection

This study utilized primary data that was collected by the use of a questionnaire. The researcher targeted Supply chain manager, Operations manager and Information Technology manager or their equivalent. The questionnaire is divided into four sections; Section A captured respondents' bio data, Section B supply chain analytics used by cement manufacturing firms in Kenya, Section C the relationship between supply chain analytics and

operational performance and Section D challenges in the implementation of supply chain analytics. The questionnaire was administered through email and/or by "drop and pick later method". Respondents were required to rate their responses using a 1 – 5 point Lickert scale designed questionnaire.

3.5 Data Analysis

The data generated by the study after fieldwork was edited, coded then entered into a computer for processing using the Statistical Package for Social Sciences (SPSS v.17.0). In section A descriptive statistics was used to analyse information generated from respondents. Section B was analysed using descriptive statistics, section C correlation and regression analysis and section D used descriptive statistics.

The regression model is;

$$\mathbf{Y = \beta 0 + \beta 1 X1 + \beta 2 X2 + \beta 3 X3 + \varepsilon}$$

Whereby: **Y** = operational Performance (OP);

X1 = DMR (SCA); **X2 =** ISP; **X3 =** PMR

B0, β1, β2, β3 =Regression model coefficients.

ε = Error Term.

Table 3.2 Summary Data Collection and Data Analysis

OBJECTIVE	**Data Collection**	**Data Analysis**
General information	Section A of the questionnaire	• Descriptive statistics
supply chain analytics used by cement manufacturing firms	Section B	• Descriptive statistics
supply chain analytics and operational performance	Section C	• Correlation and regression analysis

Source: Researcher (2016)

CHAPTER FOUR: DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This chapter is a presentation of results and findings obtained from field responses and data broken into two parts. The first section deals with the background information, while the other section presents findings of the analysis, based on the objectives of the study as explored by the questionnaires where both descriptive and inferential statistics have been employed.

4.2 Response Rate

From the data collected, out of the 21 questionnaires administered, 20 questionnaires were fully completed and returned making a response percent of 95.24%. Mugenda and Mugenda (2003) argues that for generalization a response rate of 50% is adequate for analysis and reporting, 60% is good and a response rate of 70% and over is excellent, thus 95.24% was excellent for an analysis. The high response rate can be attributed to the data collection procedures, where the researcher pre-notified the potential participants and applied the drop and pick method where the questionnaires were picked at a later date to allow the respondents ample time to fill the questionnaires.

Table 4.3: Response Rate

Response	Frequency	Percentage
Filled-in Questionnaires	20	95.24
Unreturned Questionnaires	1	4.76

Source: Research data (2016)

4.3 Reliability Analysis

Reliability of the questionnaire was evaluated through Cronbach's Alpha which measures the internal consistency. Cronbach's alpha was calculated by application of SPSS version 20 for reliability analysis. The value of the alpha coefficient ranges from 0-1 and may be used to describe the reliability of factors extracted at 0.5 significance level from dichotomous and or multi-point formatted questionnaires or scales. A higher value shows a more reliable generated scale. Cooper & Schindler (2008) have indicated 0.7 to be an acceptable reliability coefficient. Table 4.2 shows that IT- based supply chain planning had the highest reliability (α=0.814) followed by Data Management resources (α=0.803) and performance management resources (α=0.754). This illustrates that all the three scales were reliable as their reliability values exceeded the prescribed threshold of 0.7 (Mugenda & Mugenda, 2008).

Table 4.4: Reliability Coefficients

Scale	Cronbach's Alpha	Number of items
performance Management resources	0.754	7
IT- based supply chain planning	0.814	4
Data Management resources	0.803	5

Source:Research data (2016)

4.4 Demographic Characterization of the Respondents

The study sought to find out the demographic information of the respondents which included gender, age, years of experience and level of education. This was important since it forms foundation under which the study can fairly adopt in coming up with conclusions. The analysis relied on this information of the respondents so as to categorize the different results according to their acquaintance and responses.

4.4.1 Gender of the Respondents

Further the study sought to determine the gender distribution of the respondents in order to establish if there is gender balance in the positions indicated. The findings were as indicate in table 4.5.

Table 4.5: Gender of the Respondents

Gender	Percentage
Male	56%
Female	44%
Total	100%

Source: Research data (2016)

According to the findings, majority (56%) of the respondents were male while the rest (44%) were female. This implies that there is gender imbalance in occupation most of the positions are occupied by the male.

4.4.2 Age Bracket of the Respondent

The study further established respondent's age distribution categorized in a certain range. This was to determine how age relates to procurement practices based on experience. The findings were as indicated in table 4.6.

Table 4.6: Age Bracket of the Respondents

Age Bracket	Percentage
21- 30 years	0%
31- 40 years	10%
41- 50 years	60%
51- 60 years	25%
60 years and above	5%
Total	100

Source: Research data (2016)

The respondents were required to indicate their age where the study findings indicated that majority (60.0%) indicated that their age bracket was between 41 and 50 years. Analysis of findings also indicated that 25% of the respondents were between 51 and 60 years of age. The findings further indicated that 10% were 31-40 years. While the remaining 5% indicated that they were 60 years and above. This implies that most of the employees are energetic such that they can adjust to the strategies adopted within the organization and also that they are experienced enough to give appropriate answers concerning the study.

4.4.3 Duration as a manager in the Organization

The study found it necessary to find out the number of years in which the respondents had worked as a manager in the organization. This was to determine if their responses could be relied upon to make study conclusions about the variables under concern due to their longevity in the organization. The findings were as indicated in table 4.7.

Table 4.7: Duration in the Organization

Duration in the organization	Percentage
Less than 1 year	5%
1-3 year	20%
4-6 year	35%
7-10 year	15%
Over 10 years	25%
Total	100%

Source: Research data (2016)

From the findings, most (35%) were in the organization for 4-6 years, 25% for over 10 years, 20% for between 1-3 years, 15% for between 7-10 year while the rest (5%) had worked in the organization for less than a year. This implies that majority of respondents have been in the organization for a good duration and could therefore be familiar with the supply chain of the organization. Also this implies that these are experienced employees who could have given the relevant information to the study area.

4.2.4 Highest Level of Education

This section sought to determine the respondents' level of education. The researcher also requested the respondents to indicate their highest level of the academic qualification. This was to ascertain if they were well equipped with the necessary knowledge and skills in their respective areas of specialization. Table 4.8 shows the findings of the results.

Table 4.8: Level of Education

Level of Education	Percentage
Master's Degree	65%
Bachelor's Degree	30%
Diploma	5%
Secondary Education	0%
Total	**100%**

Source: Research data (2016)

From the table 4.8, majority (65%) of the respondents had master's degree, 30% had bachelor's degree while the remaining 5% had a Diploma as their highest level of education. The findings therefore indicate that the respondents have the capacity, skills and management acumen to conduct procurement activities successfully in their organizations.

4.5 Supply Chain Analytics Used By Cement Manufacturing Firms in Kenya

The researcher sought to investigate supply chain analytics used by cement manufacturing firms in Kenya. To achieve this, the respondents were required to indicate to what extent the supply chain analytics are used by the cement firms in Kenya. The summary of the findings is as presented in Table 4.9.

Table 4.9: Extent to which SCA techniques are implemented

Extent to which DA techniques are implemented	Mean	S.D
Data Management Resources	4.02	0.415
IT- Based supply chain planning Resources	4.37	0.602
Performance Management Resources	4.09	0.341

Source: Research data (2016)

The researcher sought to determine the extent to which supply chain analytics techniques are implemented. The respondents were required to fill their own responses in a five point likert scale. 5. Very great extent 4. Great extent 3. Moderate extent 2. Little extent 1. Not at all. From the findings shown in table 4.4 the respondents agreed to a great extent that the supply chain analytics techniques are greatly implemented as indicated by a mean of 4.02 under implementation of Data Management resources, 4.37 under IT- Based supply chain planning Resources and lastly 4.09 under performance management resources.

This finding is consistent with those of Davenport and O'dwyer, (2011) state that a number of companies globally like Proctor & Gamble and Wal-Mart are reported to have successfully implemented SCA, this have significantly enhanced operational efficiency through use of data analytical information technology tools for supply chain decisions and cost savings. Supply chain analytics is not a new concept (Davenport and O'dwyer, 2011); this is because various quantitative techniques and modeling methods have long been used in manufacturing firms (Shapiro 2000; Kusiak 2006; Trkman et al. 2010).

4.6 Relationship Between Supply Chain Analytics and Operational Performance

The researcher sought to investigate the influence of the implementations of supply chain analytics and its effect on operational performance of cement manufacturing firms in Kenya. To achieve this, the respondents were required to indicate to what extent the supply chain analytics affect the organizational performance. The summary of the findings is as presented in Table 4.10.

Table 4.10: Extent to which SCA techniques implementation affects Operational performance

Implementation of Data Management Resources	Mean	SD
Analytic techniques can be used to generate important manufacturing data or master data	4.45	0.375
The greater the uncertainty of the task, the greater the amount of information that has to be processed between decision makers	3.92	0.811
Data management greatly affects firm operational performance	4.11	0.501
Implementation of IT- Based supply chain Planning Resources has	**Mean**	**SD**
Analytic techniques are invaluable means for supply chain planning activities	4.21	0.347
Master production planning, material requirements planning, and capacity planning are important to supply chain analytics.	4.42	0.155
Supply chain planning software have the capability of accessing large data stores thus optimizing performance	4.05	0.137
Implementation of Performance Management Resources	**Mean**	**SD**
Performance management resources are important on closing the gap between planning and execution	4.32	0.136
Performance management Resources enables critical thinking and fact based management.	4.26	0.483
PMR is an integral component for SCA, since it helps monitor Supply chain execution, control performance variability, and improve the quality of planning and execution.	4.43	0.673

Source: Research data (2016)

The researcher sort to determine the extent to which supply chain analytics techniques implementation affect operational performance of the manufacturing companies. The

respondents were required to fill their own responses in a five point likert scale. 5. Very great extent 4. Great extent 3. Moderate extent 2. Little extent 1. Not at all.

Regarding the implementation of Data management resources, from the findings shown in table 4.10 the respondents agreed to a great extent that Analytic techniques can be used to generate important manufacturing data or master data as indicated by a mean of 4.45. The study also indicated that the respondents agreed to a great extent that the greater the uncertainty of the task, the greater the amount of information that has to be processed between decision makers as indicated by a mean of 3.92 and lastly that Data management greatly affects firm operational performance as indicated by a mean of 4.11.

In regards to the Implementation of the IT-Based supply chain planning resources the respondents agreed to a great extent that Analytic techniques are invaluable means for supply chain planning activities as indicated by a mean of 4.21. They also agreed to a great extent that Master production planning, material requirements planning, and capacity planning are important to supply chain analytics as indicated by a mean of 4.42. Lastly that Supply chain planning software have the capability of accessing large data stores thus optimizing performance as indicated by a mean of 4.05.

Lastly in regards to the implementation of performance management resources, the respondents agreed to a great extent that Performance management resources are important on closing the gap between planning and execution as indicated by a mean of 4.32, also they agreed that Performance management Resources enables critical thinking and fact based management as indicated by a mean of 4.26. Lastly they agreed that PMR is an integral

component for SCA, since it helps monitor Supply chain execution, control performance variability, and improve the quality of planning and execution as indicated by a mean of 4.43.

Supply chain analytics are being increasingly used in SCM. Improving SC performance has become a continuous process that requires an analytical performance measurement system (Dionne & Kempf, 2011). Moreover, the use of SCA aids a knowledge enterprise by promoting efficiency within an organization, particularly by using analytical methods to provide valuable decision-making knowledge to minimize operating costs and accurately forecast market trends (Forslund & Jonsson, 2007).

4.7 Regression Analysis

In addition, the researcher conducted a multiple regression analysis so as to attain relationship between PMR, IPR and DMR on the organization performance. The researcher applied the statistical package for social sciences (SPSS V 20) to code, enter and compute the measurements of the multiple regressions for the study. Coefficient of determination explains the extent to which changes in the dependent variable can be explained by the change in the independent variables or the percentage of variation in the dependent variable (operational performance) that is explained by all the three independent variables (Data Management Resources (DMR), IT-based supply chain planning (IPR) and Performance management resources (PMR).

4.7.1 Correlation Analysis

Pearson correlation was used to measure the degree of association between variables under consideration i.e. independent variables and the dependent variables. Pearson correlation coefficients range from -1 to +1. Negative values indicates negative correlation and positive values indicates positive correlation where Pearson coefficient <0.3 indicates weak

correlation, Pearson coefficient >0.3<0.5 indicates moderate correlation and Pearson coefficient>0.5 indicates strong correlation.

Table 4.11: Correlation Coefficients

	Data Management Resources	**IT-based supply chain planning**	**Performance management resources**	**operational performance**
Data Management Resources	1			
IT-based supply chain planning	0.631	1		
Performance management resources	0.551	0.451	1	
Operational performance	0.524	0.614	0.511	1

Source: Research data (2016)

*. Correlation is significant at the 0.05 level (1-tailed).

The analysis above shows that IT-Based supply chain planning resources has the strongest positive (Pearson correlation coefficient =.614; P value 0.000) influence on operational performance. In addition, Data management resources and performance management resources are positively correlated to organization performance (Pearson correlation coefficient =.524 and .511). The correlation matrix implies that the independent variables are

very crucial determinants of operational performance as shown by their strong and positive relationship with the dependent variable; operational performance. This finding contradicts with those of Dehning, (2007). DMR is important for IPR since the data become inputs for supply chain planning. In general, the more sophisticated those technologies are, the more such analytic methods and data access capabilities are embedded (Singh, 2003).

4.7.2 Model Summary

Regression model is used here to describe how the mean of the dependent variable changes with changing conditions. Regression Analysis was carried out for focus on Data Management Resources, IT-based supply chain planning, Performance management resources and operational performance. To test for the relationship that the independent variables have on organization performance, the study did the multiple regression analysis.

The study ran the procedure of obtaining the coefficients, and the results were as shown on the table below.

Table 4.12: Coefficient Results

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.147	1.2235		1.615	0.367
	Data Management Resources	0.487	0.1032	0.152	4.223	. 0269
	IT-based supply chain planning	0.752	0.3425	0.054	3.724	. 0192
	Performance management resources	0.545	0.2178	0.116	3.936	.0251

Source: Research data (2016)

Multiple regression analysis was conducted as to determine the relationship between organization performance and the four variables. As per the SPSS generated table above, the equation ($\mathbf{Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon}$) becomes:

$Y= 1.147+ 0.487\ X_1+ 0.752X_2+ 0.545X_3$

According to the regression equation established, taking all factors into account (performance measurement, E-procurement, procurement planning and contract management) constant at zero, customer satisfaction was 1.147. The data findings analyzed also shows that taking all other independent variables at zero, a unit increase in Data Management Resources will lead to a 0.487 increase in operational performance; a unit increase in IT-based supply chain

planning will lead to a 0.752 increase in operational performance, a unit increase in Performance management resources will lead to a 0.545 increase in operational performance. This infers that performance measurement contribute most to the organization performance followed by procurement planning. At 5% level of significance and 95% level of confidence, IT- Based supply chain planning had a 0.0192 level of significance; data management resources showed a 0.0269 level of significance and performance management resources a 0.0251 level of significance hence the most significant factor is performance measurement.

This finding is consistent with those of Shah and Ward, (2007) PMR becomes an integral component for SCA, since these organizational resources help monitor supply chain execution, control performance variability, and improve the quality of planning and execution. These resources have been extensively surveyed in the literature (Rungtusanatham 2001, Shah and Ward 2003, Holweg 2007, Shah and Ward 2007, Schroeder 2008, Zu, *et al.*, 2008), but with no focus on their data oriented, analytical aspects.

Table 4.13: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.937	0.878	0.789	0.5273

Source: research data (2016)

The three independent variables that were studied explain 87.8% of the operational performance as represented by the R^2. This therefore means that other factors not studied in this research contribute 12.2% of the operational performance. This implies that these variables are very significant therefore need to be considered in any effort to boost operational

performance in the manufacturing industries in Kenya. The study therefore identifies variables as critical determinants of operational performance.

Table 4.14: ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	2.761	3	1.267	8.701	.0153[a]
	Residual	6.543	16	2.327		
	Total	9.304	19			

Source: Research data (2016)

NB: F-critical Value 88.33 (statistically significant if the F-value is less than 88.33: from table of F-values).

a. **Predictors: (Constant),** Data Management Resources, IT-based supply chain planning and Performance management resources.

The significance value is 0.0153 which is less than 0.05, thus the model is statistically significance in predicting how Data Management Resources, IT-based supply chain planning and Performance management resources influence the operational performance in the manufacturing firms. The F critical at 5% level of significance is 8.701. Since F calculated is greater than the F critical (value = 3.23), this shows that the overall model was significant.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The study sought to determine the supply chain analytics used by cement manufacturing companies in Kenya and their effects on the operational performance of the firms. This chapter presents; the summary of the findings conclusions and recommendations of the study.

5.2 Summary of the Findings

The objective of the study was to establish the relationship between supply chain analytics and the operational performance of cement companies in Kenya. The outcome of the study revealed that majority (56%) of the respondents was male while the rest (44%) were female. This implies that though there is gender distribution in occupation most of the positions are occupied by the male. The study also revealed that majority of the respondents was between the age of 41 and 50 years and had stayed in the companies for duration of between 4-6 years. Also the findings revealed that the highest level of education attained by the respondents was master's degree which was attained by most of the respondents.

In the supply chain analytics used by the cement manufacturing firms in Kenya, the study revealed that supply chain analytics techniques are greatly implemented as indicated by a mean of 4.02 under implementation of Data Management resources, 4.37 under IT- Based supply chain planning Resources and lastly 4.09 under performance management resources. Many companies globally like Proctor & Gamble and Wal-Mart are reported to have successfully implemented SCA, this have significantly enhanced operational efficiency through use of data analytical information technology tools for supply chain decisions and

cost savings. Supply chain analytics is not a new concept this is because various quantitative techniques and modeling methods have long been used in manufacturing firms.

In regards to the relationship between supply chain analytics and operational performance the study revealed that Analytic techniques can be used to generate important manufacturing data or master data as indicated by a mean of 4.45. The study also indicated that the greater the uncertainty of the task, the greater the amount of information that has to be processed between decision makers as indicated by a mean of 3.92 and lastly that Data management greatly affects firm operational performance as indicated by a mean of 4.11.

In regards to the Implementation of the IT-Based supply chain planning resources the study revealed that Analytic techniques are invaluable means for supply chain planning activities as indicated by a mean of 4.21 that Master production planning, material requirements planning, and capacity planning are important to supply chain analytics as indicated by a mean of 4.42. Lastly that Supply chain planning software has the capability of accessing large data stores thus optimizing performance as indicated by a mean of 4.05.

In regards to the implementation of performance management resources, the study revealed that Performance management resources are important on closing the gap between planning and execution as indicated by a mean of 4.32, also that Performance management Resources enables critical thinking and fact based management as indicated by a mean of 4.26. Lastly the study revealed that PMR is an integral component for SCA, since it helps monitor Supply chain execution, control performance variability, and improve the quality of planning and execution as indicated by a mean of 4.43.

Supply chain analytics are being increasingly used in SCM. Improving SC performance has become a continuous process that requires an analytical performance measurement system. Moreover, the use of SCA aids a knowledge enterprise by promoting efficiency within an organization, particularly by using analytical methods to provide valuable decision-making knowledge to minimize operating costs and accurately forecast market trends.

5.3 Conclusions

The study concluded that there is gender distribution in occupation but most of the positions in the cement manufacturing companies are occupied by the male. The study also concluded that supply chain analytics techniques are greatly implemented be it Data Management resources, IT- Based supply chain planning Resources and performance management resources.

In regards to the relationship between supply chain analytics and operational performance the study concluded that Analytic techniques can be used to generate important manufacturing data or master data, that the greater the uncertainty of the task, the greater the amount of information that has to be processed between decision makers and lastly the study concluded that Data management greatly affects firm operational performance.

In regards to the Implementation of the IT-Based supply chain planning resources the study concluded that Analytic techniques are invaluable means for supply chain planning activities, that Master production planning, material requirements planning, and capacity planning are important to supply chain analytics. Lastly that Supply chain planning software has the capability of accessing large data stores thus optimizing performance.

In regards to the implementation of performance management resources, the study concluded that Performance management resources are important on closing the gap between planning and execution that Performance management Resources enables critical thinking and fact based management. Lastly the study concluded that PMR is an integral component for SCA, since it helps monitor Supply chain execution, control performance variability, and improve the quality of planning and execution.

5.4 Recommendations

The study found that up to 16.7% percent of the cement firms in Kenya are yet to establish a supply chain analytics framework underscoring the need for the management of these cement companies to consider establishing a supply chain management framework to enhance their competitiveness.

The study also recommends that Analytic techniques should be used to generate important manufacturing data or master data and that the companies should reduce the uncertainty of the task so as to reduce the amount of information that has to be processed between decision makers.

In regards to the Implementation of the IT-Based supply chain planning resources the study recommends the cement manufacturing firms should focus on Analytic techniques because they are invaluable means for supply chain planning activities, and that Master production planning, material requirements planning, and capacity planning are important to supply chain analytics.

Lastly the study recommends that the companies should implement Performance management resources as they are important on closing the gap between planning and execution enables critical thinking and fact based management. The study also recommended

that PMR should be an integral component for SCA, since it helps monitor Supply chain execution, control performance variability, and improve the quality of planning and execution.

The findings of this study further underpins the need for firms in Kenya to foster collaborative private and public research designing the scope and functionality of a supply chain analytics framework specifically tailored to the Kenyan macro environment to enhance supply chain and overall operational performance in firms.

5.5 Limitations of the Study And Areas for Further Research

This research aimed at drawing information from 21 respondents. However only 20 respondents participated and therefore led to the conclusion that the results may have been different if there was 100% participation. Time was also a major constraint considering that most respondents were either busy or out of office and repeated reminders had to be made to them. Most of the respondent could not spare time for face to face interviews due to their nature of work and their busy schedules it therefore required pick and drop later method and emailing of questionnaires this explaining the difference in number of respondents.

Studies involving confirmatory factor analysis will need to be carried out to further test the model so established and to confirm the findings of the study. Further studies can be conducted to test and confirm the factor loadings in different industrial firms so as to establish the validity and strength of the model. In the same context, there is need for further research to focus on the critical success factors in the adoption of best practice supply chain analytics models.

The need for further research into this aspect of supply chain Analytics is further compounded by the facts that supply chain analytics is a relatively new phenomenon in Kenya.

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APPENDICES

Appendix I: Introduction Letter

June, 2016

P.O Box,

Nairobi.

RESEARCH PROPOSAL

Hello my name is Rachael, I am an MBA student from Nairobi University. I am carrying out research on the '**Supply chain Analytics and Operational Performance of Cement Manufacturing Firms in Kenya'**. This will take approximately 15-25 minutes of your time. Your answers will not be shared with anyone outside this project. I kindly seek your authority to conduct the research at your financial institution through research interviews and use of relevant documents. I have enclosed an introductory letter from the University. Your assistance is highly valued. Thank you in advance.

Yours faithfully,

Rachael M. Nyauncho

Researcher

Appendix II: Questionnaire

The purpose of this study is to investigate the influence of supply chain analytics on operational performance on manufacturing firms in Kenya.

INTRUCTIONS

i) Please respond to all the items

ii) Please tick (√) the most appropriate response.

SECTION A: GENERAL INFORMATION

1. What is your gender? Male { } female { }

2. What is your age? 21- 30 years { } 31-40 years { } 41-50 years { } 51-60 years { }

3. How many years have you been a manager in your current station?

Less than 1 { } , 1-3 { }, 4-6 { } , 7 – 10 { } over 10 { }

4. What is your highest academic qualification?

i) Secondary education [ ]
ii) Diploma [ ]
iii) Bachelor's degree [ ]
iv) Master's degree [ ]
v) any other , specify _____

SECTION B: SUPPLY CHAIN ANALYTICS USED BY CEMENT MANUFUCTURING FIRMS IN KENYA

6. To what extent are the following Data Analysis (DA) techniques implemented in your firm?

5. Very great extent 4. Great extent 3. Moderate extent 2. Little extent 1. Not at all

Extent to which DA techniques are implemented	**1**	**2**	**3**	**4**	**5**
Data Management Resources					
IT- Based supply chain planning Resources					
Performance Management Resources					

SECTION C: ESTABLISH THE RELATIONSHIP BETWEEN SUPPLY CHAIN ANALYTICS AND OPERATIONAL PERFORMANCE

7. To what extent does the implementation of supply chain analytics affect operational performance at your firm?

5. Very great extent 4. Great extent 3. Moderate extent 2. Little extent 1. Not at all

Implementation of Data Management Resources has	**1**	**2**	**3**	**4**	**5**
Analytic techniques can be used to generate important manufacturing data or master data					
The greater the uncertainty of the task, the greater the amount of information that has to be processed between decision makers					
Data management greatly affects firm operational performance					
Implementation of IT- Based supply chain Planning Resources has	**1**	**2**	**3**	**4**	**5**
Analytic techniques are invaluable means for supply chain planning activities					
Master production planning, material requirements planning, and capacity planning are important to supply chain analytics.					
Supply chain planning software have the capability of accessing large data stores thus optimizing performance					

Implementation of Performance Management Resources	1	2	3	4	5
Performance management resources are important on closing the gap between planning and execution					
Performance management Resources enables critical thinking and fact based management.					
PMR is an integral component for SCA, since it helps monitor supply chain execution, control performance variability, and improve the quality of planning and execution.					

THANK YOU FOR YOUR PARTICIPATION IN THIS STUDY
END

Appendix III: List of Cement Manufacturing Firms in Kenya.

1. ARM Africa Ltd
2. Bamburi Cement
3. East Africa Portland Cement
4. Lafarge Group
5. Mombasa Cement
6. National Cement
7. Savanna Cement

Source: Researcher (2016)

Appendix IV: Work Plan

ACTIVITY TO BE UNDERTAKEN	February 2016	June 2016		July 2016	August 2016
Write and submit the draft proposal to the supervisor for reading and corrections		X	X		
Defence of the proposal before the panel					
Questionnaire pretested and the necessary corrections made to the research instrument					
Field work-collection of data					
Data analyzed and interpreted Presentation of the final report to the supervisor					
Final Defense					