DYNAMICS OF SUPPLY CHAIN MANAGEMENT IN THE KENYAN CONSTRUCTION INDUSTRY A CASE STUDY OF NATIONAL IRRIGATION BOARD

J. M. Kimondo[1], R.N. Mutuku[2] and M. Winja[3]
[1]Sustainable Materials and Technology Centre, Jomo Kenyatta University of Agriculture and Technology, Kenya,
[2]Department of Civil, Construction and Environmental Engineering, Jomo Kenyatta University of Agriculture and Technology, Kenya
[3]Jomo Kenyatta University of Agriculture and Technology, Kenya
Email: kimondojm@yahoo.com

Abstract
Construction project failures in Kenya are evident throughout the country and continue to draw great concern to all stakeholders as a result of consequent economic and social impacts. Supply chain management (SCM) practices have been used successfully in the manufacturing industry and have particularly been recognized as having made most manufacturing companies' successful. Achievements offered by SCM practices are therefore capable of reducing construction project failures . This study sought to establish the current global supply chain management practices and determine how supply chain management visibility is affecting project performance in the construction industry in Kenya. The research study adopts cross-sectional survey research design to establish the causal relationship among Supply Chain management practices and project performance. The population of the study was 199 construction firms. The study use stratified sampling to select a sample size of 65. On average, 1.54% of the respondents indicated that they implemented the SCM best practices frequently, 81.54% of respondents indicated that they implemented the SCM best practices sometimes while 16.92% of respondents indicated that they never implemented the SCM practices. The study established that there existed a positive relationship between physical flow integration, financial flow integration, information flow integration, trust and Project Performance in construction industry. The study concluded that SCM best practices have a positive contribution on construction project performance and that improved implementation of SCM best practices by Kenyan construction firms can lead to improved construction project performance and reduce construction project failures in the industry. The study recommends that construction firms should focus significantly on improving their degree of SCM best practices implementation to boost project success. This study provides the stakeholders with a point of reference in establishing a value-sequenced transformational roadmap for mitigating actions against construction project failures in Kenya.

Key words: Supply chain management practices, performance, construction firms, and irrigation board

1.0 Introduction

1.1: Background of the Study

There were many cases of construction project failures in Kenya with most construction projects failing to meet their cost projections, time schedules and quality demands (Gwaya et al 2014). This trend was undermining the Kenyan growth and development and achievement of the Kenyan vision 2030 was at risk. Previous studies had tried to address construction project failures in Kenya through improved project planning (Muchungu 2012), resource management (masu 2006) and variations control (Gichunge 2000) but construction project failures were still high. Effective implementation of SCM practices has been proved to improve performance in the manufacturing industry. SCM best practices improve the flow of materials in one direction, the flow of money in the other direction and the flow of information in both directions. The degree of SCM practices implementation determines the "dynamics" of Supply chain system (SCS).

In a dynamic SCM system the entire SCS is visualized and SCM best practices applied to maximize strengths and efficiency at every level of the Supply chain process (close 2014).This leads to cost reduction, quality and prompt delivery of products. These are the same benefits aspired for in the construction industry. Achievements offered by SCM practices are therefore capable of improving construction project performance and has the potential of reducing construction project failures in Kenya. But the extent to which SCM practices had been embraced in the Kenyan construction industry was not known or understood. Furthermore the contribution of SCM practices on project performance in Kenya have never been verified. This study assessed the degree of SCM practices implementation in Kenya and how these contributes to construction projects performance.

Despite numerous studies that show contribution and relevance of SCM best practices in manufacturing industry, little has been done to assess the degree of entrenchment or analyze the contribution of SCM best practices on Construction projects in Kenya. Studies carried out indicate that over 50% of construction projects in Kenya were failing by not meeting their cost projections, time schedules or quality demands. If the issue of construction project failures is not treated with the seriousness it deserves and its continuance halted, it will be difficult for Kenya to achieve any meaningful growth and development and achievement anticipated in vision 2030 may not be realized. Without assessing the degree of entrenchment or analyzing the contribution of SCM best practices on Construction projects performance in Kenya, it will be difficulty to implement solutions offered by previous SCM studies.

1.2: Main Objective

To determine the degree of SCM practices implementation in Kenya and establish how supply chain management visibility is affecting project performance in the construction industry.

1.2.1: Specific Objectives

(i). To determine the extent of Supply chain management practices implementation in National Irrigation Board construction projects

(ii). To determine the contribution of Supply chain management practices on National Irrigation Board construction projects.

1.2.2: Research Hypothesis

The following hypothesis was tested in the study.

H_1 – There existed no significant SCM practices implementation in National Irrigation Board construction projects

H_2 – There existed no significant contribution of supply chain management practices on National Irrigation Board construction projects

H_3 There exist no significant moderating effect of supply chain management system integration in the relationship between supply chain management practices and construction project performance

2.0 Literature Review

2.1: Supply Chain Management Practices

SCM practices are defined as a set of activities undertaken by an organization to promote effective management of its supply chain (Suhong Lia, 2004). Tan et al. (2002) identify six aspects of best SCM practice through factor analysis as supply chain integration, information sharing, supply chain characteristics, customer service management, and geographical proximity and just in time (JIT) capability. Alvarado and Kotzab (2001) include in their list of SCM practices concentration on core competencies, use of inter-organizational systems, and elimination of excess inventory levels by postponing customization toward the end of the supply chain. Chen and Paulraj (2004) use supplier base reduction, long-term relationship, communication, cross-functional teams and supplier involvement to measure SCM Maturity. Ragatz et al. (1997) points that various components of SCM practices have an impact on various aspects of competitive advantage (such as price/cost) stating that strategic supplier partnership can improve supplier performance and reduce time to market while maintaining a level of customer responsiveness and satisfaction.

SCM practices reviewed that not only played key roles in the global evolution of supply chain management but continue to be relevant are:

i. Effective Communication

Most researchers suggest Supplier product problems are due to poor communication. Ineffective communication is therefore a fundamental weakness in the interface between a buying firm and its supplier, which undermine the buying firm's efforts to achieve increased levels of supplier performance .In their ten case studies of buying firm's in the UK, Galt and Dale (1991) revealed the importance of two-way communication with suppliers and its potential positive effects on the buying firm's competitiveness. Effective inter-organizational communication could be characterized as frequent, genuine, and involving personal contacts between buying and selling personnel.

ii. Supply Network Coordination

Various forms of production-inventory-distribution coordination have been widely studied. Managers are coordinating with companies beyond their own, seeking new ways to lower costs or improve service in procurement, production and distribution through mechanisms such as vendor managed inventory and just-in-time scheduling (Thatte, 2007). Coordination is needed across enterprise boundaries interfacing with external suppliers, carrier partners and customers.

iii. Strategic Purchasing

Purchasing is increasingly assuming a strategic role in SCM. For example, more purchasing professionals are now trained in cross-functional areas and strategic elements of the competitive strategy where purchasing selects the right type of relationship with its suppliers, supplier relationships are strategically managed and purchasing performance is being measured in terms of contributions to the firm's performance (Chen and Paulaj, 2004).The conceptual re-description of purchasing as the integration of internal and external exchange functions is affiliated with many neo-classical tasks of industrial purchasing such as measuring internal customer's perception of purchasing service quality, making entrepreneurial ventures through innovation, risk-taking, proactiveness and establishing cooperative supplier relationships to match a firm's competitive stance. The ability of purchasing to influence strategic planning has increased due to the rapidly changing competitive environment (Coban, 2012) and has therefore been considered a key SCM practice in this study.

iv. Logistics Integration

The breadth of corporate objectives pursued through teamwork indicates that it is central to many attempts at wide-ranging organizational transformation. Organizations achieving transformation through increased customer focus anticipate quite dramatic increases in team-based efforts. Firms changing their value chain and supplier relations also anticipate major contributions through team efforts. Logistics provides industrial firm's with time and space utilities. A more recent interpretation calls for logistics to guarantee that the necessary

quantity of goods is in the right place and at the right time. The reduction of organizational slack, of which inventory is a typical example, needs close coordination of and an intensive information exchange between the supply chain partners (Vollman, Berry, and Whybark, 1997). This current trend in using strategic partnerships and cooperative agreements among firm's forces the logistics integration to extend outside the boundaries of the individual firm.

v. Internal Integration

Internal integration is the degree to which firms are able to integrate and collaborate across traditional functional boundaries to provide better service or products (Chen and Poulraj 2004). Managing logistical activity involves other functions within the firm, namely marketing, finance, purchasing and production. It is widely agreed that task interdependence is the catalyst for interdepartmental customer satisfaction which is dependent on the output of more than one worker or one functional area.

vi. External Integration

This concept is mentioned most often in the literature. External integration is the integration of logistics activities across firm boundaries. Managers are coordinating with companies beyond their own seeking new ways to lower costs or improve service through mechanisms such as vendor managed inventory and just-in-time (Thatte, 2007)

vii. Trust and Commitment with Partners

The long-term orientations support most recent findings, which discover that once transactor have made the upfront investment to develop self-enforcing safeguards such as relational trust, the transaction costs decline in the long term because self-enforcing safeguards can control opportunism over an indefinite time horizon, the relational trust has been proven to be an efficient governance mechanism that reduces transaction costs by minimizing search, contracting, monitoring and enforcement costs in the long term (Dyer, 1997)

viii. Good Interaction

Fueled by the strategic recognition and extended role of purchasing, buyer–supplier relationship or supply management has drawn unprecedented interest in SCM literature. Good interaction have a profound and direct contribution on cost, quality, time and responsiveness of the buying firm's that leads to the management of business and relationships with other members of the supply chain increasingly being referred to as SCM.

ix. Working with Certified Suppliers

Chen and Poulraj (2004) describe a certified supplier as a vendor who after extensive investigation of its manufacturing operations, production capabilities, personnel and technology, is certified to provide materials and components without routine testing of each receipt. Working with certified suppliers therefore reduce inspection and inventory costs for the buyer.

x. Few Supplier Policy

Many firm's are also reducing the number of primary suppliers and allocating a majority of the purchased material requirements to a single source (Shinm *et al*, 2000). There are multiple benefits provided by the process of supplier base reduction which includes fewer suppliers to contact in the case of orders given on short notice, reduced inventory management costs, volume consolidation and quantity discounts, increased economies of scale based on order volume and the learning curve effect , reduced lead times due to dedicated capacity and work-in-process inventory from the suppliers, reduced logistical costs , coordinated replenishment , improved buyer–supplier product design relationship , Improved trust due to communication , Improved performance and better customer service and market penetration.

xi. Supplier Involvement in Product Development

A considerable amount has been written documenting the importance of integrating suppliers in the new product development process (Chen and Pualraj, 2004). The involvement may range from giving minor design suggestions to being responsible for the complete development, design and engineering of a specific part of assembly .This practice can be attributed to the fact that suppliers accounted for approximately 30% of the quality problems and 80% of product lead-time problems. Chen and Pualraj, (2004) asserted that involving suppliers in research and development (R&D) efforts influence success in projects. Research has further concluded that the effective integration of suppliers into new product development can yield such benefits as reduced cost and improved quality of purchased materials, reduced product development time, and improved access to and application of technology (Chen and Pualraj (2004).

xii. Prudent Supplier Selection

Selecting suppliers for specific goods and services is a critical decision for most organizations since supply performance can have a direct financial and operational impact on the business. It has thus been argued that organizations are buying the supplier's capabilities (Croom, 1992) Ceteris paribus; the formal sourcing protocol relied heavily on the supplier's ability to meet cost targets. The abilities to meet quality standards and deliver products on time as well as performance history are the most critical determinants in choosing suppliers.

xiii. Long-term Relationships

Research has revealed that managing long-term relationships with customers using cross-functional teams is becoming a common practice in supply chains. Though longer planning horizon have become a crucial characteristic of modern supply chain relationship, long-term relationships does not refer to any specific period of time, but rather, to the intention that the arrangement is not going to be temporary. Through close relationships, supply chain partners are willing to share risks, reward and maintain the relationship over a longer period of time. Through a long-term relationship, the supplier will become part of a well-managed chain and will have a lasting effect on the competitiveness of the entire supply chain (Kotabe, M., Martin, X. and Domoto, H. (2003). Supplier contracts have increasingly become long-term, and more and more suppliers must provide customers with information about their processes, quality performance, and even cost structure .Closer and long-term relationships with suppliers are evident in several industries which cause increasing dependence on suppliers (Tuten and Urban, 2001).

2.2 Supply Chain System Integration and Project Performance

The supply chain system (SCS) is made up of the flow of materials in one direction, the flow of money in the other direction and the flow of information in both directions (Rai et al, 2006).The philosophy behind supply chain management is that by visualizing the entire SCS and applying SCM practices, those involved can maximize strengths and efficiencies at each level of the process to create a highly competitive, customer-driven SCM system that is able to respond immediately to changes in supply and demand (close, 2014). The concept of Supply Chain Management is based on the core idea that practically every product that reaches an end user represents the cumulative effort of multiple organizations connected through the flow of materials in one direction, the flow of money in the other direction and the flow of information in both directions. SCM practices create waves of influence in these organizations and these waves of influence are reflected in cost, quality and prompt delivery of construction projects. How these influences propagate through the SCM system determines the “dynamics” of the SCM system.

2.2.1 Information Flow

Information flow is the extent to which information is shared between a firm and its supply chain partners (Rai *et al.* 2006). According to Lee *et al.* (2007), information sharing within business units, across supply chain partners such as suppliers and other strategic alliances is essential to perform three major linkages: supplier linkage, internal linkage and customer linkage. In particular, this integration through effective and efficient information flow will eventually lead the firm and total supply chain to better performance (Palsson and Johansson, 2009). Past studies suggest positive relationships between the level of information flow integration and performance. Coyle *et al.* (1996) states that today’s business

competition has changed the characteristic of supply chain management, where information sharing becomes the most important characteristic to achieve supply chain success. A high level of information sharing within the supply chain management improves supply chain success and contributes to firm's project performance. Increasing the level of integration and information sharing among the members of a construction supply chain is therefore a necessary component for a successful project delivery.

2.2.2 Financial Flow

According to Rai *et al.* (2006), financial flow integration is defined as the extent to which exchange of financial resources between a firm and its supply chain partners is driven by workflow events. This includes all activities required to facilitate the flow of funds across the supply chain, including invoicing customers, paying suppliers and internal transfers (Johnson and Mena, 2008).This implies that effective flow of funds across the supply chain improves cash conversion cycle or cash-to-cash cycle through reduced days-in-inventory, shortened days-in-receivables and prolonged days-in-payables. Eventually, the financial flow optimization will make possible shareholders satisfaction and the supply chain working improvement. Effective and efficient management of financial flow integration is therefore essential to improve the supply chain performance.

2.2.3 Material Flow

Material flow also referred to as physical flow integration makes a significant contribution to the firms performance and finally to the total supply chain members. Jarnbring (1994) found in his study on material flows in Swedish construction that the value-added time of those flows is 0.3% to 0.6% of the total flow time. Various studies show a cost reduction potential varying from 10% to 17% of the material costs (i.e. purchasing price) by means of improved logistics (Wegelius-Lehtonen 1995). Physical flow integration therefore improves the productivity of firms through reduction in production cost, effective just-in-time inventory management and improved supplier management. Khalfan *et al.* (2007) declares that trust is a major requirement for successful SCM in construction supply chains but is however, negatively affected by many factors in construction projects such as lack of honest communications and reliability and the problems in the delivery of the project. Most studies point to ways of measuring trust in a dynamic supply chain as: shared goals; having experience of working together; solving problems together; rewarding culture on trusted behaviors; fair working and reasonable behaviors in work environment.

2.2.4 Trust

Khalfan *et al.* (2007) declares that trust is a major requirement for successful SCM in construction supply chains but is however, negatively affected by many factors in construction projects such as lack of honest communications and reliability and

the problems in the delivery of the project. Most studies point to ways of measuring trust in a dynamic supply chain as: shared goals; having experience of working together; solving problems together; rewarding culture on trusted behaviors; fair working and reasonable behaviors in work environment.

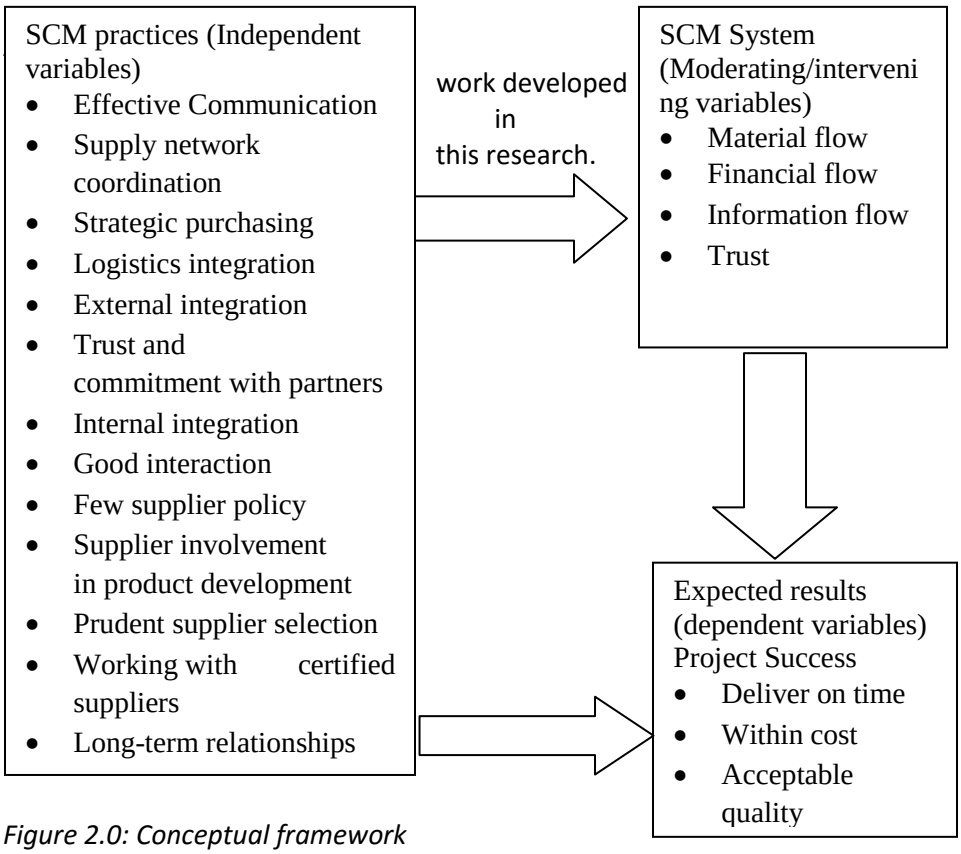

Figure 2.0: Conceptual framework

3.0 Research Design and Methodology

This research study adopts cross-sectional survey research design. The study sought to establish the causal relationship between Supply Chain management practices and project performance. This study sought to establish 'how' the various aspects of supply chain management contributes to the performance of construction projects. Descriptive statistics involves organization, summarization, and display of data. A cross-sectional study Saunders, Lewis & Thornhill, (2009) seeks to measure the relationship of variables at a specified time so as to describe the incidence of a phenomenon and how the variables are related. Furthermore, descriptive statistics was used to prepare the data for further statistical analysis and therefore provide for generalization from the study sample to the study population. Statistical analysis provided the basis for establishing the probabilistic

causation between the research variables, testing of the research hypothesis, and making of conclusions.

The population of the study was the 199 construction firms listed in the NIB register of contractors in the year 2013. The sample of the study was drawn from all the 199 contractors. The respondents included construction managers, senior to middle level supply chain managers and NIB project engineers supervising them.Their hands on experience made them the most suitable targets for the study. Stratified sampling was adopted to select 65 construction companies based on the value categories. The study collected primary data using questionnaire with three main sections. The questionnaire was used because it helped in collecting a large volume of data, easy to be administered, save time and enabled collection of quantitative data for the study. The questionnaires were Self-administered to the respondents. Secondary data on performance of the construction companies were collected from the performance records of the company projects.

To confirm reliability of the survey instrument, a Cronbach's alpha (Cronbach coefficient alpha), which is based on internal consistency was calculated using SPSS. This methodology measured the average of measurable items and its correlation. Petzer and Mackay quoted from Pallant (2010) that Cronbach's alpha value that is at least 0.70 is adequate for a reliable research instrument. In this study a threshold of 0.70 was determined confirming the reliability of the data collection instrument.

3.1 Data Analysis

Quantitative data was analyzed using descriptive and inferential statistics, percentages, frequencies, means, and standard deviations while inferential statistics included factors analysis and regression analysis. The study sought to determine contribution of supply chain management practices to predict performance of construction project. Inferential analysis examined the relationship between supply chain management practices and project performance of National Irrigation Board through the use of multivariate analysis. The research sought to test hypothesis at 0.05 significant level. Results of quantitative data analysis were presented using charts and tables. The study carried a multiple regression models that involve analyzing moderation effects of supply chain management system. Moderation was tested using the following three regression equations;

$Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \varepsilon$ …… Equation (i)

$M = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X15\ \varepsilon$ …… Equation (ii)

$Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 6M + \varepsilon$ …….. Equation (iii)

Where;

Y = Construction Project Performance, X1= Strategic supplier partnership, X2= Customer relationship, X3= Information Sharing, X4= Sourcing, Z = Supply Chain

Management System, M = Integration, β1, β2, β3, β4, β5 and β6 = Beta coefficients and ε = Error term

4.0: Research Results Analysis and Discussion

4.1: Implementation of SCM Practices

Table 1: Implementation Of SCM Practices

SCM Practices	Mean	Std dev
Effective Communication	2.48	.58
Supply network coordination	3.11	.69
Strategic purchasing	3.14	.68
Logistics integration	2.91	.51
External integration	3.09	.55
Trust and commitment with partners	3.15	.59
Internal integration	3.43	.81
Good interaction	3.44	.72
Few supplier policy	3.74	.97
Supplier involvement in product development	3.65	.91
Prudent supplier selection	3.74	.97
Working with certified suppliers	3.76	.95
Long-term relationships	3.80	1.01

The findings in Table 1indicated that long-term relationships, working with certified suppliers, prudent supplier selection and few supplier policies affect the project performance at National Irrigation Board to a great extent as indicated by a mean of 3.80, 3.76, 3.74 and 3.74 supported by standard deviation of 1.01, 0.95, 0.97 and 0.97. The respondents indicated that supplier involvement in product development; good interaction and internal integration affect the construction project performance at National Irrigation Board to a great extent as indicated by a mean of 3.65, 3.44 and 3.43 with standard deviation of 0.91, 0.72 and 0.81. The respondents indicated that trust and commitment with partners, strategic purchasing, supply network coordination, external integration, logistics integration and effective communication affect the construction project performance at National Irrigation Board to a moderate extent as indicated by a mean of 3.15, 3.14, 3.11, 3.09, 2.91 and 2.48 supported by standard deviation of 0.59, 0.68, 0.69, 0.55, 0.51 and 0.58.

4.2: SCM System Integration

Table 2: Material Flow integration

Supply chain system integration	Mean	Std Dev
Supply chain wide inventory is jointly managed with suppliers and logistics partners	3.11	.60
Distribution networks are configured to minimize total supply chain-wide inventory costs.	3.12	.62
Inventory holdings are minimized across the supply chain.	3.33	.73
Suppliers and logistics partners deliver products and materials just in time.	4.03	1.27

Results presented shows that, majority of the respondents indicated that suppliers and logistics partners deliver products and materials just in time thus affect the construction project performance at National Irrigation Board to a great extent as indicated by a mean of 4.01 with standard deviation of 1.27. Most of the respondents indicated that inventory holdings are minimized across the supply chain, distribution networks are configured to minimize total supply chain-wide inventory costs and supply chain wide inventory is jointly managed with suppliers and logistics partners therefore affects the construction project performance at National Irrigation Board to a great extent as indicated by a mean of 3.33, 3.12 and 3.11 with standard deviation of 0.73, 0.62 and 0.60. This is in line with Wegelius-Lehtonen (1995), who stated that physical flow integration therefore improves the productivity of firms through reduction in production cost, effective just-in-time inventory management and improved supplier management.

Table 3: Financial Flow integration

Financial Flow integration	Mean	ST Dev
Account receivables processes triggered when invoice the customers	3.00	.58
use activity based costing	3.48	.66
Capital efficiency, working and fixed, is maximized across the supply chain.	4.00	.89
Account payable processes are triggered when receive supplies from suppliers.	4.44	.90

Table 3 results indicated that having account payable processes that are automatically triggered when supplies are receive from suppliers, capital efficiency and work being maximized across the supply chain, use of activity based costing for key supply Chain processes and account receivables processes being automatically triggered when customers are invoiced affects the construction project performance at National Irrigation Board to a great extent as indicated by a

mean of 4.44, 4.00, 3.48 and 3.00 supported by standard deviation of .90, 0.89, 0.66 and 0.58. This implies that effective and efficient management of financial flow integration is therefore essential to improve the supply chain performance. This is in line with Johnson and Mena (2008), who stated that effective flow of funds across the supply chain improves cash conversion cycle or cash-to-cash cycle through reduced days-in-inventory, shortened days-in-receivables and prolonged days-in-payables

Table 4: Information flow integration

Information flow integration	Mean	Std dev
Supply chain members collaborate in arriving at demand forecasts.	3.85	.53
Production and delivery schedules are shared across the supply chain.	4.11	.88
Inventory data are visible at all steps across the supply chain.	4.35	.70
Our downstream partners share their actual sales data with us.	4.31	.86
Order fulfillment and shipment status are tracked	4.37	.89
Performance metrics are shared across the supply chain	4.57	.60

From the findings in Table 4, performance metrics being shared across the supply chain, order fulfillment and shipment status being tracked at each step across the supply chain, inventory data being visible and the downstream partners sharing their actual sales data affects the construction project performance at National Irrigation Board to a great extent as indicated by a mean of 4.57, 4.37, 4.35 and 4.31 with standard deviation of 0.60, 0.89, 0.70 and 0.86. Most of the respondents indicated that production and delivery schedules are shared across the supply chain and supply chain members collaborate in arriving at demand forecasts affecting the construction project performance at National Irrigation Board to a moderate extent as indicated by a mean of 4.11 and 3.85 with standard deviation of 0.88 and 0.53.

Table 5: Trust Integration

Trust integration Indicators	Mean	Std Dev
Information about procedures and cost structures are shared.	3.80	0.63
Parties do not make any demands that can hurt the relationship.	3.19	.68
Long-term relationships with Strategic partners.	3.35	.68
Trust or greater, Significance as formal contracts.	4.19	.77

Table 5 indicates that majority of the respondents indicated that trust and goodwill being leveled with or greater significance as formal contracts affects the construction project performance at National Irrigation Board to a very great extent as indicated by a mean of 4.19 with standard deviation of 0.77. Most of the respondents indicated that information about procedures and cost structures being shared and long-term relationship with strategic partners affects the construction project performance at National Irrigation Board to a great extent as indicated by a mean of 3.80 and 3.35 with standard deviation of 0.63 and 0.68. Most of the respondents indicated that not making any demands that can hurt the relationship affects the construction project performance at National Irrigation Board to a moderate extent as indicated by a mean of 3.19 with standard deviation of 0.68. This is in line with Khalfan (2007),who declares that trust is a major requirement for successful SCM in construction supply chains but is however, negatively affected by many factors in construction projects such as lack of honest communications and reliability and the problems in the delivery of the project.

4.3: Relationship between Supply Chain management Integration and Construction Project performance

The study sought to establish the extent to which physical flow integration, financial flow integration, information flow integration and trust affected performance. A multivariate regression model was developed.

Table 6: Model Summary of Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.78(a)	.6084	.587	0.12	1.741	6	.207	8.191	.001(a)

a Predictors: (Constant) physical flow integration, financial flow integration, information flow integration and trust

Dependent: Construction Project Performance

Adjusted R^2 is called the coefficient of determination which indicates how Construction Project Performance varied with variation in physical flow integration, financial flow integration, information flow integration and trust. From the table 4.13, the value of adjusted R^2 was 0.6084. This implied that, there was a variation of 60.8. % of Construction Project Performance varied with variation in supply chain system and which was statistically significant as r=0.6084, P= 0.001 < 0.05.

Table 7: ANOVA (b)

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	5.364	18	.298	1.307	0.02(a)
	Residual	10.152	47	.216		
	Total	10.516	65			

Predictors: (Constant) a Predictors: (Constant) physical flow integration, financial flow integration, information flow integration and trust

Dependent: Construction Project Performance

The study established that there existed a significant goodness of fit between variables as F-test (F=1.6569, P=0.01< 0.05). The calculated F=1.6569 far exceeds the F-critical of 1.307. This implied there the level of variation between independence and dependent variable was significant at 95% confidence level. This indicated that the model formed between Supply chain systems physical flow integration, financial flow integration, information flow integration and trust and Construction Project Performance was a good fit for the data. The strength of variation of the predictor values contruction project performance was significant at P= 0.02<0.05.

Table 8: Regression Coefficients (a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.768	.275		3.640	0.01
	Physical flow integration	0.883	.205	0.857	2.931	0.03
	Financial flow integration	0.717	.146	0.629	2.803	0.01
	Information flow integration	0.868	.120	0.751	1.906	0.02
	Trust Integration	0.791	.390	0.729	1.672	0.01

a. Predictors: (Constant): Physical flow integration, financial flow integration, information flow integration and trust

b. Dependent: Dependent: Construction Project Performance

$Y = 5.768 + 0.883X_1 + 0.717X_2 + 0.868X_3 + 0.791X_{4+} e$

From the regression model, it was found that Construction Project would fail by 5.768% without physical flow integration, financial flow integration, information flow integration and trust. The findings in Table 8 found that a unit increase in Physical flow integration would lead to a significance positive increase in construction project performance as r=0.883, P= 0.003<0.05. Thus increase in physical flow integration would lead to increase in project cost effective, quality, completion timeliness and. The study found that a unit increase in financial flow integration would lead to increase in Construction Project Performance as r =0.717, P< 0.02. This implied that there exist a positive relationship between financial flow integration and construction Project Performance. The study also indicated that a unit increase in information flow integration would lead to a unit increase in increase in construction project performance as r =0.868, P< 0.02). This clearly indicated that information flow integration plays a critical role in improving performance of Construction project performance.

The regression results further indicated that increase in trust among the stakeholders would lead to increase in construction project performance as r =0.791, P< 0.01.Thus increase in trust would improve construction Project Performance. This clearly indicated that there existed a positive relationship between physical flow integration, financial flow integration, information flow integration and trust and Project Performance in construction industry.

4.4 Relationship Between SCM Practices and Project Performance

The regression analysis in the relationship between SCMP and project performance was done. From the model summary, R-Squared was 0.292 indicated that there was significant variation between strategic supplier partnership, Customer relationship, information sharing and Sourcing**.** This implied that there was a variance of 29.2% between variables in general. The study established that there existed a significance positive variation between supply chain management and construction project performance as r= 0. 292, P=0.01 < 0.05.

Table 9: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.54(a)	.292	.253	0.29	1.615	5	.215	5.751	.002(a)

a Predictors: (Constant) Strategic supplier partnership, X_2= Customer relationship, $X_{3=}$ information sharing , $X_{4=}$ Sourcing = Error Term

Dependent: Construction Project Performance

ANOVA (b)

The study established that there existed a significant goodness of fit between variable as F=4.871, P=0.001< 0.05. The strength of variation of the predictor values of strategic supplier partnership, customer relationship, and information sharing and sourcing had a significant construction project performance as 95% confidence level.

Table 4. 1: ANOVA (b)

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	2.642	1	.537	4.871	0.001(a)
	Residual	18.497	53	.349		
	Total	19.034	54			

a Predictors: (Constant) Strategic supplier partnership, X_2= Customer relationship, $X_{3=}$ information sharing , $X_{4=}$ Sourcing = Error Term

Dependent: Construction Project Performance

Table 10: Regression Coefficients (a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.000	.467		4.120	0.01
	Strategic supplier	0.838	.635	0.615	2.034	0.02
	Customer relationship	0.449	426	0.012	2.313	0.01
	Information Sharing	0. 278	.322	.145	2.906	0.03
	Sourcing	0.167	.231	.159	2.769	0.002

a Predictors: (Constant) Strategic supplier partnership, X_2= Customer relationship, $X_{3=}$ Information Sharing , $X_{4=}$ Sourcing = Error Term

Dependent: Construction Project Performance

$Y = 3.000 + 0.838X_1 + 0.449X_2 + 0.278X_3 + 0.167X_4$

From the above regression model, it was found that construction projects would fail by 3.0% without strategic supplier partnership, customer relationship, information sharing and sourcing. The study established that there existed a significant positive relationship between strategic supplier partnership and construction project performance as r=0.838, t=2.034, P= 0.02<0.05. The study established that a unit increase in customer relationship would significantly result into increase in Construction project performance as r=0.449, t=2.313, P=0.03<0.05. The study found that information sharing had significant positive contribution on Construction project performance as r= 0.168, t=2.906, P= 0.03<0.05. The study found that increased in Sourcing had a significant positive contribution to construction project performance as r=0.167, t=2.769, P= 0.002<0.05. The study therefore rejects the null hypothesis and accepts the alternative hypothesis that there exists a significant positive relationship between supply chain management practices and construction project performance.

4.5: Relationship between SCMP, SCS and Construction Project Performance

The study sought to test the hypothesis that there exist no significant moderating effect of supply chain management systems in the relationship between supply chain management practices and construction project performance. Introduction of moderating variable supply chain management system, the resultant regression model was $Y = \alpha + \beta_1 X_{1+} \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$ which resulted to an increase in change of construction project performance. With supply chain systems introduced, the predictor variables explained 34.3% of change in construction Project Performance

Table 11: Supply Chain Management Practices

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.586[a]	.343	.328	.55881

a Predictors: (Constant) Strategic supplier partnership, X_2= Customer relationship, $X_{3=}$ information sharing , $X_{4=}$ Sourcing, $X_{5=}$ Supply chain management system = Error Term

Dependent: Construction Project Performance

ANOVA

With supply chain systems introduction, the resultant model $Y = \alpha + \beta_1 X_{1+} \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$ had a significant goodness of fit as F=14.356, *P*=000<0.05.

Table 12: ANOVA

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.415	5	.483	14.356	.000[b]
	Residual	15.288	49	.312		
	Total	17.294	54			

a Predictors: (Constant) Strategic supplier partnership, X_2= Customer relationship, $X_{3=}$ information sharing , $X_{4=}$ Sourcing, $X_{5=}$ Supply chain management system = Error Term

Dependent: Construction Project Performance

Coefficients

The coefficients table shows that three predictor variables were statistically significant contributors to 34.3% change in construction project performance. Strategic supplier partnership (β=.424, *P*=.002<0.05), customer relationship (β=.336, *P*=.0033<0.05), Information Sharing (β=.245, *P*=.002<0.05), and Supply chain management system (β=.5.16, *P*=.002<0.05) were the statistically significant predictors

Table 13: Coefficients

Coefficients[a]

Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**		
1	(Constant)	2.844	.314		5.869	.000
	Strategic supplier partnership	.424	.096	.309	3.364	.002
	Customer relationship	.336	.104	.032	.342	.0033
	Information Sharing	.245	.073	.043	.627	.002
	Sourcing	.102	.093	.002	.018	.986
	Supply chain management system	.516	.102	.285	3.098	.002

a Predictors: (Constant) Strategic supplier partnership, X_2= Customer relationship, $X_{3=}$ information sharing , $X_{4=}$ Sourcing, $X_{5=}$ Supply chain management system = Error Term

Dependent: Construction Project Performance

4.6: Moderating Relationship

To establish the moderated relationship, regression analysis model $Y_2 = \alpha + \beta_1 X_{1+} \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 (X_1 M) + \beta_6 (X_2 M) + \beta_7 (X_3 M) + \beta_8 (X_4 M) + \varepsilon$ was used. The results show that predictor variables explain 32.5% of change in construction project performance

Table 14: Model summary of moderating relationship

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.57[a]	.325	.302	.37865

Predictors: (Constant), MX4, Zscore(Strategic supplier partnership), Zscore(Customer relationship), MX3, Zscore(information sharing), Zscore(Sourcing), MX1, MX2
Dependent: Construction Project Performance

Table 4. 2 ANOVA of moderating relationship

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	2.768	8	.346	12.297	.000[b]
	Residual	34.561	46	.760		
	Total	37.229	54			

Predictors: (Constant), MX4, Zscore(Strategic supplier partnership), Zscore(Customer relationship), MX3, Zscore(information sharing), Zscore(Sourcing), MX1, MX2

Dependent Variable: Zscore (Construction Project Performance)

In the moderated relationship, the overall equation was statistically significant (F=12.297, p<.000).

Table 15: Coefficients Model of Moderating Relationship

Coefficients[a]

Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	Std. Error	Beta		
1	(Constant)	1.005	.060		.085	.000
	Zscore(Strategic supplier partnership)	.301	.092	.289	2.166	.031

Zscore(Customer relationship)	.227	.090	.160	.302	.002
Zscore(Information Sharing)	.189	.068	.089	1.313	.012
Zscore (Sourcing)	.101	.076	.272	3.550	.064
MX1	.226	.068	.396	3.301	.001
MX2	-.130	.098	.050	.303	.011
MX3	.153	.063	.097	.834	.004
MX4	-.183	.053	-.398	3.473	.101

a. Dependent Variable: Zscore (Construction Project Performance)

In the moderated relationship, strategic supplier partnership (β=.301, *P*=.031) , customer relationship (β=.227, *P*=.002<0.05) and Information Sharing (β=.189, *P*=.012<0.05) were statistically significant.

4.7: Summarized multiple regression analysis results

Summarized results of multiple regression analysis are presented in a table as shown below.

Table 4. 3 Summarized multiple regression analysis results

Models	Control	Model 1		Model 2	
		Standardized Coefficients Beta	Sig.	Standardized Coefficients Beta	Sig.
	(Constant)	3.000	.000	1.005	.000
	Strategic supplier partnership	0.838	.001	.301	.031
	Customer relationship	0.449	.908	.227	.002
	Information Sharing	0. 278	.772	.189	.012
	Sourcing	0.167	.003	.101	.064
	MX1			.226	.001
	MX2			-.130	.011
	MX3			.153	.004
	MX4			-.183	.101
	R	. 54a		.57a	
	R Square	. 292		.325	
	Adjusted R	. 253		.301	

	Square		
	Std. Error	0.29	. .37865
	F	4.871	12.297
	Sig.	.001a	.000b

From multi regression analysis, the study established that there was a significant change of 3.3% from 29.2% to 32.5% in the relationship between supply chain management practices and construction project performance when supply chain management system integration was introduced. This implied that supply chain management system integration plays a significance role in enhancing the effectiveness of supply chain management practices in achieving better project performance.

4.8 Discussion

From the descriptive analysis, the study revealed that Construction project in National Irrigation Board had implemented the Supply chain management practices to some extent. The findings in Table 4. Indicated that there existed a positive relationship among physical flow integration, financial flow integration, information flow integration and trust and Project Performance in construction industry found that a unit increase in Physical flow integration would lead to a significance positive increase in construction project performance as r=0.883, P= 0.003<0.05. Thus increase in physical flow integration would lead to increase in project cost effective, quality, completion timeliness and. The findings were consistent with Rai et al. (2006) who found that fundamental areas of SCM system are information flow, financial flow and the physical flow. The study found that a unit increase in financial flow integration would lead to increase in Construction Project Performance as r =0.717, P< 0.02. This implied that there exist a positive relationship between financial flow integration and construction Project Performance. The study also indicated that that a unit increase in information flow integration would lead to a unit increase in increase in construction project performance as r =0.868, P< 0.02). This clearly show that information flow integration plays a critical role in improving performance of Construction project performance. The regression results further indicated that increase in trust among the stakeholders would lead to increase in construction project performance as r =0.791, P< 0.01. The findings were consistent with Jarnbring (1994) found in his study on material flows in Swedish construction that the value-added time of those flows is 0.3% to 0.6% of the total flow time.

The study sought to test the hypothesis that there existed no significant relationship between supply chain management practices and construction project performance. The study accepted the alternative hypothesis as the study established that there existed a significant positive relationship between strategic supplier partnership and construction project performance as r=0.838, t=2.034, P=

0.02<0.05. The study established that a unit increase in customer relationship would significantly result into increase in Construction project performance as r=0.449, t=2.313, P=0.03<0.05. The study found that information sharing had significant positive contribution to Construction project performance as r= 0.168, t=2.906, P= 0.03<0.05. The study found that increased in Sourcing had a significant positive contribution to construction project performance as r=0.167, t=2.769, P= 0.002<0.05. The study therefore rejects the null hypothesis and accepts the alternative hypothesis that there existed a significant positive relationship between supply chain management practices and construction project performance

In the moderated relationship, strategic supplier partnership (β=.301, *P*=.031), customer relationship (β=.227, *P*=.002<0.05) and Information Sharing (β=.189, *P*=.012<0.05) were statistically significant while sourcing was insignificant as P=0.986>0.05. From the findings, the study established that there existed a significance positive moderating effects of supply chain management system in the relationship between supplier partnership and construction project performance. The study established that there existed a significance positive moderating effects of supply chain management system in the relationship between Customer relationship and construction project performance. The study established that there existed a significance positive moderating effects of supply chain management system in the relationship between Information Sharing and construction project performance. This clearly demonstrated that supply chain management system, would increase construction project performance by influencing project completion in time, at low cost and achieving quality.

5.0 Summary of Findings

The study established that long-term relationships, working with certified suppliers, prudent supplier selection and few supplier policies, supplier involvement in product development, good interaction and internal, trust and commitment with partners, strategic purchasing, supply network coordination, external integration, logistics integration and effective communication affect the construction project performance at National Irrigation Board. The study revealed that suppliers and logistics partners delivering products and materials just in time, minimizing inventory holdings across the supply chain, configuring distribution networks to minimize total supply chain-wide inventory costs and jointly managing supply chain wide inventory with suppliers and logistics partners affects the construction project performance at National Irrigation Board. The study established that having account payable processes that are automatically triggered when supplies are receive from suppliers, capital efficiency and work being maximized across the supply chain, use of activity based costing key supply Chain processes and account receivables processes being automatically

triggered when customers are invoiced affects the construction project performance at National Irrigation Board.

The study revealed that there exist a positive relationship between financial flow integration and construction Project Performance. The study shows that a unit increase in information flow integration would lead to a unit increase in increase in construction project performance. The study found that performance metrics being shared across the supply chain, order fulfillment and shipment status being tracked at each step across the supply chain, inventory data being visible and the downstream partners sharing their actual sales data, production and delivery schedules that are shared across the supply chain and supply chain members collaborate in arriving at demand forecasts affects the construction project performance at National Irrigation Board. The study established that having trust and good will, sharing information about procedures and cost structures and long-term relationship with strategic partners affects the construction project performance at National Irrigation Board. The study established that there existed a positive relationship among physical flow integration, financial flow integration, information flow integration and trust and Project Performance in construction industry.

5.1: Conclusions

The study concluded that SCM best practices have a positive contribution to construction project performance and that improved implementation of SCM best practices by Kenyan construction firms can lead to improved construction project performance and reduce construction project failures in the industry. Physical flow integration improves the productivity of firms through reduction in production cost, effective just-in-time inventory management and improved supplier management. The study concludes that effective and efficient management of financial flow integration is therefore essential to improve the supply chain performance. Effective flow of funds across the supply chain improves cash conversion cycle or cash-to-cash cycle through reduced days-in-inventory, shortened days-in-receivables and prolonged days-in-payables. Trust is a major requirement for successful SCM in construction supply chains but is however, negatively affected by many factors in construction projects such as lack of honest communications and reliability and the problems in the delivery of the project.

5.2 Recommendations

The study recommends that companies focusing on improving their project performance should focus significantly on improving their degree of SCM best practices implementation to boost project success given the significant positive relationship between SCM practices and project performance. Finally, this study had a narrow focus on the contractors working for NIB which represent a small sample size of respondents as compared to entire contractor's population in

Kenya. To increase the scientific validity of the research and reflect on more holistic approaches in identifying the true relationship between SCM best practices and performance, research should be carried out on construction firms from more than one organization.

References

Alvarado U. Y, Kotzab H. (2001) Supply chain management: the integration of logistics in marketing. Industrial Marketing Management; pp. 183–98.

Carr, A. S. and Pearson, J. N. (1999). Strategically managed buyer-seller relationships and performance outcomes. Journal of Operations Management, No 17, pp.497-519.

Chen I. J, Pualraj A. (2004).Towards a theory of supply chain management: the constructs and measurements. Journal of Operations Management; 22(2), pp.119-50.

Close M. (2014). The Changing Labyrinth of Software Pricing. Communications of the ACM,50 (7), pp.19-23.

Coban. O., (2012) "The impact of strategic purchasing on supply chain performance" European Journal of Business and Management: Vol 4, No.8

Coyle, P., Doney, P. M., & Cannon, J. P. (1996). An examination of the nature of trust in buyer-seller relationships. Journal of Marketing 61(2), pp.35-51.

Croom, S. R. (1992). The need for entrepreneurial buyers. Proceedings of the First Conference of the Purchasing and Supply Education and Research Group (PSERG). Glascow, UK

Dyer, J. H. (1997). Effective interfirm collaboration: how firms minimize transaction costs and maximize transaction value. Strategic Management Journal, 18, 535-556.

Galt, J. D. A., Dale, B.G., 1991. Supplier development: a British case study. International Journal of Purchasing and Materials Management 27 (1), pp.19-24.

Gichunge, H. (2000). Risk Management in The Building Industry in Kenya.
Unpublished PhD. Thesis. University of Nairobi.

Gwaya, D. K, Kiyondi, D. and Oyugi, L.A. (2014). The Effect Of Dividend Policy On Financial Performance Of Firms Listed In The Nairobi Securities Exchange (NSE). Proceedings of 1st JKUAT-SHRD Research Conference.

Jarnbring A., (1994). Application of line-of-balance and 4D CAD for lean planning, J. Construction Innovation. 7, pp.200-211.

Johnson M. and Mena, C. (2008). "Supply chain Management from servitised products: a multi-industry" case study," International Journal of production Economics, Vol.114, pp.27-39.

Khalfan, M., McDermott, P. and Swan, W.(2007), "Building trust in construction projects," Supply Chain Management: An International Journal, 12 (6), pp.385-391.

Kotabe, M., Martin, X. and Domoto, H. (2003). Gaining from vertical partnerships: knowledge transfer, relationship duration, and supplier performance improvement in the U.S. and Japanese automotive industries. Strategic Management Journal, 24, pp.293-316.

Lee, C.W., Kwon, I.-W.G. and Severance, D. (2007), ''Relationship between supply chain performance and degree of linkage among supplier, internal

integration, and customer'', Supply Chain Management: An International Journal, 12 (6), pp.444-52.

Masu, S.M. (2006).An Investigation into the Causes and Impact of Resource Mix Practices in The Performance of Construction Firms in Kenya. Unpublished Phd. Thesis. University of Nairobi.

Muchungu, P. K. (2012). The contribution of human factors in the performance of construction projects in Kenya. Unpublished Ph.D. Thesis. University of Nairobi.

Pallant, J. (2010): SPSS survival manual. (3rd edition). New York: McGraw-Hill.

Palsson, H. and Johansson, O. (2009),"Supply chain integration obtained through uniquely labeled goods. A survey of Swedish manufacturing industries", International Journal of Physical Distribution & Logistics Management, Vol.39No.1, pp.28 - 46

Petzer D., and Mackay N. (2014). Dining atmospherics and food and service quality as predictors of customer satisfaction at sit-down restaurants: African Journal of Hospitality, Tourism and Leisure Vol. 3 (2).

Ragatz, G. L., Handfield, R. B. and Scannell, T. V. (1997). Success factors for integrating suppliers into new product development. Journal of Product Innovation Management, 14, 190-202.,

Rai, A., Patnayakuni, R. and Seth, N. (2006), ''Firm performance impacts of digitally enabled supply chain integration capabilities'', MIS Quarterly, 30 (2), pp.225-46.

Saunders M., Lewis P and Thornhill, A (2009). Research Methods for Business Students. 4th ed. Pearson Education Publishers. USA

Shin, H., Collier, D. A., & Wilson, D. D. (2000). Supply management orientation and supplier–buyer performance. Journal of Operations Management, 18(3), pp.317-333.

Shinm H., Collier, D. A., Wilson, D.D. (2000). Supply management orientation and supplier/buyer performance, journal of operations Management 18, pp.317 -333.

Suhong Lia, Bhanu Ragu-Nathanb, and T. S. Ragu-Nathanb, S. SubbaRaob (2004): The impact of supply chain management practices on competitive advantage and organizational performance – the international journal of management science. pp.107 -124

Tan, K. C., Lyman, S. B., & Wisner, J. D. (2002). Supply chain management: A strategic perspective. International Journal of Operations and Production Management 22(6), pp.614–631.

Thatte, A. A. (2007), Competitive Advantage of a Firm through Supply Chain Responsiveness and SCM Practices. Published, PhD Dissertation. The University of Toledo.

Vollman, T. E., Berry,W. L.Whybark , D. C.(1997). Manufacturing Planning and Control Systems. Homewood: Irwin.

Wegelius-Lehtonen, T. (1995). Measuring and re-engineering logistics chains in the construction industry. In Re-engineering the Enterprise, pp. 209-218, Springer US.

