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## **Supply Chain Management (SCM): The Extent of its Application and Features in the Successful Delivery of Construction Projects**

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### **Abstract**

This study specifically sought to identify the extent and level of awareness of and adoption of the concept of SCM, identify and evaluate key features of SCM for successful construction project delivery in Nigeria. The study adopted an exploratory research design method of investigation consisting of the quantitative and qualitative methods. A purposive and convenient sampling was deployed in selecting the sample size. A semi-structured interview, case study, personal observation and questionnaire survey was carried out in a construction firm located in Abuja. The data were analyzed using descriptive statistics; Relative Importance Index (RII) and Cronbach's Alpha reliability test. The studies found out that majority of the respondents have not heard about the SCM concept, while a few of them have heard about it. The study further revealed the following features as key, they include; level of awareness/adoption of SCM was abysmally low. Findings from the 8 key features for successful SCM construction project delivery revealed the following; disseminating quality information across the various chains, deploying web based and other software and portals as well as the application of internet in improving the effectiveness of construction, ensuring that the level of service and price of suppliers are better, applying activity based costing and management as a performance measure via the elimination of non-value adding activities across the chain, top management needs to continually implement policies that would stimulate the interests of all and sundry, relationship management and trust building, communication and environmental pressures from specialists and other professionals about the benefits of SCM, and outlining trade finance as a pre-condition for successful supply chain finance.

**Keywords:** *Supply Chain Management, Features of Construction Supply Chain Management, Construction Projects, Relative Importance Index, Case Study.*

### **1.0 Introduction**

The construction industry portrays some degree of semblance with the manufacturing sector in a myriad of ways. Their processes and products are somehow unique and complex, while their degree of similarity ranges from high complexity and uncertainty, to consumer influence on product, and fragmentation in its processes, as well as the complex network of its stakeholders involving different organizations and relationships [1]. [2], [3], argued that SCM is still at its infancy in the construction industry and as such its importance to the construction industry and projects are unprecedented. SCM is adjudged to be an epitome of evolutionary and cumulative innovation that metamorphosed from the internal activities of an organization via the reduction of waste and value adding as the main reasons for improving overall effectiveness of a supply chain (SC) entity.

Aligning supply capabilities with the characteristics of demand ensures that the end user is put first in SC thinking. But aligning capabilities with customer needs is about more than meeting demand characteristics which should engage the firm as a whole together with its competitive positions. A SC is a network of firms that partake in upstream and downstream appendages via the various processes and activities that produce value in the form of products and services for the ultimate end user [4]. [5] Defined SC as a network of facilities and distribution options that distributes out the function of procurement of

materials, transforming the materials into intermediate and finished products while distributing the finished products to the users. SC can occur in the services and manufacturing organizations, although the level of complexity of each chain may vary between industries and firms. SC as defined by [6] as a network of connected and interdependent organizations mutually and cooperatively working together to control, manage, and improve the flow of materials and information from suppliers to end users. In a nutshell, a typical SC is linked to materials, information, services, procuring links possessing the characteristics of supply, transformation, and demand.

[2] in their own view stated that SCM can be seen as an example of evolutionary and cumulative innovation that is always seen to have emanated from internal programmes that are aimed at improving overall effectiveness. The main focus of SCM according to them is not limited to the internal efficiencies of an organization alone, but has extended to methods of eliminating waste and adding value within the SC. [7] opined that SCM seeks to improve on performance via the better use of internal and external capabilities in order to form a seamlessly coordinated SC thereby elevating inter-company competition to inter-SC competitors.

This work critically assessed to a greater extent the reasons for the slow adoption of this innovative ideology within the Nigerian construction industry as well as its projects. With the increasing global competition there is need for the Nigerian construction industry to form alliance with CSC stakeholders and influence the productivity of its industry and projects, more should be done in the area of stakeholders within the project. At the end of this study, the upward and downward linkages of the CSC would have been put in the right perspective to propel the Nigerian construction into achieving competitive advantage over their peers in the global construction industry by way of eliminating waste, increasing continuous improvement and the deployment of modern day technologies while also creating the mindset for achieving an operational and efficient industry.

## **1.1 Statement of the Problem**

The Nigerian construction industry has continued to occupy an important position in the nation's economy even though its contribution to the global construction business is going to be the next preferred destination as stated by the report of the Global Construction Perspectives and Oxford Economics. With the current liberal global economic order, it is challenging for the Nigerian firms in the construction sector to remain competitive. Most of the firms within the Nigerian construction industry have been bedeviled with difficulty in delivering value to their customers and on schedule [8]; [9]; [10]. There have been cases of customer dissatisfaction resulting from the inability of products and services delivered by the firms to aptly meet the needs and expectations of end users. One of the criticisms bedeviling the Nigerian construction industry [11] is the increasing rate of delays in the delivery of projects. Given the diverse nature of the industry, lack of stability, susceptibility to fluctuation in demand cycle, uncertainty in production, unspecific project, product demand and most specifically divergent skills etc. The outcome of all these have really affected the industry, giving room for the ensuing problems. These delays often results to schedule and cost overruns, disputes, litigation and consequent abandonment of projects as the major problem confronting the construction industry.

The industry according to [12] has grown to the stage of handling large and complex projects with modern technology, but it is quite unfortunate that it is still largely being dominated with manual operations due to a disconnect along the value chain and between partners. The inefficiencies associated with the practice of manually tracking of materials, equipment and tradesmen in the construction setting often gives rise to problems of unsuccessful completion of projects [12]. The construction industry according to [13] has always been reported as an underperforming sector. The reasons have been adduced to the ingrained patterns of work that has bedeviled the industry for quite some time. The adversarial nature of the industry gave rise to contractors undermining their colleagues within the CSC thereby

leading to hostility and litigations here and there thus hampering strategic and coordinated modes of project management. They further opined that, to address this impasse, collaborative forms or working and partnering related ventures should be looked into in order to facilitate the delivery of construction projects to schedule, cost and specification.

According to [14], one of the areas of construction project delivery where waste is still prevalent is between the various SC partners. They opined that each of the partners choose to work for their individual objectives without considering the effects of their singular actions on the downstream process of the SC thus leading to wastage via ineffective supplier relationships and transactions. The importance of trust as a key driver of collaborative endeavours and project performance in the industry has still not been accepted fully thus leading to the inhibiting of collaborative relationship among the parties in a construction project. It is against this backdrop that the Construction Industry reform in the U.K sought to change the tide of this unsatisfactory adversariality in the sector to a more relational and trust-based sector by promoting relational tendencies amongst clients, contractors, interface within the CSC via partnering arrangements as exemplified by Latham's and Egan's report of 1994 and 1998 respectively. The revolution brought in by information technology (IT) has changed the operational mechanisms of most industries and the construction industry is no exception. The use of IT in the construction industry is limited and this has led to the lack of cooperation, and adverse relationship among the different SC stakeholders. The proper deployment of its facilities within the industry would aid information flow across the SC. A typical deployment of a Computer Aided Design (CAD) for purposes of drafting reduces cycle time, productivity and accuracy while reducing cost of production. This study specifically attempts; to identify the extent and level of awareness of the adoption of the concept of SCM in the Nigerian construction industry, to identify and evaluate key features for successful SCM in project delivery in the Nigerian construction industry.

The outcome from this study will be of utmost importance to all and sundry. In particular, the outcome will create an enabling environment for both the public and private sector drivers in the Nigerian construction industry to launch into the real construction business where the individual stakeholders within the CSC will align themselves in providing innovative ideas that will help create value in support of achieving competitiveness in the construction industry. The outcome from this research will provide a plethora of opportunities all of which will provide ample opportunities for research into construction supply chain management (CSCM).

## **2.0 Literature Review**

SCM according to [2] is the process of strategically managing the movement and storage of materials, parts, and finished inventory from suppliers, through the firm and to customers. According to [15], there is this belief that for business processes to achieve success there is a need for a significant increase in productivity via the management of relationships, information and material flow across the entire SC processes. This idea culminated into the propounding of a standard and all encompassing definition of SCM by a Professor Emeritus of SCM at the Ohio State University, Bernard J. LaLonde, who defined SCM as the delivery of enhanced customer and economic value through synchronized management of the flow of physical goods and associated information from sourcing to consumption. [16], opined that the traditional focus of SCs hinges on transaction and delivery. In recent faster-paced markets, attention has been moved to meet market demands perfectly, rapidly and profitably. The flow of materials downstream via suppliers, manufacturers, warehouses, stores to customers and information flowing in the same direction, SCs should be maintained and sustained in a technology-based and quality-driven environment with a view to minimizing system wide cost, reducing lead times and transit time while improving customer service at all levels.

Years back, the procurement system in Nigeria has been characterized by the non adherence to the principles of tendering in the selection of competent contractors that possesses the financial, managerial, technical skills to deliver construction projects to schedule, cost, and quality objectives [9]. Incidences of abuse of the procurement system by the public agencies have led to loss of resources. They further stated that the country might have lost huge sums of money as a result of abuse of procedures, inflation of contract sums, lack of transparency, lack of the use of competency based competition and merit as key criteria for the award of public contracts. The Nigerian construction industry is highly susceptible to questionable tendencies [17], due to its heterogeneous nature. One of the factors affecting meaningful development in the industry is the issue of corruption. The international community according to [17] sees corruption and other unethical issues as a ritual that ensues at different stages of the country's workforce. They further opined that the causative factor precipitating corruptible tendencies usually emanates from bribe taking and the abuse of procurement processes by political allies of government officials. The political allies and government officials involved in such corruptible tendencies rarely get prosecuted in most developing countries of the world and as such they continue unabatedly in the same cycle of corruption due to the vulnerable nature of their institutions.

Different methods of procuring construction projects abound in the literature [18]; [8]; [19]. The different methods include; design build (DB), build own operate and transfer (BOOT), build operate and transfer (BOT), construction management, management contracting, public private partnership (PPP), concessioning, partnering, framework agreements, design build finance and operate (DBFO), build transfer and operate (BTO), etc. In Nigeria, the most widely used method is the traditional procurement method, otherwise known as the design bid build (DBB) method [20]; [21]. Despite the criticisms trailing the continued use of the design bid build method of procurement in Nigeria, its use has continued to dominate the country's procurement process irrespective of the criticisms of the method. Given the draw backs of the design bid build method of procurement, other modern methods of procurement gradually started crawling into the Nigerian construction industry [22]; [23]. The build own operate and transfer for instance was used in the construction of the Murtala Mohammed Airport II by Bicourtney Aviation Management. Others are the development of Dolphin Estate through a Public Private Partnership (PPPs) arrangement between the Lagos State Government and HFP Construction Limited [24]. The modern/innovative/non-conventional methods of procuring construction projects in Nigeria are not strange, even though the methods came into being in Nigeria in the early nineties, [8]; [22]; [24] their adoption into the industry has not seen the light of the day as many of them fail during their conception stage. Notably, among these are the cancellations of Lagos-Ibadan express way by the federal government, the Kuto-Bagana Bridge over the River Benue failed as the parties (Kogi and Nasarawa States) could not keep to their own end of the bargain. Others are the Victoria Island-Epe express road built by the Lekki Concession Company (LCC) [24].

## **2.1 Nature of SC in the Construction Industry**

In a bid to thoroughly understand the concept of SCM in the construction industry, it is imperative to critically assess the different SCs from the very beginning [25]. According to [26], the temporary nature of CSCs and demand driven nature of the industry makes it very different compared to the manufacturing and service industries. In order to achieve a feasible and effective SCM strategy, it will be important to have an idea of how CSCs operates. CSC consists of different stakeholders who are distinct service providers like subcontractors, designers, consultants, transporters, manufacturers of materials and equipment [26].

In as much as the CSC consists of stakeholders who act as individual service providers, the need for a continuous flow of information from the client becomes imperative given the demand driven nature of the industry. In a typical building and construction industry, designing, contracting and supplying parties in the SC work together in a consistently and dynamic form creating different projects [27]. They further

stated that in a typical traditional construction environment, various contractual engagements are entered into between the various parties until the entire project is consummated. This scenario, i.e. the CSC, is akin to an extended enterprise in which all the firms or parties viz; project developer, architect, engineering firms, contractors, subcontractors and suppliers virtually operate as different business units representing the individual business functions like marketing, design, engineering, component manufacture, supply, assembly and delivery.

According to [3], the formula identified as key to the successful reform of the U.K. construction industry is the involvement of contractors during the early stage of decision making. The idea behind SCM is to align organizations within a SC via integrating trust, improving communication, effective collaboration between each systems and processes. Contractors according to [28] select their partners from amongst their supply base and from the open market at the same time creating room for effective collaboration during the life span of the project. [29] opined that, the client and main contractor build relationships with multiple tier suppliers by unifying the entire team thereby adding value to the client's goals and objectives. As a result of the stiff competition faced by the construction industry, larger construction companies have resorted to deploying flexible mechanisms such as outsourcing, externalization, subcontracting in order to contend with the rigidity posed by the ensuing phenomenon [30]. Subcontracting according to [31] is a long-standing practice of the construction industry the world over and has been adjudged to be a cost-effective means of delivering projects. As a result of the nature of the specialist's works involved and the unsatisfactory practices ensuing from the industry, disputes are bound to occur amongst the stakeholders which are a common phenomenon in the industry.

The nature of the construction industry according to [32] requires a large number of specialists working together. Most, at times, the workers are specialized tradesmen that are unique in a specific aspect of the construction works. These specialist tradesmen are called the subcontractors. The subcontractors offer various services like equipment, materials, skilled tradesmen and the technical knowhow in the course of executing the projects, while the main contractor (MC) is strictly responsible for managing the entire work process in order to satisfy and meet the client's objectives. Specialist contractors or subcontractors according to [33] carry out construction works that requires skilled labour from main specific trades like electrical, plumbing, iron works, etc. for which they possess adequate skills on. Due to the nature of their specialization, the work is limited in scope within the entire project.

Certain problems do arise when coordinating the activities of the subcontractors as opined by [28]. Some of these problems are usually in the form of task sequencing and overlapping job site logistics and skills integration amongst others. While other problems could be as a result of substandard work quality, project delays, labour wage disputes [31]. According to [34], there has been a considerable growth in the non-traditional ways of employing via the casual/temporary, part time and contract/subcontract employment. The growth in this employment is further driven by economic gains, technological and regulatory drifts as well as increased product market uncertainties.

There is need to select capable and reliable suppliers on the basis of evidence, engaging those who will be capable of providing value for money through a competitive and effective procurement process within the entire CSC. As opined by [35], Capability Assessment Toolkit (CAT) is continuously been used as a tool in carrying out pre-qualification exercise in most construction activities of its establishments. Collaborating Industry Directions [36] view that SC performance skyrockets whenever there is sync between suppliers and the customers. As most buyers get frustrated whenever suppliers do not acknowledge their purchase orders, revise their schedules or order changes [36].

Customer-supplier relationship is seen as a vital component of SCM. As opined by [37], a good relationship between the customer and supplier improves performance and enhances the speedy delivery of goods and services to the end users. [37] further stated that most firms tend to adopt the Japanese



approach of customer-supplier relationship which favours collaborative relationship that is based on mutual benefit and trust. It is vital to design a strategic partnership with suppliers in order to achieve a successful SC.

## **2.2 Conceptual Framework of the Study**

A conceptual framework according to [38] categorizes and describes concepts relevant to a study while also mapping the relationships among the various constructs. In the course of carrying out this study, a conceptual framework was developed to elucidate the relationships between the independent and dependent variable. In this study, the dependent variable is successful construction project delivery, while the independent variables comprises of; instituting trust and long term relationships amongst supply chain partners, supply chain finance, supply chain and continuous performance measurement, quality management, information technology, supply base management, senior management's involvement, and supply chain orientation.

### **2.2.1 Information Technology**

According to [39], information technology (IT) has been adjudged to be an essential ingredient for organizational survival, success and enhancing SCM activities via supporting and integrating business processes across the various functional units. According to [40], the construction industry is adjudged to be an information dependant industry given its diversity in terms of information generated procedures that are associated with detailed drawings and photos, cost analysis sheets, budget reports, risk analysis, charts, contract documents, and planning schedules. According to [26], IT has altered the way information is stored and transferred from one place to another and the construction sector is no exception to this. [26] further opined that the use of IT in construction is limited in the areas of accounting, project control, drafting, wireless communications etc. Example of firms that had utilized IT resources in achieving transformational growth according to [26] include; Wal-Mart, Dell Computers etc. In the construction sector, computer aided design (CAD) has consistently helped in reducing cycle time, productivity and accuracy whenever there is need for a change in design. While other construction firms use productivity and cost reduction software applications like Primavera, CAD design tools, enterprise information portals for multi-project visibility and other costing and scheduling modules. [41] opined that RFID technologies can help improve SCM activities via the reduction of inventory losses, increase in efficiency and speed of processes, while also improving information accuracy.

### **2.2.2 Supply Base Management**

Supply base management as opined by [42], is a key approach in many companies, by having a few number of suppliers, manufacturers are bound to have more time to closely work with each of the SC partners. Effective supplier management according to [42] commences with the selection of the key and appropriate suppliers on a competitive basis by way of making provision for high quality parts, aggressive pricing, and a reliable delivery mechanism. [43] opined that regular and comprehensive quality appraisals, close monitoring, technological capabilities, delivery records, service level and price have contributed in no small measure in the production of high quality components within a more stable long-term business environment. According to [44], the automotive sector in the U.S and most of their European competitors have set up programs to lower their level of vertical integration, lower their total number of direct suppliers as well as moving towards publicly declaring their strategic partnerships. [44] further stated that innovative firms cut down the size of their supply base by selecting few of their best suppliers to provide

basic products and services. They further went on to state that one of the fastest ways of achieving higher SC quality, is via supply base rationalization, that is, the process of selecting the right mix and number of suppliers for a given purchase category or commodity.

### **2.2.3 Supply Chain Orientation**

[45] defined SCO as the extent to which there is predisposition among SC partners towards seeing SC as an integrated entity and on satisfying the needs of the chain in an integrated manner. When this orientation, which is a management philosophy, is implemented in an organization, it would lead to the manifestation of SCM philosophy within the nooks and crannies of the organization. Therefore in order to smoothen the integration of supply chain, most business organization needs an aspect of technology that can support integration properly. According to [46], a firm's SCO is usually developed based on the culture of the organization. While, trust, commitment, sharing of common relationship-building foundations, compatibility between organizations and the support of top management all contributes to a firm's SCO. Therefore, organizations implementing SCM as a matter of urgency must first have a SCO in place [47]. [45], opined that credibility, top management support, commitment, benevolence (trust), cooperative norms, and organizational compatibility are critical ingredients that are necessary for a successful SCM. While [48] included communication and environmental pressure as SCO features that could lead to organizational performance.

### **2.2.4 Supply Chain and Continuous Performance Measurement**

Measuring the performance of a process is most times a daunting challenge to firms [49]. According to [50], difficulties usually emanates during the definition of metrics, this is followed by when using the information provided. The use of standardized metrics according to [50] is to appraise the performance of suppliers while providing a feedback as a measure for the improvement of SCM. Although [51] opined that given the importance of performance measurement, its impact has not been felt in the construction industry. [49] further opined that some researchers adopted the balanced score card (BSC) and activity based costing (ABC) methods in evaluating SC performance. According to [52], project SC metrics span the entire SC with specific focus on common processes as well as the capturing of all aspects of SC performance. The Supply Chain Operations Reference (SCOR) model developed by the SC Council in 1996, provided a comprehensive framework in tracking performance and as such has been the basis for SC improvement in terms of global and site specific projects. The SCOR Model according to [53] is considered as the key to strategic decision making and the most rigorous for SC performance evaluation. [53] further opined that SCOR model enables firms to critically assess the configuration of their SCs. It also helps in identifying and eliminating redundant and wasteful practices along the different SCs. By integrating well known concepts of business process re-engineering (BPR), benchmarking and process measurement, the SCOR model provides a medium for cross functional framework for improving SC performance. The SCOR model according to [52], uses five (5) key aspects of SCs viz; plan, source, make, deliver and return (PSMDR) as building blocks in describing SC. The figure below depicts how the SCOR model can be deployed in a typical CSC.

Continuous performance improvement is usually construed as a fundamental element of success for an organization. It normally consists of eliminating defects, reducing waste, managing production time and improving productivity and performance [51]. Various performance metrics exist as medium for achieving SC effectiveness. The different SC performance measures according to [54] are in the cost and non-cost, strategic, tactical or operational, as well as the business process and functional perspectives. According to United States Agency for International Development [55], optimization is an approach to designing strategic planning, and continuous improvement in SC activities. It can be used to design new SCs, or to design existing SCs. Using simulation software and routine data, the optimization process identifies flexible strategies used in increasing the performance and cost effectiveness of each SC

function. It can further present a variety of options for SC leaders to consider in locating warehouses, setting inventory levels, creating or revising transport routes, removing distribution tiers and re-engineering business process [55].

According to [56], most leading companies manage their SC performance by holistically defining the solution and scope of resolving SC issues; avoid unintended consequences by approaching their SC as interactive systems. [57] further argued that to improve performance in SCs, there is need to apply quality standards such as the ISO 9000, electronic data interchange (EDI) usage, JIT and lean principles in achieving performance targets. While [58] was of the view that to achieve proper performance measures, activity based costing and management should be deployed in identifying any non-value adding activity across a SC. [59] on the other hand stated that in measuring the performance of construction works, the actual and planned schedule and cost performance could be achieved using the earned value management metric.

### **2.2.5 Senior Management's Involvement**

Senior management's involvement or management leadership or top management, is a situation that involves the top management of an organization inculcating on its employees the need to value supplier-customer relationships by way of sharing tactical SC information and education [60]. [7], opined that top management should be conversant with the competitive benefits that can accrue from the impact of strategic purchasing and IT on effective supply chain relationships with a view to remaining competitive in the market. [61] argued that the support from top management is key for purposes of coordinating the different departments within an organization for training of employees and the development of suppliers as well. [62] are of the view that in order to achieve optimum supply chain quality management, the top management of an organization needs to communicate, motivate and commit as well as continuously implement policies that would stimulate the interest of all and sundry. They further stated that the possible barriers to successful supply chain integration includes; managerial complexity, and lack of vision from top management as well as a weak corporate culture of an organization.

### **2.2.6 Instituting Trust and Long Term Relationships among Supply Chain Partners**

Trust may be defined as the belief that an individual's word or intention would be relied upon and as such that individual will fulfill his/her own obligation. As the degree of trust between the different SC partners evolves, there is the tendency for a mutual flow of materials and information between the different individuals in the SC. The issue of trust according to [62] is a major hindrance to the collaborative tendencies of most SC partners if the issue of trust is not properly instituted and clearly defined from the onset. In relationship development, trust is important as it eliminates tension and helps build confidence. According to [63] SC relationships plays a significant role in achieving the goals and objectives of an organization. A properly developed long-term relationship with suppliers within a SC will help in developing a well managed SC that will have an effect on the competitiveness of the entire chain. [37] and [7] opined that a long-term relationship with few suppliers will enable effective communication and if the relationship is strategically coordinated, will have a positive impact on the financial performance of the firms as a result of a well integrated industrial relations that precipitates into speedy delivery of quality goods and services. [63] further stated that SCM is related with relationship management which is made up of suppliers and customers. The composition makes up the components of SCM practices which lead to information sharing thus making up part of the pillar for a solid SC relationship.

As opined by [64], most organizations are establishing less adversarial and more collaborative relationships more than they were decades back. [64] further recommends collaborative commitment,



goal congruency, and integrated information sharing as means of achieving SC performance. While [65] identified extent of information sharing, joint planning, goal congruence, personal interactions as well as trust amongst SC partners as essential for SC collaboration that is likely to provide improved business success.

### **2.2.7 Quality Management**

Successful SCM according to [16] depends on how well quality and technology are introduced and managed within the framework of a social and technical system of a SC. In the construction industry, for instance, separate quality control activities amongst the main contractors and subcontractors would not bring the desired quality objective envisaged, but with an integrated and all encompassing effort within the entire SC quality is certain. To this end, the quality management literature has beamed its searchlight on understanding the critical dimensions of quality. For instance, it was found that product quality is highly correlated with customer focus, employment empowerment, supplier quality management, supplier performance and internal quality information usage [16]. [66] opined that the quality of information dissemination is key in the success of supply chain activities, thus satisfying the needs of the end users. [67] are of the view that the purpose of any supply chain is to achieve competitive advantage perfectly, rapidly and profitably by maintaining and sustaining and IT based and quality driven capabilities to their end users. [68] further argued that reducing the number of subcontractors to a sizeable few will go a long way in addressing quality related issues inherent in most construction projects. They further stated that in order to achieve quality as a norm, the concept of quality needs to be integrated throughout the entire supply chain.

### **2.2.8 Supply Chain Finance**

The current global economic recession and its attendant grip on credit are impacting on the flow of trades as well as pressure on buyers and suppliers the world over [69]. Financial supply chain deals with the movement of funds along the SCs. As most firms are recognizing the importance of working capital to support their businesses, there is need to tap into a more sustainable and integrated approach to liquidity management with the aid of the systematic and consistent approach offered by the financial supply chain management (FSCM). The optimization mechanism brought by the FSCM as opined by [69] can be achieved by a collaboration in managing accounts payable, accounts receivable, cash and risk. The final objective of the FSCM is to achieve a visible purchase-to-order and order-to-cash process that will lead to efficiency and cost savings throughout the chain. [70] stated that the main purpose of the SCF is to achieve a multi-win-win situation between the various upstream, downstream and third party logistics in a typical SC setting. [69] further stated that certain conditions needs to be put in place for a successful SCF management within a project. They further opined that the an organization (corporate) with its bank's assistance needs to get its key stakeholders on board; an outline trade finance facility is also a precondition for a successful SCF programme as this has been proved to have been the critical ingredient for efficient supplier finance solutions for clients.

## **3.0 Methodology**

This study deployed an explorative and descriptive research design methods in a bid to ensuring the research questions are answered accurately. Specifically the study adopted the survey method as well as the case-study method. The research involved a population of project management practitioners in the study area consisting of project managers, quantity surveyors, architects, engineers, builders, etc. The researcher selected an appropriate and adequate number of participants from the research study's population. The samples were selected conveniently and purposefully to capture the required group of respondents in the population using the Krejcie and Morgan method for determining sample size from a

given population. Abuja, the Federal Capital Territory (FCT) situated in the North Central region of Nigeria constituted the study area.

**Table 1: Sample Size Determination from Population**

Construction Company	Location	Population (N)	Sample Size (n)
CCC	Abuja, F.C.T.	758	487

The study deployed the use questionnaires in collating data from the sampled respondents using the face-to-face method. While also a semi-structured interview session was carried out in the course of data collection in the case study organization. The Likert five-point scale was employed to explore the respondent’s opinions in relation to the questions posed in the study, where the step “1” represents least important and “5” is strongly important in the first instance. While in the second instance, the percentage of adoption of certain SCM principles in construction project delivery were outlined for the respondents to choose from. The main reason behind the adoption of the Likert scale was to give some degree of flexibility of choice to reflect the intensity of respondent views. The questionnaire targeted groups consisting of long-experienced persons in the field of SCM related activities in the Nigerian construction industry. The use of questionnaires and semi-structured interviews raises two data quality issues namely, validity and reliability. Specific statistical methods were used to analyze the data, starting with the descriptive analysis by providing a summary of respondent characteristics, in addition to their organizational characteristics. In analyzing the data further statistical analysis were required in understanding and investigating the most appropriate analysis to be used. Cronbach’s Alpha was used to measure internal consistency of the results. Cronbach’s alpha is one of the most popular reliability statistic used for measurement of reliability of scale. Cronbach’s alpha ( $\alpha$ ) is given by the formula;

$$\alpha = \frac{k}{k-1} \left( \frac{\sigma_y^2 - \sum \sigma_i^2}{\sigma_y^2} \right) \dots\dots\dots(1)$$

where  $k$ = number of items,  $\sigma_y^2$  = variance of the sum of all items; and  $\sigma_i^2$  =variance of the  $i$ th item. [71] and [72] opined that a Cronbach’s value of 0.50 to 0.70 is regarded as adequate proof of internal consistency. In this study, Cronbach’s Alpha coefficient was calculated using SPSS version 17.0

Relative importance index (RII) was used to analyze the results of the extent and level of awareness/adoption of the concept of SCM as well as identify and evaluate key features for successful SCM in the Nigerian construction industry. Relative Importance Index RII has been used in construction related research by such authors like [19], [73], [74], [75].

$$RII = \frac{\sum_{i=1}^5 ni \cdot ki}{N \cdot Rh} \dots\dots\dots(2)$$

Where,  $N_i$  is the number of respondents where  $k_i=1$  to 5 or more on the Likert scale,  $N$  is the total number of questionnaire collected, and  $R_h$  is the highest value in ranking order. In this study, RII was calculated using a Microsoft excel programmed software.

## 4.0 Results and Discussions

The organization for the case study was analyzed based on its location, organizational profile, case study project description, nature of construction related activities and projects as it relates to SCM. In order to respect the anonymity of the construction company and for ethical reasons, the construction firm (case organization) was referred to as construction company C and thus assigned the name CCC. CCC is a leading construction firm in collaboration with its subsidiaries offers integrated construction solutions and other related services. The company in collaboration with its subsidiaries makes it possible for the company to realize multifaceted projects with the highest level of performance by effectively managing and fulfilling construction projects from the initial idea through to planning, design, engineering, construction, operation and maintenance. With its attendant desire for reliability with unmatched breadth and depth of expertise as well as a strong penchant for supply chains gave rise to assurance and guaranteed success in the delivery of the client's objectives. CCC's project site located in Mpape, a suburb in the FCT participated in this study.

### 4.1 Description of the Case Study Project

CCC's project consists of construction of an estate for residential housing of public employees located within the Mpape area of the FCT. The vast area of land for the project was initially a virgin land covered with shrubs and trees of all kinds. Giving the rocky nature of the area, an extensive land clearing and blasting of the rocks and stones was carried out with the help of bulldozers, compressing machines, jack hammers and electronic blasting equipment, etc. The table below shows some of the characteristics of CCC's project.

**Table 2:** Characteristics of CCC's Project

Nature of Project	Estate Development
Location of Project	Mpape, Abuja F.C.T.
Nature of Work	Construction of an Estate
Type of Client	Public Client
Mode of Contract Selection	Competitive Procurement
Proposed Project Duration	36 Months
Procurement Method	Design and Build
Contract Sum	About ₦ 15 Billion
Present Stage of Project	80% Complete

### 4.2 Respondents in the CCC's Project

A face-to-face semi structured and recorded interview, walk through/observations as well as a discussion session was carried out at CCC's project. The project's quantity surveyor and project manager who were deeply involved in the project were interviewed. Having handled similar projects of this nature in the past made them more competent and appropriate to be part of the interview.

### 4.3 Questionnaire Response Rate Analysis

In this chapter, the study firstly presents the results of the survey in the form of descriptive and inferential statistics using tables, figures and charts as well as other non-parametric statistical tools to arrive at the findings in the first instance. Secondly, the findings from the case study organizations were presented from the outcomes of the interviews, discussions, narratives, walkthroughs, and observations which were presented using tables, photographs etc. The study population consists of 487 personnel from a construction firm named CCC. Questionnaires were self-administered to the professionals in the construction firm mentioned earlier. The number of questionnaires distributed based on the sample size earlier determined and those retrieved as well as those found useable for the analysis are shown in table 3.

**Table 3: Questionnaire Response**

Construction Company	Questionnaire Sent	Questionnaire Retrieved	Questionnaire Found Useable
CCC	487	437	403 (82.75%)

### 4.4 Reliability and Validity Tests

The internal consistencies of each item in each category of the questions on factors for successful SCM of construction project delivery in the Nigerian construction industry were determined using the Cronbach’s alpha coefficient. The Cronbach’s alpha has been adjudged to be appropriate in determining the reliability and validity of data. The table IV shows the value of the internal consistency of the various items under study using SPSS version 17.0.

**Table 4: Cronbach’s Alpha Coefficient**

Factors	Number of variables	Cronbach’s Alpha Value	Level of Reliability
Instituting trust and long term relationships among supply chain partners	5	0.745	Good
Supply chain finance	4	0.896	Good
Supply chain and continuous performance measurement	6	0.922	Good
Quality management	5	0.755	Good
Information technology	4	0.854	
Supply base management	6	0.779	Good
Senior management’s commitment	4	0.877	Good
Supply chain orientation	6	0.752	Good

The Cronbach's Alpha coefficient for all the main eight (8) criteria for factors of successful supply chain management in construction project delivery which were identified from the literature are 0.745, 0.896, 0.922, 0.755, 0.854, 0.779, 877, and 0.752 respectively. This is an indication that the instrument is perfect in terms of reliability and as such possesses an adequate proof of internal consistency. As rightly stated earlier on, a reliability value of less than 0.6 is usually adjudged poor, 0.6-0.7 acceptable, while over 0.8 is adjudged to be good [71], [72]. The findings further states that higher Cronbach's Alpha coefficient values indicates that the data generated are reliable as they possess a relatively high internal consistency and can be generalized to reflect opinions of all the respondents in the target/study area. The study hence deduced that all the main eight (8) criteria for factors of successful supply chain management in construction project delivery are reliable and was later used for further analysis.

#### **4.5 Respondents Characteristics**

In the first section of the questionnaire the respondent's characteristics as regards their nationality, discipline, years of experience, qualifications as well as types of project executed etc are presented.

**Table 5: Demographic Responses**

<b>Nationality of Respondents</b>		
	<b>Frequency</b>	<b>Percentage</b>
Nigerians	315	78.16
Foreigners	88	21.84
<b>Total</b>	<b>403</b>	<b>100%</b>
<b>Respondents Discipline</b>		
	<b>Frequency</b>	<b>Percentage</b>
Project Managers	74	17.62
Engineers	106	22.08
Architects	63	15.63
Builders	89	18.36
Quantity Surveyors	51	12.66
Others	20	4.96
<b>Total</b>	<b>403</b>	<b>100%</b>
<b>Academic Qualification</b>		
	<b>Frequency</b>	<b>Percentage</b>
OND/ND	90	22.33
HND/B.Sc/B.Tech/B.Eng	178	44.17
MBA/M.Sc/M.Eng	127	31.51
PhD	8	1.99
<b>Total</b>	<b>403</b>	<b>100%</b>
<b>Years of Experience in the Industry</b>		
	<b>Frequency</b>	<b>Percentage</b>
1-5 years	52	12.90
6-10 years	71	17.62
11-15 years	75	18.61
16-20 years	122	30.27
Over 21 years	83	20.60
<b>Total</b>	<b>403</b>	<b>100%</b>



<b>Concept of CSCM</b>		
	<b>Frequency</b>	<b>Percentage</b>
Heard of CSCM	322	79.90
Not heard of CSCM	81	20.10
<b>Total</b>	<b>403</b>	<b>100%</b>
<b>Extent of involvement in any CSCM activity</b>		
	<b>Frequency</b>	<b>Percentage</b>
Not been involved	132	32.75
Been involved	57	14.14
About to be involved	214	53.10
<b>Total</b>	<b>403</b>	<b>100%</b>

#### **4.5.1 Nationality of Respondents**

From the nationality of the respondents, the findings indicates that 315 (78.16%) of the respondents are Nigerians, while 88 (21.84%) are foreigners. This implies that the aforementioned construction firms comprises of a mix of home and foreign nationals whom are well experienced in their own rights to deliver quality projects to Nigerians.

#### **4.5.2 Respondents Discipline**

In terms of the respondents discipline, 106 (17.62%) are engineers, 74 (18.36%) are project managers, 89 (22.08%) builders, 63 (15.63%) are architects, 51 (12.66%) are quantity surveyors, while others are 20 (4.96%). This finding demonstrates that the respondents are professionals in their own rights and as such they possess the technical knowledge needed to contribute to the research thus providing the needed insights into the research. As stated by [19], the representation of all the professionals in the industry denotes an equal and adequate representation of every professional.

#### **4.5.3 Respondent's Years of Experience in the Industry**

The experience of the respondents in the industry shows that majority 122 (30.27%) put in between 16-20 years, 83 (20.60%) over 21 years, 75 (18.61%) 11-15 years, 71 (17.62%) spent 6-10 years, while 52 (12.90%) of the respondents have spent between 1-5years. The response from the findings indicate that since majority of the respondents have spent 16-20 years in the industry, it implies that the respondents must have understood the technicalities as well as gained ample experience in dealing with issues bordering the industry. Hence they are fit to contribute their wealth of experience in the survey.

#### **4.5.4 Respondent's Academic Qualification**

The findings from the academic qualifications of the respondents shows that majority of the respondent 178 (44.17%) had HND/B.Sc/B.Eng, 127 (31.51) had MBA/M.Sc as qualification, 90 (22.33%) had NCE/ND while 8 (1.99%) had Ph.Ds. The findings demonstrate that majority of the respondents possesses the requisite educational/academic qualifications to practice and provide the needed information in supporting the findings of this research. Another reason for the large proportion of educated respondents could be attributed to the existence of foreigners (multinationals) in most of the construction firms within the study area.

#### 4.6 Concept of CSCM

The finding from the study depicts that majority of the respondents 322 (79.90%) have not heard of the concept of CSCM, while 81 (20.10%) have heard about it and as such are not knowledgeable in CSCM. The results of the findings could be attributed to the low level of awareness of what the concept is all about. Another reason for the large proportion of respondents affirming not to have heard of the concept may be that the respondents don't know that the concept exist and as such a concerted effort should be made towards educating them on the need and gains ensuring there from the application of the concept.

#### 4.7 Extent of Involvement in Any CSCM Activity

The finding from the study shows the extent of involvement of the respondents in CSCM related activity. Majority of the respondents 132 (32.75%) have not been involved in any CSCM activity, while 214 (53.10%) were about to be involved, and 57 (14.14%) have already been involved in CSCM activity. This implies that majority of the respondents are ignorant of the concept of SCM. As earlier stated, most of the respondents are not aware that they are deploying some of the techniques as depicted in the eight (8) features of successful SCM construction project delivery identified in the literature. Hence there is need to adequately educate the respondents on these key features.

**Table 6:**Relative Importance Index Score for Instituting Trust and Long Term Relationships among Supply Chain Partners

	SA	A	N	D	SD	RII	Rank
	5	4	3	2	1		
Engage in Collaborative Commitment	85	138	60	77	43	0.90	5
Goal Congruency	86	189	64	43	21	0.99	2
Deploy Integrated Information Sharing attitude as key component	94	163	68	44	34	0.97	4
Ensure that there is trust amongst the Supply Chain Partners	150	99	64	51	39	0.99	2
Relationship management and trust building	141	116	73	47	26	1.01	1

The results presented in table 6 shows that the most important factor for instituting trust and long term relationships among SC partners is relationship management and trust building with a RII of 1.01 and ranked first. While the results indicate that engaging in collaborative commitment has the least relative importance index RII of 0.90 and ranked fifth. Ensuring that there is trust amongst the supply chain partners and goal congruency are the next in the list of the highest ranked factors.

**Table 7:**Relative Importance Index Score for Supply Chain Finance

	SA	A	N	D	SD	RII	Rank
	5	4	3	2	1		
Getting organization's stakeholders on board via the bank's financial assistance	124	77	86	64	52	0.91	4
Outline trade finance as a pre-condition for a successful supply	154	86	73	51	39	0.98	1

chain finance							
Tendency to achieve a visible purchase-to-order	108	129	64	51	51	0.93	3
Ability to deploy an order-to-cash process	103	137	73	56	34	0.95	2

The results presented in table 7 shows that the most important factor for supply chain finance is online trade finance as a pre-condition for a successful supply chain finance with a RII of 0.98 and ranked first. While the results indicate that getting the organization’s stakeholders on board via the bank’s financial assistance has the least relative importance index (RII) of 0.91 and ranked fourth. Ability to deploy an order-to-cash process and tendency to achieve a visible purchase-to-order are the next in the list of the highest ranked factors.

**Table 8:** Relative Importance Index Score for Supply Chain and Continuous Performance Measurement

	SA	A	N	D	SD	RII	Rank
	5	4	3	2	1		
Holistically define the solutions and scope of resolving supply chain issues	86	116	81	69	51	0.88	6
Avoid unintended consequences by approaching our supply chain as interactive systems	103	133	64	56	47	0.93	4
Apply different quality standards such as ISO 9000 in achieving our project objectives	146	120	56	47	34	1.00	2
Deploy Just-in-time and lean techniques in achieving our performance targets	159	86	47	60	51	0.97	3
Apply Activity based costing and management as a performance measure via the elimination of non-value adding activities across the chain	180	94	60	43	26	1.05	1
Deploy earned value management metrics in our schedule and cost performance	90	150	69	51	43	0.93	4

The results presented in table 8 indicates that the most important factor for supply chain and continuous performance measurement is applying activity based costing and management as a performance measure via the elimination of non-value adding activities across the chain with a RII of 1.05 and ranked first. While the results show that holistically defining the solutions and scope of resolving supply chain issues has the least relative importance index (RII) of 0.88 and ranked sixth. Applying different quality standards such as ISO 9000 in achieving our project objectives and deploying Just-in-time and lean techniques in achieving our performance targets are the next in the list of the highest ranked factors.

**Table 9: Relative Importance Index Score for Quality Management**

	SA	A	N	D	SD	RII	Rank
	5	4	3	2	1		
Adopt and implement ISO 9000 systems in improving the quality of our projects	184	94	51	43	31	1.04	4
Disseminating quality information across the various chains	249	77	43	21	13	1.16	1
Maintain and sustain an IT based and quality driven capability	176	137	39	31	20	1.08	3
Minimize the number of contractors/subcontractors to a sizeable number	94	120	86	60	43	0.91	5
Integrate the concept of quality management system throughout the entire supply chain	240	77	43	26	17	1.14	2

The findings presented in table 9 indicates that the most important factor for quality management is disseminating quality information across the various chains with a RII of 1.16 and ranked first. While the results show that minimizing the number of contractors/subcontractors to a sizeable number has the least relative importance index (RII) of 0.91 and ranked fifth. Integrating the concept of quality management system throughout the entire supply chain and maintaining and sustaining an IT based and quality driven capability are the next in the list of the highest ranked factors.

**Table 10: Relative Importance Index Score for Information Technology**

	SA	A	N	D	SD	RII	Rank
	5	4	3	2	1		
Integrate Radio Frequency & Identification (RFID) technology in fast tracking construction activities on site	137	90	73	60	43	0.95	4
Make use of mobile devices & personal digital assistants in supporting our activities	120	171	56	34	22	1.03	3
Deploy Web based & other software and portals in improving the effectiveness of our construction activities	223	69	43	34	34	1.08	1
Make use of Internet applications and web based technologies	197	103	43	34	26	1.08	1

The results shown in table 10 depicts that the most important factor for information technology is making use of Internet applications and web based technologies as well as deploying web based and other software and portals in improving the effectiveness of construction activities with a RII of 1.08 and both ranked first. While the results show that integrating Radio Frequency & Identification (RFID) technology in fast tracking construction activities on site has the least relative importance index (RII) of 0.95 and ranked fourth. Making use of mobile devices & personal digital assistants in supporting our activities is the next in the list of the highest ranked factor.

**Table 11:**Relative Importance Index Score for Supply Base Management

	SA	A	N	D	SD	RII	Rank
	5	4	3	2	1		
Select few suppliers with a view to enabling effective communication and supplier relationship	171	103	52	43	34	1.03	3
Often conduct a regular and comprehensive quality appraisal on our suppliers	137	111	60	51	44	0.97	4
Monitor our suppliers more closely	112	146	51	56	38	0.96	5
Deploy technological capabilities in our supply base management	99	137	64	56	47	0.93	6
Lay more emphasis on Delivery records of our suppliers	176	120	43	34	30	1.06	2
Also ensure that the Service level and price of our suppliers are better	218	73	47	39	26	1.08	1

The findings presented in table 11 indicates that the most important factor for supply base management is ensuring that the service level and price of suppliers are better with a RII of 1.08 and ranked first. While the results show that deploying technological capabilities in our supply base management has the least relative importance index (RII) of 0.93 and ranked sixth. Laying more emphasis on delivery records of our suppliers and selecting few suppliers with a view to enabling effective communication and supplier relationship are the next in the list of the highest ranked factors.

**Table 12:**Relative Importance Index Score for Senior Management’s Commitment

	SA	A	N	D	SD	RII	Rank
	5	4	3	2	1		
We believe top management needs to communicate effectively its policy directions	94	120	77	69	43	0.91	4
We believe top management needs to motivate its employees towards the realization of their objectives	150	112	60	47	34	1.00	2
Top management needs to commit to the achievement of the concept	103	129	73	56	42	0.94	3
Top management needs to continually implement policies that would stimulate interests of all and sundry	180	90	56	43	34	1.03	1

The results presented in table 12 shows that the most important factor for senior management’s commitment is top management needs to continually implement policies that would stimulate interests of all and sundry with a RII of 1.03 and ranked first. While the results depict that we believe top management needs to communicate effectively its policy directions has the least relative importance index (RII) of 0.91 and ranked fourth. We believe top management needs to motivate its employees towards the realization of their objectives and top management needs to commit to the achievement of the concept are the next in the list of the highest ranked factors.



**Table 13: Relative Importance Index Score for Supply Chain Orientation**

	SA	A	N	D	SD	RII	Rank
	5	4	3	2	1		
Credibility on the part of all and sundry in orientating employees in our organization	94	125	77	60	47	0.91	5
Top management support is needed in SCM orientation	129	90	77	64	43	0.94	4
Commitment from employers and employees in achieving SCM	86	176	69	42	30	0.97	2
Benevolence	51	43	146	86	77	0.74	6
Communication of the concept	124	103	77	56	43	0.95	3
Environmental pressure from specialists and other professionals about the benefits of SCM	116	154	60	47	26	1.00	1

The findings in table 13 indicates that the most important factor for supply chain orientation is environmental pressure from specialists and other professionals about the benefits of SCM with a RII of 1.00 and ranked first. While the findings depict that benevolence has the least relative importance index (RII) of 0.74 and ranked sixth. Commitment from employers and employees in achieving SCM and communication of the concept are the next in the list of the highest ranked factors.

In discussing the findings from the results proper, we looked at the various issues raised from the analysis of the research questions posed at the beginning of this research. The case study findings also show that the level of awareness/adoption of the SCM concept is abysmally low even though some of the construction firms were applying the concept in the delivery of their construction projects unknowingly. From the findings so far, CCC were to a greater extent applying majority of the SCM concepts judging from their assessment of the eight (8) main and forty (40) sub-criteria. Reasons for the deployment of the SCM success factors even though the response gotten from the respondents regarding their level of awareness of the concept was abysmally low, could be as a result of the firm is a foreign based multinational company hence they must have been conversant with the techniques right from their home country and the tendency to apply the concept becomes eminent. It is also surprising to state that the respondents in the construction firm were also ignorant of the fact that they were applying some of the SCM techniques in the delivery of their construction projects. In the area of IT application, quality management, supply chain continuous performance measurement and instituting trust and long term relationships among supply chain partners, the construction firm was up to date to a larger extent. While in the second instance, the construction firm performed low in the areas of SBM, SCF, SMC and SCO to a lesser extent. As stated by [39] IT has been adjudged to be an essential factor for the survival, success, and enhancement of various business organizations. The importance of IT in SCM cannot be undermined as information has always been the pivot in the management of most concerns [62]. On the aspect of quality management, [68] opined that for quality projects to emerge in a SC environment there is need to streamline all efforts towards the different areas with a view to enhancing quality from the end users point of view. [57] is of the view that the importance of continuous improvement processes with the SC entities as a measure for ensuring the satisfaction of all entities within the chain from the source point to the users by sharing information for purposes of improving the performance and effectiveness of the entire chain. The outcome of this exercise often leads to cost reduction, improved delivery time, improved quality and reduced inventory.

Performance in terms of cost, schedule, quality, fit-for-purpose, buildability as well other criteria could be enhanced if the various entities within a chain can adopt a collaborative method of working

together. In relationship development, trust is critical as it tends to eliminate tension while helping to build confidence. Trust and flexibility according precipitates innovation and skills sharing that would lead to some benefits to the SC entities. While for effective collaboration amongst the various SC partners there is need for relationship management and trust building as one amongst other key variables to be considered in entrenching a successful outcome.

Ensuring that there is trust amongst the supply chain partners and goal congruency are the next in the list of the highest ranked factors. These findings demonstrated that relationship management and trust are vital amongst the various SC partners if they must achieve their objective of delivering their construction projects via SCM hence benefiting from the outcome of the project. The findings from this study agrees with that of [62] who opined that the issue of trust is a major hindrance if not addressed prior to engaging in any collaborative commitment amongst SC partners. A mutual agreement based on trust is key to the integration of the activities of the various SC entities. For collaboration to ensue amongst SC parties, one of the key variables to be considered must include relationship management and trust building. Ability to deploy an order-to-cash process and tendency to achieve a visible purchase-to-order are the next in the list of the highest ranked factors. The findings from the study corroborates with that of [69] who stated that putting certain conditions on ground would assist to a greater extent to the successful delivery of a project. One of such conditions is the outlining of trade finance facility as a precondition to achieving a successful SC. SCF hinges on the activities of most organizations and most specifically it hinges on credit decisions, payment collections, financing, procurements and sales. Applying different quality standards such as ISO 9000 in achieving our project objectives and deploying Just-in-time and lean techniques in achieving our performance targets are the next in the list of the highest ranked factors. The findings from this study agrees with [58] findings which states that in a bid to achieve a proper performance measure amongst the SC linkages, there is need to deploy ABC and management techniques with a view to eliminating any non-value adding functions while also achieving the initially stated objectives of the project. [51] contend that continuous performance measurement is a fundamental ingredient for success in most organizations. It consists mainly of defect elimination, waste reduction, improving productivity and performance while also managing production time. Integrating the concept of quality management system throughout the entire supply chain and maintaining and sustaining an IT based and quality driven capability are the next in the list of the highest ranked factors. The findings corroborates with [66] findings which states that the quality of information dissemination within the entire SC activities would definitely lead to the success of SC activities which would invariably lead to the satisfaction of the end users. In order to instill quality within a SC entity, effort should be geared towards streamlining the various entities with a view to enhancing quality from the end users perspectives. While the results show that integrating Radio Frequency & Identification (RFID) technology in fast tracking construction activities on site has the least relative importance index (RII) of 0.95 and ranked fourth. Making use of mobile devices & personal digital assistants in supporting our activities is the next in the list of the highest ranked factor. The findings are in tandem with [26]. They opined that web based technologies are the most effective means of integrating effective SC in the delivery of most construction projects. CAD and other software application specifically in the areas of construction project management have helped in the reduction of cycle times, increased productivity and accuracy in construction project delivery. Notable amongst this software are primavera, enterprise information portals for multi-project visibility and other costing as well as scheduling modules. Laying more emphasis on delivery records of our suppliers and selecting few suppliers with a view to enabling effective communication and supplier relationship are the next in the list of the highest ranked factors. The findings from the study corroborates with that of [43] who stated that the type of service and price at which services would be rendered contributes in no small measure in producing high quality components that would be needed in the delivery of a project. As [44] opined that most innovative firms prune down the size of their suppliers to a reasonable few that have been adjudged to be the best after some rigorous form of scrutiny must have been conducted. We believe top management needs to motivate its employees

towards the realization of their objectives and top management needs to commit to the achievement of the concept are the next in the list of the highest ranked factors. The findings from the study agrees with that of [62] who are of the view that for optimum SC management to ensue, there is need for top management of an organization to continually implement policies that would stimulate the interests of all parties within the chain. [7] further opined that one of the vital functions of top management in any organization is to stimulate the entrenchment of values that would improve on the organization's performance. Commitment from employers and employees in achieving SCM and communication of the concept are the next in the list of the highest ranked factors. The findings from this study is in line with [48] who stated that communications and environmental pressures could lead to an organization fostering the acceptance of SCO in an organization. [45] further opined that SCO extends to a stage where there is some sort of predisposition amongst the different partners in a SC which ultimately would lead to the formation of an integrated whole. He further stated that if this orientation which is a management philosophy *per se* is implemented in an organization, would definitely lead to the manifestation of SCM philosophy within such an organization.

## **5.0 Conclusions**

From the results obtained, analyzed, and discussed, the study now concludes that; there is a general low level of awareness of the concept of SCM as applicable in the Nigerian construction industry. On the extent of involvement in CSCM related activity, we conclude that there were few response concerning the involvement of respondents in CSCM related activity 14.14%, while 53.10% were about to be involved and 32.75% have not yet been involved in any CSCM related activity. Findings from the case study organization also revealed some interesting features. CCC was found to have deployed majority of the SCM key features to a greater extent even though the response gotten from the respondents regarding their level of awareness of the concept was abysmally low. It is also surprising to state that most of the respondents were ignorant of the fact that they were applying some of the SCM techniques in the delivery of their construction projects. The study finally concludes that the most important feature for successful SCM construction project delivery includes; disseminating quality information across the various SC entities. This is followed in that order by deploying web based and other software and portals as well as the application of internet technologies in improving the effectiveness of construction, ensuring that the level of service and price offered by suppliers are better, applying activity based costing and management as a performance measure via the elimination of non-value adding activities across the chain, top management needs to continually implement policies that would stimulate the interests of all and sundry, relationship management and trust building, communication and environmental pressures from specialists and other professionals about the benefits of SCM and outlining trade finances as a pre-condition for successful supply chain finance.

In delivering construction projects successfully using the SCM approach, adequate attention and emphasis should be accorded to the following important (critical) features as they would aid in effecting the much needed success. Quality information dissemination across the entire chain should be accorded adequate attention as the quality of a construction project determines to a greater extent the level of success achieved by that project. The next in line is the deployment of web based portals, software and internet technologies in the execution of construction activities. This is very important as IT has revolutionalized the way things are done these days. To achieve quality and schedule effective construction project, the deployment of IT facilities is inevitable. It is incumbent on most of the local/indigenous construction firms to embrace IT if they must compete with the outside world effectively. In ensuring that professionals within the Nigerian construction industry get to know more about SCM concept as applicable to the construction sector, it would be necessary to create an awareness using professional associations platforms, international conferences and workshops to enlighten them on the benefits accruing from the deployment this concept judging from what obtains in other advanced

countries of the world where the concept has fully been embraced into the delivery of most modern day, cutting edged construction projects.

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