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CRITICAL SUCCESS FACTORS FOR ADOPTING SUPPLY CHAIN MANAGEMENT IN TANZANIAN CONSTRUCTION PROJECTS

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ABSTRACT

Supply chain management (SCM) has been effective in several industries, such as the manufacturing industry and agriculture. SCM is the active management of supply chain activities to maximize customer value and achieve a sustainable competitive advantage. Therefore, the adoption of SCM by construction businesses can help reduce delays, thereby improving their competitive advantage. The purpose of this study is to discover which critical success factors (CSFs) determine the successful adoption of SCM by construction projects, with the aim of filling the knowledge gap in the context of a developing country using a questionnaire. To achieve this, respondents were purposely selected from construction firms registered in Class 1 and 2 by the Contractors Registration Board of Tanzania. Out of 100 questionnaires distributed, 60 were returned filled in fairly well for analysis. The data was analysed using two features of IBM SPSS version 20, which are descriptive statistics-frequencies and Compare Means-One Sample T- Test. The findings reveal that the CSFs for adopting SCM bý construction projects were providing logistics at a lower cost and on-time delivery to clients, and having a centrally coordinated logistics function and top management's commitment and support. The findings mean that clients, contractors, sub-contractors, consultants and suppliers/manufacturers will need to rethink what CSFs determine the performance of construction projects using SCM, as knowing which ones are critical would lead to improved project delivery. This study contributes to the body of knowledge by providing insights into the CSFs that can be adopted by firms so as to successfully implement SCM in construction projects for sustainable construction businesses in Tanzania, which has not been explored.

Keywords: Construction, logistics, project, SCM, Tanzania

INTRODUCTION

The concept of SCM is widely used in manufacturing industries. The application of SCM, mainly in the manufacturing industry, has been successful and has achieved the expected benefits like reducing costs, maintaining a competitive advantage, improving productivity, adding value and creating better relationships between parties (Sospeter et al., 2019; Kocoglu *et al*., 2011). Unlike other industries, construction is a business where a number of fragmented actors, such as the main contractor, consultant, sub-contractor and suppliers, are given contracts to supply goods and services in order to provide the customer (construction client) with a designated product. Since SCM is an approach to management, it is relevant because the key supply chain participants, comprising clients, consultants, main contractors, sub-contractors and suppliers, must work collaboratively (i.e., having joint risk management, using collaborative tools for sharing information and being transparent during construction and throughout the project life cycle so as to reduce performance-related problems, thereby giving construction clients value for money). Although Tanzania wants to remain competitive in the world, it is still faced with a number of challenges (Sospeter *et al.,* 2019; Nguyen *et al.,* 2018), which have led to unreliable time schedules for projects, low productivity, cost and time overruns, and disputes resulting in claims and time-consuming litigation in many building projects. Delays in a project have been acknowledged as the major cause of performance-related problems facing building projects in Tanzania. The main reason for delays in construction projects is supply or procurement problems

(Kikwasi, 2012), which implies that an improvement in SCM is greatly needed to enhance the performance of the construction industry.

Despite the growing need for SCM in the construction industry, not much is known about the CSFs for adopting it. The knowledge and practice of SCM vary widely among industries. Therefore, knowing about CSFs for adopting SCM will help to improve the performance of projects in the Tanzanian construction industry and encourage partnership for sustainable development, because SCM in construction projects can help to reduce delays. This will give construction companies a competitive advantage, ensure customer satisfaction, reduce cost overruns and improve the delivery of construction projects. The goal of SCM is to synchronize clients' requirements with the flow of materials and information so that a balance is reached between clients' satisfaction and costs, which is necessary for making the project successful (Kocoglu *et al*., 2011; Jagtap and Kamble, 2019). Unlike other industries, in construction, products are derived from the requirements of the customer, who then finds the main contractor who can meet their demands. The main contractor will then find the sub-contractors and suppliers to help them complete the project. This process needs effective partnership for sustainable development as it continues to create a construction supply chain by engaging all key participants to create the final product.

With the increasing global competition, construction firms in Tanzania need to focus on new ways of improving productivity through adopting SCM to meet global standards. The CSFs for integrating SCM will probably cause the project to be successful. Handfield and Nichols (2003) argue that SCM is becoming recognized as a core competitive strategy. It is aimed at synchronizing a set of activities, from designing the construction that a client has demanded, procuring materials and workers, and executing and coordinating the work to delivering the project through the flow of information, logistics and cash to form a construction network with architects, sub-contractors and suppliers to ensure the value of the end product (Khalfan *et al.*, 2003). Although SCM has been in existence for over twenty years, its complexity and the difficulties in adopting the concept make it challenging for academicians or practitioners to understand and implement (Ying *et al.,* 2017), which is similar to the concept of CSFs, as there is no established framework to determine them. Nevertheless, SCM is the basis of firms' competitive advantage and is a successful strategy, implementation of which benefits firms in terms of increased customer satisfaction, market share and profitability (Tan, 2001).

A number of studies in other countries have discussed SCM, its role in construction projects, its benefits and challenges, and factors affecting its application and strategies (McDermott and Khalfan, 2012; Tucker et al, 2001; Vrijhoef and Voordijk, 2003; Nguyen et al., 2018). For example, in the Japanese construction industry, an integrated approach to projects is common in establishing a long-term relationship between the contractor and sub-contractor (Ireland, 2004). Other authors include Papadopoulos et al. (2016), Jagtap & Kamble (2019), Segerstedt and Olofsson (2006), Hassan, (2018) and Ying et al. (2017), the majority of whom focused on developed countries, with few focusing on developing countries. For instance, the available studies are the potential of SCM in building projects in Tanzania (Hassan, 2018) and SCM in construction projects (Remmy, 2018). Addressing the issue of logistics to balance cost and performance will enable the industry to improve its performance. There is a need for specific studies, especially on stakeholders in sub-Saharan Africa, focusing on CSFs as another dimension for adopting SCM to deliver construction projects in Tanzania. However, the few studies available focus on integrating the supply chain in other industries such as agriculture (Hasenklever, 2016) and timber production (Ochieng and Price, 2009). This study is relevant to the Tanzanian construction industry because it differs from other industries in terms of the nature of activities, characteristics of the industry, the business environment, procurement system and products/services.

LITERATURE REVIEW

Although there are different definitions of a supply chain, a typical one comprises the supply of materials, information and services, and procuring links that enable the client's demands to be met. In that way SCM involves integrating all the activities through good relationships along the supply chain to achieve a competitive advantage (Kocoglu *et al*., 2011). Generally, it means coordinating the activities of everyone involved in the supply chain so that the client is satisfied with the product that has been delivered, and the costs of the organization applying the SCM principles are reduced.

2.1 Characteristics of construction supply chain

Unlike the manufacturing industry where multiple products pass through the factory and are distributed to many customers, a construction project has only one client to satisfy. Creating a supply chain for the construction industry is complicated, with the result that the construction supply chain is typified by instability and fragmentation, especially when the design and construction of a building are separated. There are two schools of thought with regard to the SCM in the construction industry. First is the logistics theory concerned with reducing waste through efficient management of the supply of materials to the construction site, whereby suppliers are viewed as clusters of sub-contractors around the main contractor (Kocoglu *et al*., 2011; Asad et al. 2005). In this regard, Bertel et al. (2008) concluded that productivity is increased when building materials needed at the site are delivered on time. The second is promoting and coordinating the supply chain parties in a project (O'Brien et al.2002), as the construction supply chain has been characterized as project-based, (Koskela and Vrijhoef, 2000; Cheng et al., 2010; Gosling et al, 2014), a network (Aziz and Hafez, 2013; Vrijhoef and Voordijk, 2003) and forecasting demand (Gosling et al., 2013; Olhager, 2003).

2.2 Reasons for implementing SCM

SCM is implemented more by private construction firms than public ones in Tanzania (Remmy 2018). Hassan (2018) found that SCM practices in Tanzania's construction industry go through the five stages of bidding, sourcing and procuring materials, constructing and assessing the challenges each phase faced and the factors that led to success. SCM is adopted so that the contractor, sub-contractors and suppliers understand what the client needs and are committed to meeting them, the designers participate fully throughout the construction process, and the contractor has regular contact with the suppliers, so that all involved in the supply chain pass on information about the project on time. Hassan (2018) states that contractors are greatly aware of the need to integrate key aspects and members of the supply chain to deal with its fragmented nature, which is why Kocoglu *et al (*2011) stressed the need for everyone involved in the supply chain to be quick to share information. Duncan (2001) stated that, before starting a project using SCM principles, all members of the senior management team should state their commitment to it. Early in the implementation phase of a project, logistical performance should be measured. Communication is key driver to success and the information technology system should not be an excuse for not proceeding in other areas.

Fawcett & Magnan (2003) researched on the bridges when implementing advanced supply chain practices. They contend that the most common bridges that can help overcome barriers and improve SCM are senior and functional management support, open and honest information sharing, accurate and comprehensive measures, trust, synergistic alliances, aligning and rationalizing the supply chain, experienced managers, good measurement and documentation systems, low inventory-driven costs, education and training and effective use of pilot projects (Fawcet & Magnan, 2003; Nguyen *et al.,* 2016). Some reasons for implementing SCM are that there is the sharing of information, teamwork, top management support, feedback, and partnership with suppliers (Ying, et al. 2017), who further noted that numerous factors need to be considered by a firm for successful implementation of supply chain principles, from selecting strategies that are aligned with business requirements to defining the critical processes needed to execute the strategy. Nothing can be implemented without the right persons with the competence to support development and execute supply chain processes (Kocoglu *et al*., 2011).

An effective measurement system is also a prerequisite as it provides good support for monitoring operational performance. Azfara et al (2014) identified antecedents to measure performance of the supply chain, which are inventory level, quality, satisfaction, operational performance in terms of time and cost, environmental cost and cash-to-cash cycle (economic performance), and business waste (environmental performance). Using these antecedents, they proposed a performance measurement conceptual framework for existing supply chain paradigms. Without honest collaboration between the parties in the supply chain, the benefits in terms of lower costs, flexibility and service level are difficult to achieve. To implement SCM is a complex task as it requires professional management and a good relationship between partners in the supply chain. To achieve this, using an external consultant may be crucial to overcome all the implementation barriers (Fawcet & Magnan, 2003). Nguyen et al. (2016) state that logistics play an important role in establishing a supply chain, which will lead to improved business performance. They further noted that outsourcing in SCM is significant for the opportunities and risks involved.

Various studies have been conducted on CSFs for implementing SCM. Kumar et al. (2015) determined CSFs for implementing SCM in Indian SMEs as top management commitment, development of an effective SCM strategy, resources devoted to the supply chain, logistics synchronization, using modern technologies, sharing information with supply chain members, forecasting demand based on point-of-sale, developing trust between supply chain partners, just-in-time capabilities in the system and reliable suppliers, having a flexible production system, focusing on core strengths, and having a long-term vision for survival and growth. Ab Talib et al. (2015) revealed that the CSFs for implementing SCM are the use of information technology, top management commitment, partnership/integration, service quality, processes, resource capability, government intervention, skilled employees and trust. Hariharan et al. (2019) stress the involvement of top management, collaboration with supply chain partners, sharing information, using sophisticated technologies, a less rigid production system, competitive priorities, long-term goals, product differentiation and innovation and inventory management as CSFs for implementing SCM in SMEs. Chau et al. (2021) investigated improving management of the supply chain and found that significant factors were focusing on the customer, the quality of the information technology, increased collaboration among supply chain members, process integration and leadership.

Most of the factors for implementing SCM are generic and some come from the manufacturing industry. The methodology used for studying these factors are somewhat different from that of this study. For instance, Ab Talib et al. (2015), Ying et al. 2017) and Jagtap and Kamble (2019) used case studies and a literature review. Due to the temporary nature of the construction supply chain, its instability and fragmentation, and the fact that each project is unique, a specific study was needed on critical success factors for adopting SCM in the construction industry.

METHODOLOGY

Supply chain management is a relatively new approach to delivering projects in the construction industry. This is a descriptive study seeking to reveal the CSFs that can enhance adoption of SCM in construction projects. The population of this study is 377 Class one and two contractors registered by the Contractors Registration Board of Tanzania located in Dar es Salaam at the end of 2019.

A sample size of 100 was estimated using the Yamane Formula (1967) with 10% precision level, and since class one and two are a homogenous group (Singh and Masuku, 2014) a small sample size was adequate for this study. Purposive sampling was used to select the respondents for the study, which was deemed appropriate because they were hand-picked due to the researchers' first-hand knowledge of contracting firms (Saunders *et al.,* 2016). Data was collected using a literature review and questionnaires. The information gathered from the literature review guided the design of the structured questionnaire (Saunders *et al.,* 2016), which was divided into two distinct sections:

- ***Section 1*** sought to obtain general background information of the Class one and two contractors involved in the study and assumed to have been part of SCM practices. The questionnaire had closed questions on CSFs, the age, sex and experience of the respondents and the class of contractor. To enable cross-comparative analysis as part of a robust data protocol, the responses were nominally coded so that they could be entered into one of the categories prepared beforehand.

- ***Section 2*** comprised the rating and ranking of the 48 reasons for implementing SCM, from which CSFs are determined. Reasons for implementing SCM from the literature were included in the questionnaire sent to the respondents.

- The questionnaire had mainly closed questions on reasons for adopting SCM and on the respondents' profession, sex and experience, and the class of contractor. Forty-eight reasons for implementing SCM extracted from the literature and the CSFs were rated, for which a 5-point Likert scale was used. Implementation was rated as 5=Highly implemented, 4= implemented, 3= implemented on average, 4=rarely implemented and 1=

not implemented, while CSFs were rated as 5= Very Critical; 4= Critical; 3= Average; 2= Low; and 1= Not at all. Out of 100 questionnaires distributed, 60 were returned fairly filled in for analysis. Data was analysed using two features of IBM SPSS version 20, which are descriptive statistics-frequencies and Compare Means -One Sample T-Test.

RESULTS

Respondents' information

Figures 1 to 4 present respondents' information, showing that the majority were quantity surveyors (43.3%) followed by engineers (31.7%) and procurement officers (10%), while 15% were project planners, project managers and accountants. Males comprised 76.7% and females 23.3%. The respondents' experience was remarkable with most of them having experience of 6-10 years (40%), followed by over 10 years (33.3%). The study was dominated by contractors registered in class one (86.7%) with the rest in class two (13.3%).

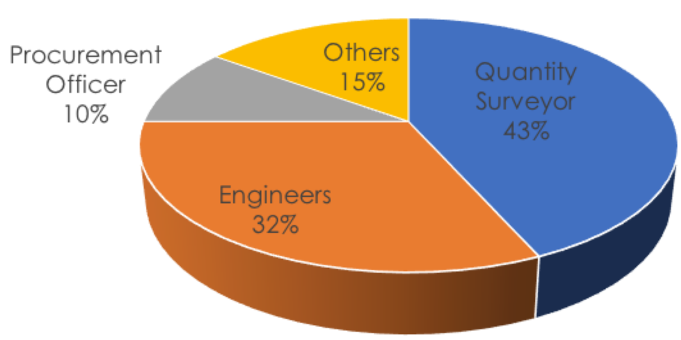

Figure 1: Professional status of respondents

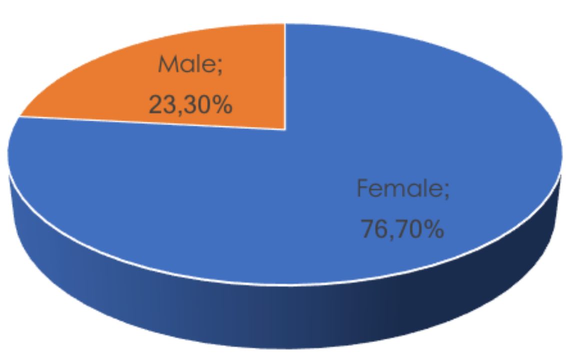

Figure 2: Sex of respondents

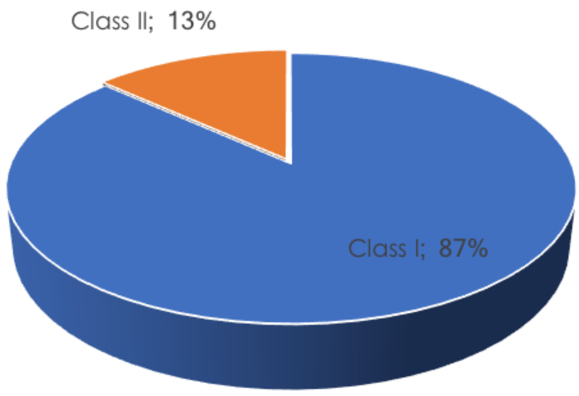

Figure 3: Class of contractors

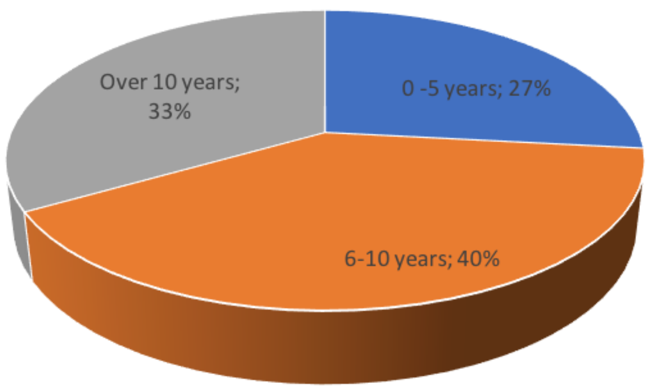

Figure 4: Experience of respondents

Implementation of SCM in construction projects

Figure 5 presents the implementation of SCM in projects undertaken by the firms that participated in the study, indicating that the majority (98.3%) implement SCM in their firms. This result is important for identifying CSFs for successful adoption of SCM in construction projects. To ascertain the extent of implementation, descriptive analysis of factors was done as indicated in Table 1.

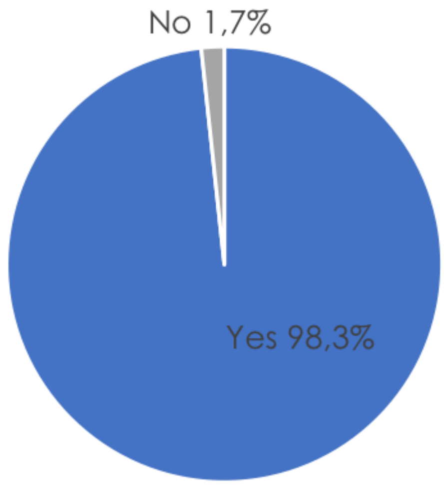

Figure 5: Implementation of SCM in projects

Table 1 presents 48 factors for implementing SCM. The results indicate that six (6) were the most implemented (MS=4.00≤5.00); twenty-four (23) were implemented (MS =3.5≤3.9) and nineteen (19) were implemented on average (MS 2.50≤3.4).

Table 1: Descriptive statistics

SCM Factors	N	Mean	Std. Deviation	Std. Error Mean	Rank
Most implemented					
Provide logistics at lower cost	59	4.25	0.733	0.095	**1**
Provide on time delivery to customers	59	4.05	0.775	0.101	**2**
Have a centrally coordinated logistics function	59	4.03	0.718	0.094	**3**
Top management Commitment and support	59	4.00	0.947	0.123	**4**
Supply chain performance contributes to cash-flow	58	4.24	3.957	0.52	5
Planning and involving customers and stakeholders in demand management	56	4	1.062	0.142	6
Implemented					
Just in time (JIT) delivery	58	3.95	0.804	0.106	7
Inter-organization information systems to coordinate integrate the entire Supply chain	57	3.93	0.799	.106	8
Teamwork and inter-organizational coordination	60	3.88	0.976	0.126	9
Deliveries in full and on time to customers	56	3.86	0.841	0.112	10
Effective use of ERP & MRP systems	58	3.83	1.172	0.154	11
Just in time manufacturing	59	3.81	1.008	0.131	12
Responsiveness to meet engineering changes	56	3.77	0.894	0.119	13
Monitoring and measuring customer service level	56	3.73	0.904	0.121	14
Intra-organizational information coordination and sharing	59	3.71	0.852	0.111	15
Company-wide coordination and management of inventory	58	3.71	1.043	0.137	16
Superior quality services compared to competitors	56	3.71	0.909	0.121	17

A 360-degree view of customer needs and performance	56	3.68	0.897	0.12	18
Vendor managed inventory at production sites	57	3.63	0.938	0.124	19
Partnership with suppliers	60	3.62	0.993	0.128	20
Information sharing with supply chain partners	59	3.61	0.929	0.121	21
Sell-through information (point of sales data) from distributors, partners and retailers	57	3.6	0.961	0.127	22
A process to manage customer dissatisfaction returns	55	3.6	1.011	0.136	23
Low inventory driven costs	54	3.59	1.037	0.141	24
Optimizing supply chain via Efficient Customer Response (ECR) System	59	3.58	0.875	0.114	25
Supply chain performance is continuously improving	57	3.58	0.823	0.109	26
Outscoring of non-core manufacturing activities	56	3.57	0.892	0.119	27
Customers are very satisfied with our supply chain capabilities	54	3.54	0.946	0.129	28
There is high employee morale and productivity	57	3.53	0.928	0.123	29
Implemented on average /low					
Effective management of customer complaints	57	3.49	0.826	0.109	30
Effective use of internet to manage business to business commerce	59	3.47	0.878	0.114	31
Cycle times from supplier to customer delivery are excellent	57	3.47	0.928	0.123	32
Effective use of internet to manage business to consumer commerce	56	3.45	0.807	0.108	33
Collaboration and bidding for parts and commodities via the internet	56	3.43	0.97	0.13	34
High utilization of employees' skills and abilities	58	3.38	0.933	0.123	35
Quick resolution of industrial disputes	56	3.38	0.885	0.118	36
Eliminating non-value layers like wholesalers in the supply chain	58	3.36	0.931	0.122	37
Supply chain cost is low compared to competitors	57	3.35	0.876	0.116	38
Company-wide purchasing contracts for best pricing	58	3.34	1.001	0.131	39
Employees are involved in supply chain management	59	3.32	0.84	0.109	40
Regional distribution centers for product distribution	55	3.31	0.9	0.121	41
Product design for environmental and recycling needs	58	3.31	0.94	0.123	42
Product customization or postponement to meet customer needs	55	3.29	0.875	0.118	43
Employees are trained in supply chain concepts and management	56	3.23	0.953	0.127	44
Employees are empowered to make decisions and changes	58	3.19	0.982	0.129	45
Focus on reducing the number of suppliers	58	3.16	0.834	0.109	46
Automated ware house management systems (Automatic storage and retrieval system)	58	3.12	0.919	0.121	47
Effective use of multiple media to manage customer relationships	56	2.95	1.212	0.162	48

Notes: [a] mean score of the CSFs where 5= most implemented; 4=implemented 3=implemented on average 2= implemented low; 1= not implemented. The higher the mean score the more critical the SFs;

Testing for normality

Figure 6 and Table 2 present the test for normality on distribution of the 48 factors for implementing SCM in construction projects. The results in Figure 6 indicate the frequency of responses against their mean scores and it shows that 56 out of 57 responses are valid, with a mean score of 3.4 and standard deviation of 0.519 and were normally distributed, while only one outlier was identified as indicated on the normal distribution curve. This implies that SCM is highly implemented in most construction firms. Nonetheless, the outlier means that one firm has not implemented SCM with a mean score of less than 3.

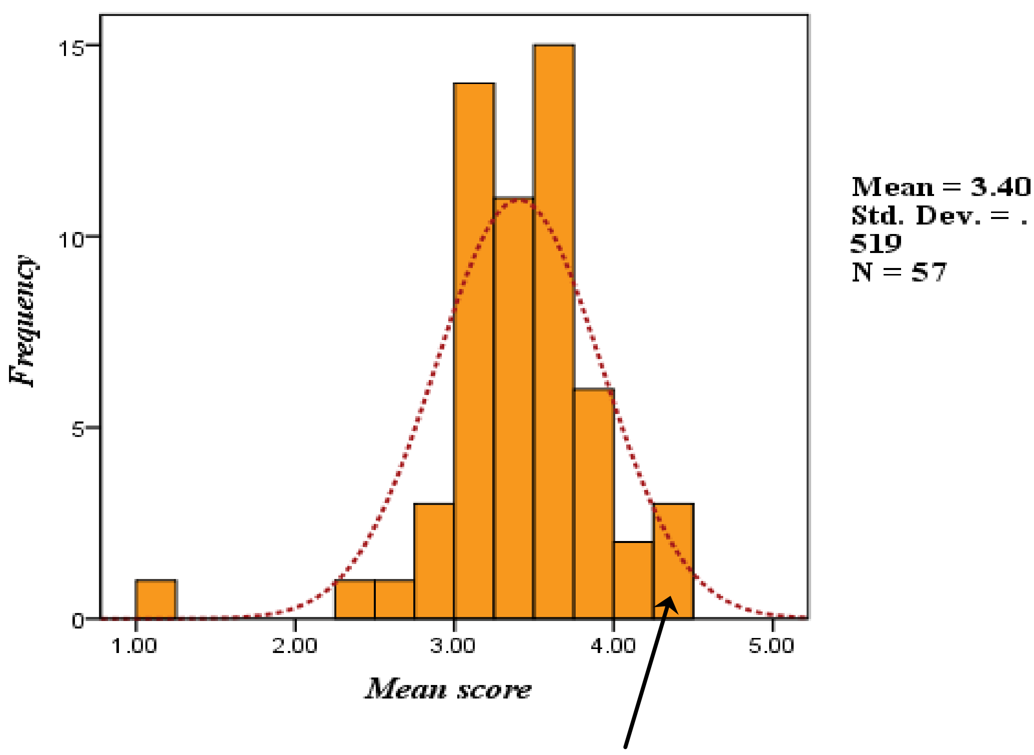

Figure 6: Normal distribution curve of Respondents

The results in Table 2 reveal that 57 responses are valid while 3 are invalid. Since both Shapiro-Wilk and Kolmogorov-Simonov (Sig.) values are greater than 0.05, it implies that the mean score of responses is normally distributed. Thus, a parametric test (One sample T-test) was employed to test for CSFs for implementing SCM in construction projects.

Table 2: Testing for normality of factors for SCM implementation

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
Mean Score	.181	57	.200	.925	57	.077
a. Lilliefors Significance Correction						

Critical success factors for adopting SCM in construction projects

Table 3 presents the One Sample T-Test that reveals the significant factors to be grouped as Critical Success Factors (CSFs) for adopting SCM in construction projects. On assessing the critical parameters, out of 48 only 20 factors were rated on the 5-point Likert scale provided. The results indicate that the CSFs for adopting SCM in construction projects are to provide logistics at a lower cost (t=5.282) .000 < 0.005, have a centrally coordinated logistics function (t=3.036) 0.004 < 0.005), deliver to clients on time (t=2.981) 0.004 < 0.005 and top management commitment and support (t=2.028) 0.0047 < 0.005.

Table 3: One-Sample T Test

S/N	Variables	Test Value = 3.75					
		t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
						Lower	Upper
1	Provide logistics at lower cost	5.282	58	**.000**	.504	.31	.70
2	Have a centrally coordinated logistics function	3.036	58	**.004**	.284	.10	.47
3	Provide on time delivery to clients	2.981	58	**.004**	.301	.10	.50
4	Inter-organization information systems to coordinate integrate the entire Supply chain	1.700	56	.095	.180	-.03	.39
5	Optimizing supply chain via Efficient Customer Response (ECR) System	-1.525	58	.133	-.174	-.40	.05
6	Top management Commitment and support	2.028	58	**.047**	.250	.00	.50
7	Teamwork and inter-organizational coordination	1.058	59	.294	.133	-.12	.39
8	Deliveries in full and on time to customers	.954	55	.344	.107	-.12	.33
9	Supply chain performance is continuously improving	-1.570	56	.122	-.171	-.39	.05
10	Customers are very satisfied with our supply chain capabilities	-1.654	53	.104	-.213	-.47	.05
11	Supply chain performance contributes to cash-flow	.946	57	.348	.491	-.55	1.53
12	Open and honest information sharing with supply chain partners	-1.156	58	.252	-.140	-.38	.10
13	There is high employee morale and productivity	-1.820	56	.074	-.224	-.47	.02

14	Sell-through information (point of sales data) from distributors, partners and retailers	-1.206	56	.233	-.154	-.41	.10
15	Company-wide coordination and management of inventory	-.315	57	.754	-.043	-.32	.23
16	Vendor managed inventory at production sites	-.953	56	.345	-.118	-.37	.13
17	Low inventory driven costs	-1.115	53	.270	-.157	-.44	.13
18	Outscoring of non-core construction activities	-1.499	55	.140	-.179	-.42	.06
19	Just in time construction	.484	58	.630	.064	-.20	.33
20	Responsiveness to meet engineering changes	.149	55	.882	.018	-.22	.26

DISCUSSION

This study examined various reasons for adopting SCM in construction projects in Tanzania. Looking at the mean scores, the top 10 reasons for implementing SCM are that logistics cost less, the cash-flow is better, the delivery to customers is on time, the function is centrally coordinated, top management are committed to support it, customers and stakeholders are involved in planning for and managing demand, just-in-time delivery, the information system is coordinated and integrates the entire supply chain, and teamwork ensures that the building project is completed on time to the customer's satisfaction. These findings are similar to those of McDermott and Khalfan (2012), Ying, et al. (2017), Kumar et al. (2015), Ab Talib et al. (2015), Hariharan et al. (2019), Chau et al. (2021)

Regarding the CSFs for implementing SCM in construction projects, the focus of this study, four factors were statistically significant. These are to provide logistics at lower cost, to have a centrally coordinated logistics function, on time delivery to customers, top management commitment and support, teamwork and inter-organizational coordination. The four CSFs are discussed below.

Provide logistics at lower cost and have centrally coordinated logistics function

A coordinated logistics function at lower cost was ranked the first of the CSFs for adopting SCM. The finding is supported by the conclusion that construction logistics are thus an essential part of construction SCM in terms of both cost and project management (Ying et al., 2017). Logistics form a substantial part of construction projects, particularly in transporting materials, equipment and other goods required for the project. A centrally coordinated function is acknowledged by McDermott and Khalfan (2012) that one of the features of an integrated construction supply chain is that it is centrally coordinated and the relationship between firms is maintained during a specific project period and beyond. Some studies recognize the importance of logistics as part of SCM in the construction industry, supporting this finding. Aneesa et al. (2015) cite a low level of logistical competence as one of the obstacles to adopting SCM in the construction industry. Nguyen et al. (2018) cite the problem of insufficient resources to integrate processes and manage logistics in a one-off project for not adopting SCM. Similarly, Al-Werikat (2017) discloses poor logistics planning as among the challenges of SCM in the industry. Duncan (2001) proposes that introducing a logistic performance measurement early in the implementation phase of the project influences project delivery. Ying et al. (2017) stress the need to provide low-cost logistics by revealing that a small cut in transport costs can have a positive effect on profits. Vidalakis et al. (2011) found that logistics costs are exponentially related to the level of demand for materials and the number of vehicle movements. Koskela and Vrijhoef (2000) established that the extra cost of site logistics in one of the cases studied was due to the extra handling and transport of materials on site. There is general agreement (Koskela and Vrijhoef, 2000) that cost savings would be realized if contractors and suppliers co-operated to identify joint opportunities to improve logistics.

On-time delivery to customers

On-time delivery was ranked second of the CSFs for adopting SCM. Other studies report that delivery performance provides an indication of the supply chain's potential for providing products and services to the customer (Rao *et al.,* 2011), showing that the timely delivery of materials, equipment or goods to a the site of a construction project is vital for its performance. SCM is thought to contribute to an improvement in the performance of construction projects due to the long-term working relationship which is expected to improve delivery. Papadopoulos et al. (2016) state that the benefits of SCM to the industry are on-time delivery, improved productivity, value creation, repeat business with key clients, greater confidence in long-term planning and better relationships between parties. The benefits of SCM for end-users and project clients include a more responsive industry that delivers facilities with no defects on time, meeting users' needs. Koskela and Vrijhoef (2000) reveal that sub-processes of SCM are slowed down due to delays in the inventory. Gosling et al. (2013) reveal that early or late deliveries is one of the sources of uncertainty in the construction supply chain.

Top management Commitment and support

Top management commitment and support was ranked third of the CSFs for adopting SCM. The finding is consistent with other researchers who assert that the involvement of top management is seen as an engine in any organization's undertaking (Sospeter *et al.,* 2020), and Kumar et al. (2015), Ab Talib et al. (2015), Hariharan et al. (2019), Chau et al. (2021) stress the importance of top management support for the successful implementation of SCM. Other studies (Duncan, 2001; Fawcett & Magnan, 2003; Sarvnandan, 2004; Ying, *et al.*, 2017) have indicated that top management's commitment is an important component of SCM adopted by the construction industry. Similarly, Nguyen et al. (2016) cite lack of top management commitment as one of the factors preventing the adoption of SCM by the construction industry. This implies that, if SCM is to be adopted for construction projects, decision makers, consultants and contractors need to be fully committed and obtain the resources needed for them.

CONCLUSION

This paper sought to determine the CSFs for adopting SCM in construction projects that will contribute to ensuring that projects are delivered on time. CSFs are essential internal aspects that are influenced by the industry, the firm, the manager, and the environment. This study focused on the areas of logistics, on-time delivery to clients, teamwork and the involvement of top management in adopting SCM. Logistics means having an integrated function that involves all partners in the business and ensures low costs on and off the building site. Timely delivery is seen as an important factor in undertaking a project, as materials, components or goods have to be delivered within a specified timeframe. Top management commitment and support is again an important factor as their involvement will ensure that all the resources required for adopting SCM are supplied. This paper provides insights into the CSFs that can be adopted by firms for the successful implementation of SCM in construction projects to achieve sustainable construction businesses. The findings also imply that clients, contractors, sub-contractors, consultants and suppliers/manufacturers need to rethink what CSFs would improve the performance of construction projects through adopting SCM. An understanding of which factors are critical would lead to improved project delivery in the future and minimize problems which may arise due to inefficient SCM.

Whilst this research makes significant contributions to academia and practice, limitations in terms of *sampling and geographical scope* are acknowledged. The respondents were drawn from one geographical location only, namely Tanzania, in sub-Saharan Africa, and the sample was limited to Class I and II contractors. Therefore, the findings may not be generalized to other industries or to organizations operating in other countries. Furthermore, the research was limited in its scope to the adoption of SCM in Tanzania, focusing on building projects, and so the results are influenced by the nature of the activities, stakeholders' involvement and the procurement system of organizations. However, it is the authors' belief that developing countries with similar activities, socio-economic conditions and business set-up could benefit. Future studies should be conducted and extended to other supply chain players in other regions with an emphasis on organizations operating in different industries and countries with the same socio-economic and business environment.

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