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TABLES CONTENTS

Stakeholders' Perception of the Impacts of Supply Chain Management on Tanzania Construction Projects' Performance

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Abstract

The current era that is characterised by growth in science and technology, free market beyond borders and globalization effects has compelled every construction industry globally to struggle to resolve the increasing and overwhelming challenges raised by increase in clients' demands and needs. The rise in demands and needs has led to a serious worldwide competition of which the construction industry and firms in particular from emerging economy countries can no longer escape from. In the domestic competitive atmosphere, construction competitors have attempted to identify the strategic competitive environment and potential adaptable market features targeting to lower unnecessary construction costs and time overrun, improving quality, safety, and environmental sustainability while attaining value for money. Thus, to tolerate within a global competition environment, supply chain management has been pointed to ease the construction projects' performance. This study aimed at examining the impacts of supply chain management on construction projects' performance. One hundred thirty-eight (138) respondents were randomly sampled from three cities in Tanzania. Primary data were collected using a structured questionnaire, and the data were analysed descriptively. An exploratory factor analysis was performed to validate the questionnaire. Afterwards, confirmatory factor analysis (CFA) was conducted, and structural equation modelling (SEM) technique was used to determine the validity of the study. The Statistical Package for Social Science (SPSS) was used to analyse the data. The findings provided pragmatic factors necessary for improving construction projects' performance. Also, it was found that fourteen supply chain impacts had a positive significant contribution to improving the construction projects' performance. Moreover, the findings showed direct and statistically significant influence of supply chain management on collaboration, integration, risk sharing and management as well as configuration. Thus, the findings suggested that supply chain management cannot be isolated from other potential factors when one needs to attain an adequate construction project's improved performance. Both social and practical implications of the study are recommended to construction industry practitioners and policymakers in Tanzania to understand the impact of supply chain management on construction projects' performance to enhance performance improvement. Therefore, increased use of

information technology (IT) in supply chain management is recommended to improve construction projects' performance.

Keywords: Supply Chain, Supply chain management, construction industry, Construction Project, Performance

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1.0. Introduction

The construction industry is one of the main sectors and a significant driver of the global scale economic development. Despite its fundamental importance including being a basis for strategic plans of most countries, it is mentioned to face various challenges globally including lack of qualified workers (Ceric, A. and Ivic, I., 2020), and projects delivery delay resulting from a frequently construction time extension that leads to a negative impact on successful completion of construction projects (Aiyetan, O. and Dillip, D., 2018). Also, it involves high construction costs ending in poor quality projects performed (Karimi, H., 2018). In a similar vein, the construction industries of developing countries have been faced with similar problems such as poor site supervision, poor management skills of staff and contractors, conflict with subcontractors, low project planning knowledge, late construction materials procurement, ineffective communication channels among project stakeholders, financial difficulties and poor financial flow, unrealistic timeframe and contractor inexperience (Yazan, 2021), to mention a few.

To date, no matter whether any research or studies will be published recently concerning the performance of local contractors in Tanzania's local market, there will be no doubt about the findings concluding by showing the never-ending inadequate performance of the firms in particular and the construction industry in general. To date, most construction projects in Tanzania have remained occupied with overwhelming challenges including health and safety issues, disputes, poor quality of completed works, high competition from foreign firms, time and cost overrun, lack or inadequate resources supply at the site, failure to attain value for money, low-profit gain, historical poor performance (Tekka, 2021) as well as lack of collaboration, coordination and faith among several supply chain stakeholders (Gimenez, C. et al., 2012). To solve the challenges, potential strategies, innovativeness, and creativity, as well as value-activity planning were observed among the features to facilitate firms to attain competitive advantages

(Nugroho,N. et al, 2021). Therefore, firms are urged to struggle to find solutions to increase their market shares and competitiveness, attain adequate performance in terms of reasonable construction time, and cost while attaining value for money. One aspect for increasing competitiveness is managing the SCM. Moreover, since many construction industries (CI) from emerging economies have been observed to be the most complex, fragmented, time-sensitive, and resource-intensive industries (Weingaertner, C. and Moberg, A., 2014), the situation has necessitated the need for the adoption of SCM practices to help improve the performance of the construction sector (Ghufran, M.et al., 2021).

Similarly, over the past decades, the theory and model of business management have undergone profound significant development changes to reduce the challenges in business. The changes have absolutely changed the tradition to new ways and or approaches of doing business. The newly discovered approaches include lean, agile, strategic management, and business process reengineering to mention a few. However, supply chain management (SCM) is undoubtedly among the newly emerged and rising management approaches believed to facilitate business growth across various sectors globally despite its low significant consideration (Shekarian,E. et al., 2022).

Essentially, most local construction firms have started to think about ways to tackle the challenges to attain better performance, reduce accidents, attain quality, and save more costs to achieve better financial performance (measured through quality performance and value added end products or services, efficiency, effectiveness with value for money) than before. Thus, it is through this tone that the importance of the supply chain in construction projects' performance has recognized (Lee, 2021). Currently, many challenges in business and in the construction industry, in particular, which are underlined and considered to bring negative impacts on firms have become increasing but others have been forgotten. One of the problems that could never be ignored is the effects of supply chain management (SCM) in construction projects. The concept and philosophy of SCM is increasingly conquering much global attention in business as it facilitates the creation of a significant role in different sectors such as manufacturing industry, transportation, services, fast-moving consumer goods and services, medical, water, and goods, etc. (Fu,Q. et al., 2022). However, very little of its occupation has been covered in the construction industry. Thus, this study aims to examine the impacts of sustainable supply chain management on construction projects' performance.

Lambert (2005) defined a Supply chain (SC) as a network alignment of companies or firms towards getting the products or services to market (Lambert, D., 2005). The supply chain is therefore considered as a fundamental and major value activity of any business entity associated with goods and services delivery to customers. Moreover, Chow, D. and Heaver, T. (1999) describe a supply chain as a group of manufacturers, distributors, suppliers, retailers, and transportation, information, and other logistics management service providers engaged in providing goods to end users famously known as consumers (Chow, 1999). Furthermore, Mentzer, J. et al. (2001) added that supply chain directly involves a set of entities (either individuals or organizations) in the supply and distribution flows of goods, services, finances, and information from the source to a destination representing a customer (Mentzer, J.et al, 2001). Thus, a supply chain can be considered as a connected set of resources with various value-added processes and extends through finished goods delivery process to the final users. It generally encompasses goods manufacturers, suppliers, transporters, warehouses, wholesalers, retailers, intermediaries, and customers to name a few. However, the supply chain involves three fundamental processes including procurement, production and distribution in which the combination of these processes is referred to as Supply Chain Management (SCM).

Supply Chain Management (SCM) started later, grounded after the concept of integration and coordination of different functional units. It increased steadily in the 1980s when various firms recognized that they could not compete successfully lonely while isolated from their suppliers or other entities in the supply chain. Despite the popularity of SCM in academic and business environments, the concept has remained a substantial misperception concerning its definition. Various scholars and academicians have considered various elements in defining SCM (Attia, A., 2018). While researchers have viewed SMC as an operational term involving the raw materials and product flows from one point to another, others have observed it as a management philosophy and regarded it as a management process. More precisely others have considered it as an integrated system (Zhang,X., 2022). In the past decade, various scholars have published various volumes researching extensively on SCM and its application that have given a number of definitions of SCM as noted from different works of literature (Attia, A., 2018).

Supply Chain Management (SCM) is noted to be not only a legacy of academic topic but also a young and nascent subject grounded later after the concept of integration and coordination of different functional units. The SCM concept has been identified as important due to the changes that occurred in the renewed

business environment including globalization, severe competition, increased customer needs and expectations depending on technological advancement as well as geopolitical factors (Piprani, A. et al., 2020) to mention a few. Consequently, SCM is considered an important firm's management approach to assist in determining the business successes or failure. Thus, SCM originated by explaining the range of activities executed by an organization during procuring and management of supplies. Despite the popularity of SCM in academic and business environments, the concept has remained a substantial misperception concerning its definition. In the past decade, various scholars have published various volumes researching extensively SCM and its applications that have given a number of definitions of SCM as noted from different works of literature (Attia, A., 2018) that have concluded to constitute multiple elements (Attia, A., 2018). Lambert et al. (2005) defined Supply chain management (SCM) as an alignment of firms that bring products or services to market (Lambert, D., 2005). Moreover, supply Chain Management (SCM) can be described as an important logistics when one needs to conduct business and its effects can be felt directly by the customer due to price increases caused by a scarcity supply of goods and or services. Conversely, a SCM entails management of the supplier base and determining what to outsource from whom to whom. Additionally, it necessitates the management of the relationships between various suppliers (Lu,L. and . Swaminathan,J., 2015).

Many businesses firms continuously view SCM as a tactic and or a strategy for obtaining products, goods, services, and a means of boosting and enhancing organizational operational performance by fostering improved supplier relations, operational performance, and a coordinated strategy. Generally speaking, any efficient SCM system increases organizational effectiveness, fosters collaboration between executives and business partners, and aids organizations in cutting waste and raising profits. In the construction industry (CI), Supply chain management (SCM) has been extensively considered as among the well-organized and resourceful operating and management strategic approaches to be adopted to improve performance. As every construction project encompasses many resources procurement, information, and capital flow, logistics, material suppliers, and the collaborative labour and work services patterns, these interconnected processes have caused the industry to suffer for many decades from long-term problems including high fragmentation, large significant waste, low productivity, cost and schedule overruns, unending conflicts between construction project participants and poor quality. However, the sustainable supply chain is believed to interlink all processes and connect all participants into a completely functional network chain structure during the production process of the construction project.

Recent literature shows that for the local firms to improve performance and gain the competitive advantages of the local market, it is necessary to pay more attention to the customers' needs in terms of innovative design, cost-effectiveness, and reduced construction time with quality output (Liao, 2019). With the adoption and implementation of supply chain management, construction firms can reorganize and integrate the production process by eliminating some duplicate links, and removing unnecessary and non-value processes or activities that can greatly reduce unnecessary waiting time and consumption and hence speed up the construction project thereby enhancing the firm's performance improvement and competitiveness.

Scholarly research demonstrates that the construction project's supply chain management incorporates a network of construction products and services under equitable specialized business division and partnership of various sections that greatly improve the business supply chain from each member eventually improving the quality of the construction project (Ramaswamy, 2017). Additionally, the adoption of sustainable supply chain management in construction projects helps to effectively share information without bullwhip effects that tend to cause delays in the supply chain and hence lead to stopping work and waiting for materials as a factor for project delay/time extension and cost overrun. Moreover, the SCM was identified to play a great part to facilitate collaboration through resources sharing, achieving synergy, innovation, and risk sharing. Furthermore, it accelerates the coordination (integration) across the supply chain operations and processes and provides the overall collaboration amongst different processes from start to end of the supply chain (Piprani, A. et al., 2020).

This study on supply chain was guided by the organizational theory (covering both descriptive theory and normative theory) that incorporates flows of goods, services between organizations from raw materials, and production to end-user consumption. The information theory also was adopted to define the transmission, processing, extraction and utilization of information. Thus, information was thought of as the resolution of uncertainty during supply chain. As researchers supported it, a supply chain is a borderless, value net, and coordinated operations network of multi-organisations built up by sovereign organisations owning their established inter-organizational relationships within integrated processes across the borderlines of the individual firms (Kummer,S. et al., 2020). A descriptive type theory explains the nature of the relationship among sub-systems of the organisation and its environment. The normative theory helps to suggest and describes how things can or should be done with conditions identified by descriptive theory to

improve the organisation and hence attain profitability, efficiency, and effectiveness.

This study aimed to capture the users' perception of the impacts of sustainable supply chain management on construction projects' performance. As every stakeholder has different views towards certain aspects that play a significant role in determining their satisfaction, through various measured variables including age, education level, experience, knowledge expertise, and or professionalism, this study adds knowledge to the existing literature through stakeholder perception on the subject topic.

2.0 Methodology

2.1 Population

For this explanatory research study data were collected from three regions of Dar es Salaam, Dodoma and Mwanza. The regions were chosen because not only they were recorded by Contractors Registration Board (CRB) to occupy many firms of the selected class limit but also because the regions have many on-going construction projects. Purposive sampling technique was adopted to collect information from respondents including engineers, architects, quantity surveyors, procurement officers, planning and logistics officers employed by class one-two local contractor firms experienced for more than ten years. The representative sample of the study was drawn from a sampling frame of 211 potential respondents using Yamane's formula. One hundred thirty-eight (138) respondents were calculated.

$$(\text{Sample Size (n)} = \frac{\text{N}}{(1 + \text{Ne}^2} = \frac{211}{(1 + 211 * 0.05^2} = 138)$$

Where: "n" defines the minimum sample size, "N" is the population size, and "e" indicates the level of precision assumed at a 95% confidence level for this study (Taherdoost, H., 2017). Moreover, the online priori-sample size calculator was used in this study to compute, test and confirm if the minimum sample size calculated supported the covariance based-structural equation model (CB-SEM) that indicates the relationship of the study variables. The computation revealed the minimum (138) as the recommended sample size appropriate for SEM generation.

Data were collected during interview using a structured questionnaire and analysed using Statistical Package for Social Sciences (SPSS-24 version) to obtain a quantitative and descriptive statistics information. The questionnaire included a 5-Likert scale which was used to designate the numerical ranks only. Conversely, no absolute quantities or equality interval between the scales was anticipated.

Moreover, a continuous average rating with suggested ordinal values ranging between (1 to ≤ 1.8; 1.81 to ≤ 2.6; 2.61 to ≤ 3.4; 3.41 to ≤ 4.2 and 4.21 ≤5) were assumed to represent strongly not important, not important, moderate, important and strongly important respectively during translation of the respondents' views. However, only 103 duly filled out questionnaire copies (74.6%) were successfully returned.

2.2 Data Analysis

The data that were collected were edited, entered in the computer and cleaned. Using SPSS-AMOS software descriptive and inferential data analyses were performed and used to check for construct data validity and reliability. The Construct validity aimed to measure the extent to which all items on a scale measure the same construct and the reliability using a standardized Cronbach's formula intended to test the internal reliability of the 5-point Likert scale and check if the used questionnaire provided similar or comparable results in diverse test sets. Thus, Cronbach's formula which was used to calculate the reliability estimate value yielded a coefficient alpha of 0.96(>0.5) showing a moderately high internal consistency for the impacts that represented 96% of the variance in the composite score. Moreover, the software enabled the confirmatory factor analysis (CFA) to test for convergent and discriminant validity. Besides, SPSS-AMOS assisted to produce the SEM relationships among the variables.

$$\text{Cronbach's formula (a)} = \frac{\text{kr}}{(1+(\text{k}-1)\,\text{r})}$$

Where: a = Reliability Estimate, k = Number of Items (11), and r = Average Correlation (0.652).

$$\text{a} = \frac{14(0.652)}{(1+(14-1)0.652)} = 0.96$$

Furthermore, Relative Importance Index (RII) formula was used to calculate the mean for the factor, which gives it weight in the perceptions of respondents. It then assists to rank in order of significance of contribution of a particular variable.

$$\text{Relative Importance Index (RII)} = \frac{\Sigma W}{A*N} \quad (0 \leq \text{RII} \leq 1)$$

Where:

W – is the weight given to each factor by the respondents and ranges from 1 to 5 (where "1" is "strongly disagree" and "5" is "strongly agree"),

A – Is the highest weight (i.e., 5 in this case), and
N – Is the total number of respondents.

3.0 Results and Discussion

The respondents' demographic information (Table 1) established that the majority (81.55%) were degree graduates to PhD level. The findings show that the majority of respondents had literacy skills, which assisted them in understanding and thus respond to the questionnaire, which predicted the availability of clear and viable data for the study. Moreover, most respondents (66.99%) had a working experience of more than ten years in the construction industry; this suggests the presence of better employee with good enough experience. Furthermore, the respondents' professions were evaluated as a variable of the study. The findings show that required professions were worthy represented including engineers (35.92%), architects (20.39%), quantity surveyors (18.44%), planning officers (7.77%), procurement specialists (11.65) and logistics officer (5.83%). The majority of respondents participated in the study acknowledged the importance of effective supply chain management in the construction project. They noted SC to facilitate managing the flow of information, effective availability and flow of materials, cash flows, and necessity of collaboration among projects participants. It was suggested that the model developed would help to minimize delays, promote long-term relations among employees, and reduce communication gaps and thus, reduce construction project complexities.

Table 1: Respondent's demographic characteristics

Item	Frequency	Per cent (%)
18-25	23	22.33
26-33	31	30.10
34-41	22	21.36
42-49	16	15.53
≥50	11	10.68
Education level		
Diploma	19	18.45
Degree	58	56.31
Masters	21	20.39
PhD	5	4.85
Working experience (Years)		
1-10	34	33.01
11-20	35	33.98
11-20	23	22.33
≥31	11	10.68

Professional		
Engineer	37	35.92
Architects	21	20.39
Quantity Surveyor	19	18.44
Planning Officer	8	7.77
Procurement Officer	12	11.65
Logistics Officer	6	05.83

3.1 Impacts of Supply Chain Management

Since the study intended to rank the impacts of supply chain management on construction projects,

RII was used to obtain the highly ranked impacts score mean above four (4), representing a high significant impacts (Table 2).

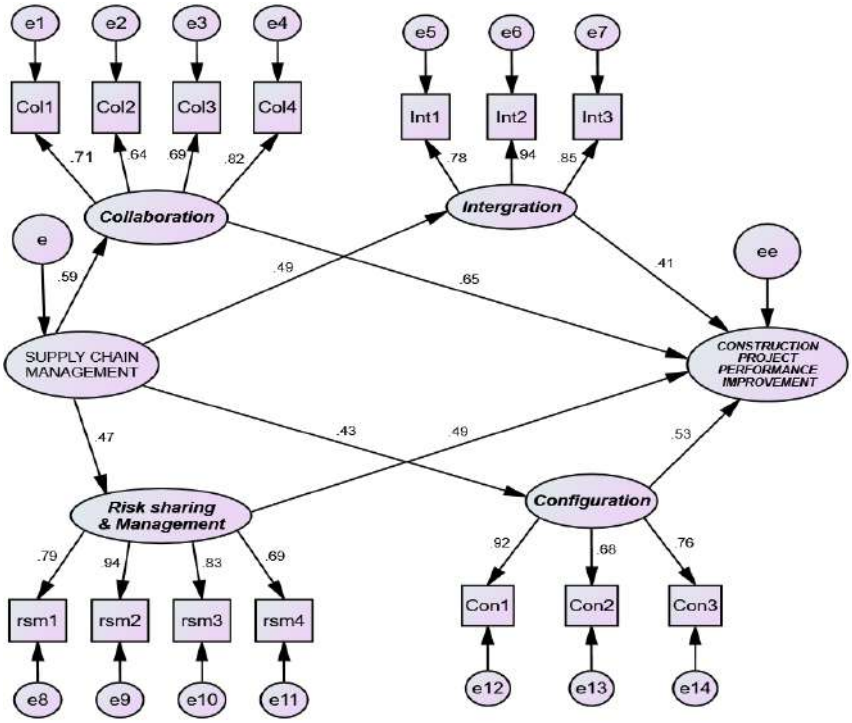
Table 2: Ranking of the supply chain management impacts

Supply chain management impacts		Likert Like Scale							RII	Rank
		5	4	3	2	1	Total	ΣW	ΣW/AN	
		Frequencies (n)								
Supply chain collaboration	Shorten production lead time	58	26	13	6	0	103	445	4.320	3
	Better quality information flow & sharing	49	45	7	2	0	103	450	4.369	2
	Creative and Innovative operational efficiency	59	28	6	7	3	103	442	4.291	5
	Facilitates resource sharing between project executors	58	36	3	5	1	103	454	4.408	1
Supply chain integration	Provide close internal & external coordination	56	26	9	8	4	103	431	4.184	9
	High capacity utilization & lower inventory	55	28	17	2	1	103	443	4.301	4
	Risk sharing on decision making & material flow	49	39	9	4	2	103	438	4.252	7
Supply chain configuration	High product quality with low defect rate	48	38	7	7	3	103	430	4.175	10
	cost optimized to deliver gross margin improvement	39	28	9	14	13	103	375	3.641	14
	Entails value processes and products only	51	33	12	6	0	102	435	4.223	8
Risk sharing & management	Risk sharing and halved	48	35	10	6	4	103	426	4.136	11
	Inventory risk upstream to their supplier	40	35	8	11	9	103	395	3.835	12
	Reduce the chances of any uncert ain situation	37	37	11	10	8	103	394	3.825	13
	It assist in achieving synergies	55	33	6	6	3	103	440	4.272	6

The results in Table 2 show that only nine impacts ranked highly in the supply chain management in the construction projects. The findings indicated that the foremost top impact was the facilitation of resource sharing between project executors, followed by shortening production lead-time and enabling attaining better quality information flow and sharing. Moreover, high capacity utilisation and lower inventory, creativity and innovation led to operational efficiency as well as assisting in achieving synergies. Furthermore, risk sharing on decision-making and material flow caused value processes and products that eased project execution, provision of close internal and external coordination, attaining high product quality with low defect rate and halved the shared risks were mentioned as among the utmost impacts of the supply chain management in the construction projects.

3.2 The supply chain impacts factor relationship

In determining the correlation between the four identified SCM impacts, SPSS-AMOS software was used. The relationship framework development involved numerous processes. The first process involved data correctness check through testing of Kaiser-Meyer-Olkin (KMO). The finding generated a KMO value of (0.813) that was within the recommended threshold value. Moreover, a confirmatory factor analysis was performed to define the impact's factor loading. Generally, all factor values obtained were within the recommended values ($\geq$0.5). As shown in Figure 1, the influence of supply chain management on construction project performance improvement was mediated by collaboration, integration, risk sharing and management as well as configuration. In all the four instances, the direct influence of supply chain management on collaboration, integration, risk sharing and management as well as configuration was statistically significant. Also, the indirect influence of supply chain management on each of the four mediating variables had a recognized positive result. Thus, it can be concluded from the findings that the influence of SCM on construction project performance improvement can be mediated by SC collaboration, SC integration, SC risk sharing and management and SC configuration.



Note: Col=Collaboration; Int=Integration; con= Configuration and rsm= risk sharing and management

Figure 1: A structural model path

The structural model (SM) for this study occupied four measurement models which were produced by four latent variables, namely supply chain collaboration, integration, and configuration and risk sharing and management. The findings of the (SM) produced a statistical model-fit that assisted in assessing the relationship between the model data. However, since the study adopted the maximum likelihood method (MLM) to compute the model fit, the findings showed the model fit values that fell within the recommended model fit indices (Table 3) including chi-square of ($\chi 2$ = 1283.6) and degrees of freedom (df = 387.3) that yielded a minimum discrepancy ($\chi 2$/df) of 3.31. Moreover, the values of the following statistics were good: Tucker Lewis Index (TLI) = 0.919, Comparative fit index (CFI) = 0.907, Adjusted Goodness of fit index (AGFI) = 0.961 and Root mean square error of approximation (RMSEA) = 0.73. The findings suggest that the relationships between construct and manifested factors supported the data (Nachtigall,C, 2003). Thus, the generated model of the study (Figure 1) reported a significant contribution relationship earning (65%' 53%, 49%' and 41% of supply chain collaboration, supply chain configuration, supply chain risk sharing and

management, and supply chain integration respectively towards attaining construction project performance improvement.

Table 3: Model Fit Indices Commonly Reported for SEM

S/N	Measure	Name	Description	Cut-off for good fit
1	X2	Model Chi-Square	Assess overall fit and the discrepancy between the sample and fitted covariance matrices. Sensitive to sample size. H0: The model fits perfectly.	P-value> 0.05
2	AGFI	(Adjusted) Goodness of Fit	GFI is the proportion of variance accounted for by the estimated population covariance. Analogous to R2. AGFI favours parsimony	GFI ≥ 0.90 AGFI ≥0.90
3	NFI/TLI	(Non) Normed Fit Index Tucker Lewis index	An NFI of .90 indicates the model of interest improves the fit by 90% relative to the null model. NNFI is preferable for smaller samples. Sometimes the NNFI is called the Tucker Lewis index (TLI)	NFI ≥ 0.90 NNFI ≥ 0.90
4	CFI	Comparative Fit Index A revised form of NFI. Not very sensitive to sample size. Compares the fit of a target model to the fit of an independent or null model.	A revised form of NFI. Not very sensitive to sample size. Compares the fit of a target model to the fit of an independent or null model.	CFI ≥.90
5	RMSEA	Root Mean Square Error of Approximation	A parsimony-adjusted index. Values closer to 0 represent a good fit.	RMSEA < 0.08

Source: (Parry, 2020)

4.0 Conclusion and recommendations

This study aimed to collect the construction industry stakeholders' opinions on the impact of supply chain management on the performance of construction projects. The study showed that the supply chain has statistically significant impacts on improving execution and performance of construction projects. Furthermore, the study showed positive effect of the mediating variables (namely collaboration, integration, risk sharing and management as well as configuration) on construction

projects' performance improvement. Thus, to attain improved performance in such projects, a supply chain is required to not only facilitate collaboration among team members and integrations between value processes, configurations of project quality, and cost optimization but to also enable risk sharing and management throughout the entire construction project.

Therefore, it can be noted from the findings that SCM can support instituting of well-coordinated supply chains by combining various strategic variables throughout the construction firm business processes to attain the firm objective. The significant contribution of the study is that supply chain management cannot be isolated and or ignored from the potential factors in the construction industry when one needs to attain adequate performance. The findings offer valuable insights of supply chain management to construction firms and stakeholders in general that provide a room for them to increase and maintain a competitive advantage over their competitors by enhancing the improved construction project performance. The construction firms need to continue investing in improving their supply chain and integrate it with the mediating variables in improving the performance. The policy implication for the study is that the supply chain coordination, integration, configuration and risk sharing are crucial for providing a room and expanding the joint venture with foreign firms that can guarantee the local firms expansion and or growth. The study recommends to researchers to increase the sample size when conducting similar studies that can increase the strength of results generalization. Moreover, it is recommended to policy makers on the need to identify essential information technology (IT) in a supply chain to facilitate performance improvement.

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