UNIOSUN Journal of Engineering and Environmental Sciences. Vol. 1, No. 1. March 2019
DOI: 10.36108/ujees/9102.10.0190

Application of Knowledge Management by Indigenous Contracting Firms for Construction Project Delivery

Rasheed A. S, Adebiyi R. T. and Musa N. A.

Abstract: This study aims to assess readiness of Nigerian Indigenous Contractors (NIC) to adopt Knowledge Management (KM).This is achieved by identify in requirements for adopting KM; evaluating NICs preparedness to meet these requirements; and examining benefits of KM to NICs. Purposive sampling technique was adopted for the survey. Fifteen factor requirements for adoption of KM was identified from literature and structured into a questionnaire which was administered to NICs. Eighty-four copies of questionnaires were retrieved from the total sample size of 129, representing 65% response rate. Data was analyzed using percentages, and Relative Importance Index (RII). The factor requirements used for the survey achieved a Cronbach's Alpha of 0.70 showing a high relationship between them. Results revealed that management's strategic plan to adopt KM; and training/education of personnel are factors highly prioritized by NICs, but mechanism to enhance storing & retrieval of knowledge is yet to exist in 98% of the NICs sampled. Improvement of profitability and process enhancements are considered more important by NICs amongst derivable benefits from KM. The Study concluded that NICs are not yet prepared to adopt KM but are willing to explore its benefits for improved organisational performance.

Keywords: Knowledge, Knowledge Management, Nigerian Indigenous Contractor, Organisational Performance.

I. Introduction

Knowledge Management (KM) is all about creating, acquiring, capturing, sharing and using knowledge [1]. As knowledge is created and captured, learning takes place and the knowledge is hopefully applied and embedded within individual and organisational processes [2]. Hence, Organisational Learning (OL) is the intellectual base that enhances storing, sharing and the eventual utilization of knowledge. Organisational knowledge is usually described in two categories as explicit and tacit knowledge. Grovera and Froesea [3, p.1284] explained that "explicit knowledge is that which can be measured, captured, examined, and can easilybe passed onto others in a formal and systematic language while tacit knowledge is highlypersonal, context-specific and comes from one's experience". To achieve actionable knowledge, organisations must institutionalize Organisational Memory (OM). This is a corporate asset that is gained by the integration of knowledge into organisational activities to develop their corporate memories.Corporate memories are therefore achieved by capturing, organizing, disseminating and reusing knowledge created by professionals in the organisation [4].

Robinson et al [5], posited that significant proportion of large construction organisations have, or plan to have a KM strategy and some are at various stages ofimplementation to increase their competitiveness and improve

Rasheed A. S, Adebiyi R. T. (Department of Quantity Surveying, University of Ilorin, Nigeria.)
Musa N. A.. (Department of Quantity Surveying, ObafemiAwolowo University, Nigeria.)
Corresponding author's email address: toajewole2002@yahoo.com

organisationalperformance. However Nigerian Indigenous Contractors (NICs) are yet to fully embrace KM as a strategy for enhanced performance despite that over the years they have been plagued with under-capitalization, poor project performance in terms of meeting completion dates, work quality and capital management which has often led to bankruptcy and in extreme cases, project abandonment [6].It is important for NICs to bear in mind that the construction industry is knowledge intensive and relies on effective KM [7]. The attitude of NICsnot embracing new strategies promotes the notion made by several researchers that the Nigerian Indigenous Contractor is incompetent and inexperienced [8], [9], [10]. Large (mostly multi-national) construction organisations in Nigeria appear to show significant presence of explicit knowledge in their operations such as theircomplex administrative procedures and controls, consistent construction methods and technical knowhow amongst others. Smaller (mainly indigenous) construction organisations, on the other hand, show the oppositewith many of their operations suggesting a complete absence ofstructured project management and construction methods.

Around the world, it has been recognised that competitive success in the global economy is achieved through the effective exploitation of knowledge, skills and creativity [11]. Also KM is considered to be one of the key sources of success for construction projects and for organisational performance [4], [11], [13], [14].Similarly, for long term success, construction organisations depend on the performance improvements made by absorbing and applying new sciences continuously [15]. NICs should be prepared to fully take advantage of the benefits of KM to improve their organisational performance, competitive edge to bid for projects and eventually deliver within set project parameters.

The aim of this study is to assess readiness of NICs to adopt KM with a view to enhancing organisational performance in construction project delivery. This is achieved through identification of requirements for adopting KM; evaluating NICs preparedness to meet requirements for adopting KM; and examination of benefits of KM to construction organisations.

Table 1: Knowledge Management Dimensions

Authors	Knowledge Management Dimensions
Chin Loy *et al.*, (2007)	KM has six sub-scales namely: knowledge creation, knowledge capture, knowledge organisation, knowledge storage, knowledge dissemination and knowledge application.
Chen & Mohamed (2008)	KM has four dimensions namely: responsiveness to knowledge within the business environment, knowledge acquisition, knowledge dissemination and knowledge utilization.
Fong & Choi (2009)	KM is divided into six processes including: knowledge acquisition, knowledge creation, knowledge storage, knowledge distribution, knowledge use and knowledge maintaining.
Zack *et al.*, (2009)	KM is observable organisational activities that relates to the ability to locate and share existing knowledge; ability to experiment and create new knowledge; culture that encourage knowledge creation and sharing; and regard for the strategic value of knowledge and learning.
Liao & Wu (2009)	KM as the process of knowledge acquisition, knowledge conversion and knowledge application
Omerzel (2010)	KM comprised five (5) elements namely the acquisition, storage, transfer, use of knowledge and the measurement of the effects of KM.

(Source: Adapted from Yusof and Abu Bakar, 2012)

II. Literature Review

A. Knowledge Management Dimensions

KM is fast becoming a science as many researchers [1], [3], [14], [15],[16] have put some science behind the art. Over the years, in order to manage knowledge effectively, various dimensions were attributed to KM in the construction industry. These dimensions were presented in form of processes to be adopted [16].

A glossary of dimensions outlining the processes attributed to an effective KM system is presented in Table 1.

In a more recent study of KM maturity in Indonesian Companies,Wibowo and Waluyo [15] also citing several authors identified activities that were termed KM processes to include: knowledge creation, knowledge sharing, knowledge acquisition, knowledge documentation, knowledge application, knowledge transfer, responsiveness to knowledge, and knowledge dissemination. Similarly [14] narrowed down these processes to four (4) basic processes of KM listed as: creating, storing/retrieving, transferring, and applying knowledge.Furthermore, gaps were identified in Information Technology (IT) supported KM and a BIM enhanced KM approach suggested[7]. Bearing in mind the slow adoption of BIM in Nigeria, the study will examine IT supported KM only and will adopt the processes as identified by [14].

Table 2: Classification of Registered Contractors under LSPPA

Class	Contract Value/Threshold (N)	Number of Registered Contractors
A	0.5 Million to 10 Million	1267
B	10 Million to 100 Million	1322
C	100 Million to 250 Million	735
D	250 Million to 1 Billion	584
E	Above 1 Billion	300
	Total	4208

Source: LSPPA (2015)

Table 3: Numbers of Active Contracting Firms

Class	Registered Number	Pilot Survey of NIC	(%)	Selected NIC	(%)
A	1267	89	39%	46	36%
B	1322	102	44%	55	43%
C	735	40	17%	28	21%
D	584	X		X	X
E	300	X		X	X
Total	4208	231	100%	129	100%

(Source: Author's field survey 2018)

B. Benefits of Knowledge Management to the Contracting Organisation.

Several benefits have been attributed to the proper implementation of KM in construction organisations. Fundamental benefit of KM is its ability to enhance growth performance of organisations [16]. This benefit is fundamental because in Nigeria, NICs' are under intense competition and pressure for limited viable projects to enable them stay in business. Belay et al. [13]citing several authors identified that KM enhances organisational innovations and improved business performance which eventually leads to improved organisational performance.

Knowledge sharing amongst professionals in NICs improves the technical capacity of the professionals. This eventually translates to improved human resource potential of the companies. Enhancing construction processes through the standardization of components and processes is made possible when KM is implemented in industrialized building construction[17]. It was seen to decrease the time and cost of solving problems. This attribute can assist in the eradication of re-works and eventually benefit future projects.

The construction phase of any project requires large supply of materials, manpower and other components; attention must be accorded to the management of the supply chain. In the

development of a framework for the implementation of KM in supply chain management, KM was identified as one of the most important factors and tools to improve supply chain performance [18].

C. Building a Knowledge Management Practice in Organisations

Developing a practice of KM in any organisation requires planning and a clear decision from the organisation to start. It was posited by [2] that the basic building blocks for creating a knowledge-centric organisation are: creating awarenessof KM, performing KM benchmarking to see what other similarorganisations have done, developing a knowledge taxonomywhich serves as a vocabulary and structure inwhich to construct the KM system,developing a KM strategy, and pinpointingtarget areas for greatest use of KM activities. They further explained that the key enablers of this knowledge framework are the domain context, organisational culture, individual value system, benchmarking/standards, and management initiatives.

Evangelista et al. [19] highlighted a model for implementing KM to include eleven (11) factors which are: management leadership and support, culture, information technology support,strategy and purpose, measurement, Organisational infrastructure, processes and activities, motivational aids, training and education,resources, and human resources management. These set of critical success factors is important as it can be used to evaluate readiness and actual implementation of a KM strategy by NICs.

Similarly [4] emphasized the importance of first institutionalizing operational Memory (OM) which is a requirement for achieving actionable knowledge. Also [15] mentioned the relative need for the human resource component of organisations to have KM capacity. Finally, in a study of knowledge sharing in the construction sector, [14] explained the importance of some facilitating factors in the organisation that can work as guidelines to achieve a successful knowledge sharing strategy. These factors are: financial/social motivations; conformity to corporate culture; honouring knowledge sharing commitments; peer recognition; perceived value and uniqueness of knowledge; reciprocity; mimicking the behaviour of leaders; and culture.The fundamental inhibitormentioned in the study which can be a requirement for KM adoption is resource.

Drawing from the literature, this study will adopt the following fifteen (15) factors as basic requirements for the adoption of KM by NIC: awareness of KM benefits; management initiatives; leadership and support; management strategic plan to adopt KM; institutionalizing Organisational Memory (OM); KM capacity of human resources employed; financial/social motivation to adopt KM; conformity to corporate culture of the organisation; Information Technology (IT) supports; motivational aids and willingness to reciprocate knowledge Shared; measurement and KM benchmarking; developing knowledge taxonomy (Purpose); organisational infrastructure; resources deployment to KM; training and education; processes and activities promoting KM practice.

III. Research Method

The study is aimed at eliciting responses from NICs. To get a good number of NIC the study was conducted in Lagos metropolis. The study area was decided because 53% of the office location of contractors in Lagos state is in the metropolis (LSPPA, 2015). Lagos State Public Procurement Agency (LSPPA) maintains a database of registered contractors and describes their classifications and categorizations based on contract value. The contracting firms registered under categories A, B and Cwere identified to participate in this study. These categories have majority as NIC which is the focus of the study. There are three thousand, three hundred and twenty - four (3324) contracting firms under these categories as presented in Table 2.

A pilot survey was conducted to identify active construction organisations with ongoing projects or head offices in the study area. The result of the survey revealed two hundred and thirty-one (231) active construction organisations with on-going projects or head offices.Purposive sampling technique which is an example of non-probability sampling technique was used to select one hundred and twenty-nine (129) NICs surveyed. The stratum selected according to the categories is presented in Table 3. The current active status of the organisations in the area and those with resident head offices is important because it afforded easy access to the NIC sampled.The respondents are the chief executives or senior managers in the selected organisations.

IV. Results and Discussion

The results from analysis of datacollected are presented in two forms. The demography of the characteristics of organisations sampled was analysed in percentages and narrated. The decisions on the results of the factors relating to the objectives are presented in tabular form. The results from the factors used for the study elicited a Cronbach's Alpha of 0.70 which indicates a high relationship between the factors tested. The summary of the Cronbach's Alpha test is presented in Table 4.

A. Response Rate from NICs

The questionnaires were distributed by hand to registered offices/active construction sites and through email to registered email addresses. Eighty - four (84) copies of questionnaire were retrieved representing sixty - five percent (65%) response rate. The summary of the responses according to the category of NIC sampled is presented in Table 5.

B. General Information of Respondents:

The organisations sampled are classified as Nigerian Indigenous Contractors based on the definition by [20] that "Nigerian Indigenous Contractors are contracting firms that are fully-owned and managed by Nigerians; the nationality of the firms' ownership and management is exclusively Nigerian". The study revealed the frequency distribution of the years of existence of responding organisations in the construction industry. Majority (54%) of the responding organisations have existed for more than 10years, while 37% of the respondents have existed for 6-10years with the remaining 9% existing for less than 5 years in the construction industry. Results also show that 61% of the responding organisations have more than 5 projects undertaken each year, while the remaining 39% have less than five (5) but at least one (1) construction projects they were involved in during the period of the

Table 4: Summary of Cronbach's Alpha test results (ANOVA)

Source of Variation	SS	df	MS	F	P-value	F crit
Rows	234.503968	83	2.825349015	3.34848387	8.9018E-20	1.2814016
Columns	465.806349	14	33.27188209	39.432424	5.2135E-88	1.70028593
Error	980.460317	1162	0.843769636			
Total	1680.77063	1259		CRONBACHS ALPHA		0.70

(Source: Authors' field survey 2018)

Table 5: Response rate of professionals sampled

Respondent's Class	Questionnaires Distributed		Questionnaires Retrieved	
	No	%	No	%
Class A	46	36%	31	36.9%
Class B	55	43%	42	50.0%
Class C	28	21%	11	13.1%
Totals	129	100%	84	100.0%

(Source: Authors' field survey 2018)

Table 6: Existing operational processes in NIC supporting KM practice

KM Processes	Existing	%	Not Existing	%
Does your organisation or currently employed human resources have the capacity to create explicit knowledge?	21	25%	63	75%
Does your organisation have storing/retrieval systems in place for knowledge created?	5	6%	79	94%
Does your organisation transfer explicit knowledge across staff & organisations?	2	2%	82	98%
Does your organisation have recorded application of created knowledge on any recent operations or processes?	2	2%	82	98%

(Source: Authors' field survey 2018)

survey. None of the organisations sampled are currently idle. Finally, 9% of the organisations sampled have 45or above numbers of staff employed, 31% of the organisations have between 30 - 44 staff employed, 54% have between 15 - 29 number of staff employed and the other 6% have between 1 - 14 staff employed. This shows a majority of the NIC having fifteen or above numbers of staff employed.

C. Existing Operational Processes in NICs supporting KM practice

To identify current KM processes and practice in the NIC, the respondents were requested to express their opinion on a two point scale, where 1 = existing and 2 = not existing to processes that were earlier identified in literature as basic in relation to the dimensions supporting KM practice. The processes adopted for the study were those narrowed by [14]to four (4) basic processes of KM which are: creating Knowledge, storing/retrieving knowledge, transferring knowledge, and applying knowledge to current operations.These processes wereused to elicit response on current KM processes existing (if any) in the NICs sampled that are supporting KM practice and can be seen as a startup activity for KM. The results for existing operational processes in NICs supporting KM practice arepresented in Table 6.

Table 7: Prioritisation ranking by NIC of factor requirements for adopting KM

Factor Requirements	Valid	Total	RII	Rank
Management strategic plan to adopt KM.	84	298	0.710	1
Training and education of personnel.	84	288	0.686	2
Management Initiatives, leadership and support.	84	205	0.488	3
Financial/Social motivation to adopt KM	84	188	0.448	4
Awareness of KM benefits.	84	185	0.440	5
Institutionalizing Organisational Memory (OM).	84	182	0.433	6
Conformity to corporate culture of the organisation.	84	179	0.426	7
Measurement and KM benchmarking.	84	173	0.412	8
Organisational Infrastructure.	84	157	0.374	9
Information Technology supports.	84	144	0.343	10
Developing knowledge taxonomy (Purpose).	84	140	0.333	11
KM capacity of human resources employed.	84	137	0.326	12
Motivational aids and willingness to share knowledge.	84	134	0.319	13
Processes and activities promoting KM practice.	84	133	0.317	14
Resources deployment to KM.	84	123	0.293	15

(Source: Authors' field survey 2018)

Table 8: Ranking importance level of benefits to NIC

Benefits of KM	Valid	Total	RII	Rank
Improving construction profitability.	84	399	0.950	1
Enhancing processes in construction delivery.	84	370	0.881	2
Improving organisational performance & growth.	84	345	0.821	3
Standardization to reducing construction mistakes.	84	341	0.810	4
Improving technical capacity of staff in organisations.	84	274	0.652	5
Creating competitive advantage through innovations.	84	250	0.595	6
Enhancing preparation & execution of future projects.	84	244	0.581	7
Improving supply chain performance	84	190	0.450	8

(Source: Authors' field survey 2018)

Twenty - five percent (25%) of the NIC sampled could create explicit knowledge either from the organisational level or human resource level but a greater percentage (75%) have not recognised their ability to do so. This indicates that a small percentage of NIC is aware of KM and has recognised their capacity to create knowledge. However, an even smaller percentage (6%) has the ability to adequately store the knowledge in a convenient way for easy retrieval. Ninety - four percent (94%) of the NIC lack the capacity to properly store the knowledge created. Transferring and utilizing the knowledge still seems very difficult and non-existence for NICs. The study revealed that only two percent (2%) of the NIC sampled could retrieve knowledge for transfer or use in their construction processes and organisational activities. Ninety - Eight percent (98%) of the NIC sampled could neither transfer nor utilize the knowledge created. This position is abysmal and it indicates that the NIC is challenged in adopting KM. The result justifies the position that the construction sector appears to have challenges in adopting the practices and strategies offered by KM [5].

D. Preparedness of NIC to adopt KM:

TheNICs sampled were requested to access their preparedness to adopt KM by showing how they have prioritised factor requirements for the implementation of KM. A questionnaire with five (5) point Likert scale was administered to test the priority level of each of the fifteen (15) factor requirements earlier identified in literature. The five (5) point Likert scale measured the level of priority and are weighted in the following scale; not a priority = 1, low priority = 2, medium priority = 3, high priority = 4 and essential = 5. The

Relative Importance Index (RII) of the level of priority of the factor requirements for the implementation of KM are presented in Table 7.

The results show a prioritisation of KM in the NIC's strategic plan for adoption with RII of 0.710. The important implication of management's strategic plan to adopt KM in the near feature by majority of IC sampled can be attributed to the need for achieving competitive advantage in business and processes. This is reinforcing believes posited by [14] that in modern economic society; organisation's competitiveness relies heavily on their ability to leverage and manage knowledge.The NICs further shows a substantial resolve to adopt KM by a high prioritisation of training and education of personnel with RII of 0.686. Realising the unique and temporary nature of construction projects and the professionals in construction, [14] posited that organisations have a basic tendency to want to keep professionals in order to retain knowledge.Training and retraining efforts can therefore not be over emphasised.

The factor requirements of; management initiatives, leadership and support; financial/social motivation to adopt KM; and awareness of KM benefits all have near average RIIs of 0.488, 0.448 and 0.440 respectively. Despite the NIC's clear desire to adopt KM, awareness level of benefits and the necessary financial support is still on the average. The emphasis on the training of staff could be responsible for the average deployment of financial and management motivation to adopt KM. This is assumed because according to [15] there is the relative need for the human resource component of organisations to have KM capacity to fully adopt and implement KM. From the result of the study it is clear that the human resource component of NICs is KM deficient. The priority level of KM capacity of the human resource component of the NIC has an RII of 0.326.

The results also show that NICs are yet deploying resources to KM with a low RII of 0.293. In the same light, their processes and activities with RII of 0.317 are yet promoting KM practice. It can also be seen from the results that key factor requirements like organisational infrastructure, information technology supports and developing knowledge taxonomy all have RII that is less than average at 0.374, 0.343 and 0.333 respectively. This indicates that very small proportion of the NIC have actually started prioritizing the actual implementation processes of KM. This supports the position of [13] that only a relatively small proportion of construction organisations have implemented KM systems. Similarly the NIC sampled has shown contrary positionsto the requirement posited by [4], emphasizing the importance of first institutionalizing Operational Memory (OM) as a requirement for achieving actionable knowledge, this factor requirement has priority level that is less than average at RII of 0.433 in the survey.

E. Benefits of KM to NICs:

The NICs sampled were requested to assess the importance of identified benefits to their organisations. Eight (8) key benefits were identified from literature that affects contractorspositively. The importance level were measured on a five point Likert scale and are weighted in the following scale; low importance = 1, slightly important = 2, neutral

= 3, moderately important = 4 and very important = 5. The Relative Importance Index (RII) of the importance of the identified benefits of KM to the NICs sampled is presented in Table 8.

The result show that the NICs considerably holdsfour (4) benefits as very important, they are: improving construction profitability; enhancing processes in construction delivery; improving organisational performance and growth; and reducing common construction mistakes by standardization with RIIs of 0.950, 0.881, 0.821 and 0.810 respectively.

Improving technical capacity of staff in the organisation is held as moderately important by the NICs. This is attributable to the possibility of replacing incompetent staff where necessary. However the level of importance is still significant at RII of 0.652 to want to adopt KM.

The benefits of: creating competitive advantage through innovations; enhancing preparation and execution of future projects; and improving supply chain performance with RIIs of 0.595, 0.581 and 0.450 are accorded neutral importance by the NIC sampled.

Generally, as posited by several authors [13], [16], [17], the results of this study showing a significant importance level forfive (5) of the key benefits of KM to NIC indicate that where NICs adopts KM, they stand a chance to benefit strongly from it in order to increase their organisational performance and improve project delivery.

V. Conclusion and Recommendation

The study concludes that NICs are yet to adopt KM as a strategic advantage in project delivery. Though some of the NICs are strategically planning to adopt KM, they have not started putting the necessary requirements in place for its full adoption. Institutionalizing organisational memory together with a proper storage and retrieval system for knowledge created are vital requirements that will enhance its adoption. The priority levels of other key requirements like organisational infrastructure, IT support and resource deployment to KM is still evidently low. This is showing the non-preparedness of the NICs to fully adopt KM.However the NICs desire to reap benevolently from the benefits of KM. This is seen in the high importance level that they attributed to majority of the benefits that KM can offer their organisation. It is therefore appropriate to conclude that the NICs are willing to adopt KM to enhance their construction profitability, improve their organisational performance and also improve competitive advantage through improved processes and reduction of construction mistakes.

This study identified the basic factor requirements NICs should concentrate on to fully adopt KM for competitive advantage. It also revealed to a large extent that NICs are willing to adopt KM but have not put in enough to get the requirements in place for its adoption. Furthermore, the inherent benefits offered by KM are yet known to many NIC. This necessitated the need for subtle training efforts being done by the NIC to get the full understanding of the KM concept for strategic advantage.

It is recommended that workshops on KM should be intensified to educate and bring awareness to NICs. In addition, NICs should employ trained staff with KM experience and

capacity for purpose of institutionalizing organisational memory, improving organisational learning and management of knowledge.

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