DEVELOPMENT OF EFFECTIVE KNOWLEDGE MANAGEMENT PROCESSES IN THE CONTEXT OF SAUDI ARABIAN PUBLIC CONSTRUCTION PROJECTS: CLIENT PERSPECTIVE

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Abstract - Saudi Arabia's construction industry has seen a construction boom due to huge changes in investment in the infrastructure. However, Most of the construction projects, which belong to the public sector, are facing a serious issue of lengthy delays. Based on literature review one of the major factors that contribute to frequent delays in construction project in KSA is the absence of effective knowledge management strategy in the public construction organization. This factor makes this serious issue of time and cost overrun exacerbated. The Saudi Arabian public sector does not appropriately have a specific strategy of knowledge transfer and as a consequence new knowledge and understanding of construction issues are not been effectively utilized. Hence, This Study proposed integrated processes of KT to be effectively implemented and used by the client entities in the Saudi Arabian public construction projects in order to acquire relevant knowledge from those other parties involved.These processes proposed are as a complement to various theoretical processes of KT incorporated in different models existed in the literature. The study conducted two rounds of data acquisition using Delphi method as the main research methodology to allow the researcher to firstly investigate the special case of KM in the Saudi Arabian public construction projects,to examine the possibility of implementing KT practices and to find out the client needs. Then, to reconsider the function of the KM processes proposed and to find effective solutions to minims the issues faced. Twelve construction project managers involved in public projects have been approached and the first round data acquisition has been conducted using semi-structured interviews. The analysis of the responses have revealed various cultural and organizational factors that have significant influence on the KT practices between the client and the other parties involved. The study also provides ideas proposed to minimize these barriers.

Keywords - Client Party, Construction Projects, Knowledge Transfer Practices, Knowledge Management Processes.
Abbreviations - KT: knowledge Transfer, KM: Knowledge Management

I. INTRODUCTION

Knowledge is the most powerful factors that empowers people, organizations, nations or any entities to reach development. It is considered as the backbone of sustainability. Therefore, the proper management of knowledge within organizations and the effective transfer of knowledge between organizations can sustain the performance and value of those organizations [1]. In the construction industry, there could be different teams, interrelated organizations and divers of experiences involved together in a complex manner to carry out one project and this creates knowledge-intensive environment. It is thus necessary to put in place systems that can effectively capture experience and knowledge during and at the end of projects and that can also be stored, developed and accessed easily in order to enable the construction industry to survive[2].

Intensive literature review has been done and the study could find out that there is lack of empirical studies concerning Knowledge transfer mechanisms between organizations at the micro level. This is particularly true in Saudi Arabia where the issue comes to the fore. Most of the Saudi Arabian construction projects, which belong to the public sector, are facing a serious issue of lengthy delays. Despite slight delays being common and permissible to an extent in most construction industries around the world, the delays in Saudi Arabia have exceeded past expectations in terms of the size and value of the project[3]. Based on literature review one of the major factors that contribute to frequent delays in construction project in KSA is the absence of effective knowledge management strategy in the public construction organization [3]; [4]. This factor makes this serious issue of time and cost overrun exacerbated [5]. Therefore, these difficulties and challenges that have significant impacts upon the successful transfer of knowledge in construction projects particularly in Saudi Arabia necessitates the need for a more effective and structured KT processes for utilizing knowledge in order to save the efforts, resources, and time from being wasted on reinventing solutions for issues that have been already solved in a previous project or elsewhere in the organizations. This would also enable the client entities to learn and transfer knowledge from those other parties involved in order to develop this knowledge acquired and reuse it in different stage of the project or in other future projects. This can also help the client teams to not reinvent the wheel or repeat mistakes that were made in previous projects [6].

Firstly, a background of the study is illustrated to show how important the research is and what problem was identified. Then, the aim of study and the objectives to reach that aim are shown. The adoption of Delphi method as a main research methodologies is explained and justified.

The research methods used in two rounds will also be explained to show how these methods can be used to meet all the objectives to reach the main aim. Afterwards, the paperdescribes the issues faced when applying KT strategy in the Saudi Arabian public construction projects that were revealed as the results of the investigation made by this study. Furthermore, the paper describes proposed KM processes that might suite the special features and practices of the governmental projects in Saudi Arabia. Finally, limitations that may have an impact on making further development and enhancement are described.

II. BACKGROUND

Construction organizations are constantly introduced to different areas of knowledge and opportunities for learning. Every new construction project can be deemed as new knowledge obtained from a period of practical experience of planning, supervising or implementing this project. This is true when an organization is involved in a construction project and every stage in this project is considered as a source of knowledge [7]. Knowledge continuously occurs in an organization. If not, then an organizational project can be failure [8]. They could also not be able to attract new opportunity in business [9]. The construction industry is thought to be rich in data yet not so in knowledge. This is because of its inability of using the wealth knowledge generated from each construction projects [10]. This ineffectiveness in failure to both collect and access relevant knowledge needed by practitioners to solve everyday project issues can result in long delay in completing a project, risking ultimate failure. The industry carries many risks and failure. Many companies in this sector struggle and even close [10]. Each project is individual and the industry has been seen as being full of inefficiency and waste in terms of resource and capturing and reusing knowledge[11]. Therefore it seems crucial that any lesson learned both positive and negative, should be competently captured. Knowledge is not only about the capability of an organization to successfully do its tasks. It is also about the capacity of an organization to effectively use specific knowledge, constantly improve it, manage depositories for it, and facilitate access to it for future need [12]. Transference of Knowledge requires proper management of communication activities and tools that can be achieved by implementing knowledge management [13]. This involves the expert use of value and method, providing useful and relevant knowledge to project team [14]. This has not been adequately developed, and this lack of transference of knowledge has resulted in project managers being restricted in sustaining advantageous, innovative and organizational competition[13]; [15] There has not been a focus on Knowledge transfer for continuous learning between various parties involved in constructing one project. The prior literature has reviewed different studies relevant to mechanisms, policies, and processes used to transfer knowledge in construction organizations and what and how factors can affect the success of those mechanisms. However, Jasimuddin, emphasized that there is limited knowledge about the mechanisms of knowledge transfer between organizations and within departments within the same organization due to a lack of research in the area. Due to the limited focus, different situations of knowledge transfer have been missed[16]. There is a need for studies concerning the KT practices between different organizations represented by different parties and involved in one project.

Veryfew studies relevant to creation and transfer of knowledge in construction concentrated on developed countries [17]. Furthermore, empirical research into KT Initiatives and learning in construction are scare in the developing countries particularly in Saudi Arabia where the government has ambitions and it is currently pumping investment around KM while studies related to KM in the public institutions of Saudi Arabia's Construction industry are becoming very limited and poor in comparison with other studies in some developed countries [17]. It is also referred that there are foreign studies done in different countries with effective results but these results cannot be applied in Saudi Arabia based on the different conditions between the KSA and the countries where these studies have been done for [18]; [19].

Construction industry in general is transformative and construction projects have very short life cycle. Construction teams are frequently circulated from one project to another and in the process knowledge of projects are not retained by projects owners (clients). This becomes more critical in Saudi Arabia where the issue comes to the fore because the public sector construction organizations do not exploit the knowledge-intensive environments being created from the construction projects they are responsible of and based on their participation with the other construction companies with varieties in experiences and knowledge.

Reviewing the pertinent literature shows that knowledge at the organizational level is classified into two types namely, explicit knowledge and tacit knowledge [20]; [21]and; [22]. The transfer of explicit is not difficult as much as the transfer of tacit knowledge. This is because explicit knowledge can be expressed and written in numbers and words in the form of documents, diagrams, reports, specifications, articles or procedures and so on.

Therefore, explicit knowledge is not difficult to acquire and store. Whereas, tacit knowledge is about personal experience in the form ofknow-how and it can only be found in an individual's mind or an organization's routine. This makes it difficult to be acquired, transferred and managed. However, tacit

knowledge can be transformed into explicit knowledge through SECI process. If the transformation of organization knowledge into explicit knowledge is successfully done, this enables the each entity of all the parties involved in a construction project to learn, acquire, transfer and store the required knowledge in order to develop it and reuse it in different stage of the project or in other future projects. This can also help their teams to not reinvent the wheel or repeat mistakes that were made4) in previous projects [6].

Many studies asserted that managing the organizational tacit knowledge plays the most significant role in their performance[23]. However, most of the existing technologies and techniques can be adopted for explicit knowledge. Knowledge arisen from the experiences of construction projects is exposed to be lost particularly tacit knowledge [24].

III. AIM AND OJECTIVES:

This paper aims to propose an integrated processes for effective KT in the Saudi Arabian Public Construction Projects to enable client construction teams to acquire knowledge from those other parties involved and to make effective use of their organizational knowledge, which in turn enhance their work performance.To reach this aim, the researcher has formulated four objectives and used literature review and semi-structured interviews as the main research methods to be conducted through two rounds using the Delphi technique as a main research methodology in order to meet all these following four objectives:

1) To review theories of KT and technical methods to support them. An intensive review of relevant literature concerning methods and techniques of KT at the individual and organizational levels is conducted to theoretically understand and underline the adoption of KT system particularly in the construction projects context.

2) To examine the possibility of applying KT system for the client use in the Saudi Arabian Public Construction Projects. Semi-Structured interviews were conducted to investigate the case of KT in the industry to assimilate and perceive how practitioners and professionals consider the subject in the public construction organizations in Saudi Arabia. It also helped to have enough understanding of what tools and mechanisms the client teams are currently using to transfer knowledge from other parties involved in their organizational practice.

3) To formulate and map effective processes of knowledge management and knowledge transfer for the context of the client construction teams in the Saudi Arabian Public Projects. A review of earlier studies of KM and KT in the construction industry had taken place and analysis of their effectiveness carried out by identifying the pros and cons of these studies. Therefore, the researcher proposed a theoretical model that might suite the special features of the public construction projects in Saudi Arabia that were revealed from the results of the investigation made during of the first round of interviews. The model was basically built a complement to what existed in the literature and was mainly built based on the different theories existing in the literature.

To develop the integrated processes proposed for KT.

IV. METHODOLOGY

This study mainly investigates different aspects of interactions, behaviors, and management of knowledge and experiences in different conditions and different levels (e.g. individual and organizational). This necessitates the use of qualitative method of data collection and analysis using semi-structured approach. However, the achievement of all the objectives of the study required a methodical approach that allows the researcher to conduct two rounds of data acquisition in a particular order in which each round of relevant data collection follows each other. Therefore, the adoption of Delphi method was essential to help the researcher to acquire pertinent data and avoid having redundant and incompatible data.

V. RESEARCH METHODS

LITERATURE REVIEW:

The beginning of this research was based on a review and analysis of various studies recently published in the pertinent literature of KTdomain to understand the different forms and types of knowledge and the various policies, activates, techniques, tools and procedures used to transfer this knowledge. Therefore, the literature review enables the researcher to theoretically understand the field of KT to support the work of research.

This also enables the researcher to have further understanding of various integrated processes incorporated into models of KT existed in the literature to conduct a more credible research. A review of analysis of some general models of KT and various KT models built specifically for the construction industry is conducted to assess the effectiveness of their processes by identifying the pros and cons of these models. This is to identify the shortcomings that these processes have and to find structured and integrated processes of KM that might suit the special features of the public construction projects in Saudi Arabia to be effectively used by the client. The next section provides a detailed description of the way in which the conduction of the selected research methods were arranged through two rounds.

Semi-Structured Interviews:

For the both two rounds, the selection and use of Semi-structured interviews was because this method permit the interviewer to make possible modifications to the questions built and their sequence based on the flow of the information needed [25]. In order to facilitate discussion on knowledge transfer in the context of Saudi Arabia's Public Construction Organizations, the author used specific open-ended and closed-ended questions in order to ask 'Why?' and 'How"? to enable interviewees to provide relevant explanations and clarifications.

The researcher had worked in the public construction projects before he moved to the academic domain. This in turn helps to find the list of relevant professionals of practitioners this field. The researcher selected a certain group of experts to elicit their opinions about the possibility of applying a system of knowledge transfer and about the suitability of the proposed processes for the context of Saudi Arabian Public Construction Projects.

This is because the information needed can be only provided by practitioners who are familiar with the practices of KT system in the construction industry who have in-depth knowledge and experience about the application of KT processes particularly in the construction domain. For this purpose, the researcher devised the following criterion for selecting eligible practitioners to participate in this Delphi survey:

1. Project managers from the client party to have considerable practical experience in the public sector of the Saudi Arabian construction industry.
2. Project managers from the consultancy party to be currently, recently or directly involved in the Saudi Arabian public construction projects.
3. Experts from both parties to have a detailed and in-depth knowledge about the various practices of knowledge transfer in the construction industry.

First Round of Semi-Structured interviews:

As part of the study endeavor to understand and consider the special gaps existed in the current used policies and mechanisms of KT in the Saudi Arabian public construction projects as well as to investigate the special case of KT practices strategies within different parties from different organization involved in a construction project.

This requires to assimilate and perceive how practitioners and professionals consider the subject in the public construction organizations and to have enough understanding of what tools and mechanisms the client teams are currently using to transfer knowledge from other parties involved in their organizational practice and what enablers and barriers found to knowledge transfer parties involved in their organizational practice and what enablers and barriers found to the successful implementation of knowledge transfer in order to develop the proposed processes of KT.

The researcher conducted twelve face-to-face interviews with a panel of experts that represent top and middle-level of project managers directly involved in a public construction projects. The purpose for choosing these practitioners who have considerable practical experience in the public sector of the Saudi Arabian construction industry was to see the different views of the client team and consultants about the subject to investigate.

Therefore, seven participants were selected from the client team representing the governmental sector. Five participants were also selected from two consultancy companies named AECOM and Dar Al-Handasah and currently involvedin the same project.

Analysis and Findings:

The study used a thematic analysis form to analyze the data collected. During the process of analysis, pertinent themes and subthemes were considered and identified in order to have better comprehension of the phenomenon under examination [26]. The following section describes the results revealed from the investigation made during the first round.

It was revealed that the interaction among the client team and other parties seems to be communication rather than acquisition of knowledge and experience. There is no specific strategy of knowledge transfer used to enable learning between the client teams and other parties involved, despite the belief of the most participants that learning is vital to enhance quality, and minimize issues faced. Therefore, the public construction organization is in a need for structured occasions and planning meetings where the client teams can acquire knowledge relevant to providing innovative solutions for actions taken every day during work practice.

The following section describes four cultural factors and three organizational factors resulted from the analysis of first round as barriers to the successful application of the KT model proposed.

VI. CULTURAL FACTORS

Lack of Consciousness of Practicises of Kt&Km:

Based on the attempt of respondents from client to define K and KT and in comparison with the definitions found in the literature, it was confirmed that the client team is under a misapprehension of what knowledge means. This is because most of the participants from the client use the term of "information" while they were trying to define knowledge. It is also because some of them consider

knowledge as only a past experience. In the other hand, it was noticed that the consultancy team are familiar with KT and its applications. This is due to the right definitions of K and KT and the right descriptions of KT practices provided them. Despite the belief of the most client participants in the importance of knowledge transfer, there is a belief that the use of knowledge transfer is restricted to those projects which requires technology that is not available in Saudi Arabia. The client responses show that they can conceive of KT as an important thing but they are not aware of its practices.

Non-Transparent Communication:
While reporting to the client team, the consultant does not provide transparent communication in order to retain a control of issues due to a concern concerned about their favour.

Vested Interset:
Based on the literature, it was found that knowledge transfer has been limited in some companies. This could be due to management lacking a desire to push forward in this area for fear of losing overall control [27]. In the Saudi Arabian Public construction projects, Participants were very explicit about the other parties that there is a strong reticence due to the vested interest in retaining that knowledge and that power. This is because at the top level for the commercial point of view contractors and consultants want to retain the knowledge because they would like to be running this public projects forever.

Blame Culture:
This was revealed as an issue existed at the public construction projects where the contractors and consultants are afraid to admit their mistakes.

VII. ORGANISATIOAL FACTORS:

Time Impact:
Most of the participants claim that the practices and strategies of KT cannot be effectively accomplished within the limited course of time given to each project.

Shortage of Client Staffversus Huge Projects:
Most of the participants emphasized that the public projects are lacking in human resources. This is due to insufficient client teams to involve with other parties and supervisea huge project.

Bureaucracy: Most of the participants indicated that the official procedures required to change or to apply something new are excessively complicated.

Second Round of Semi-Structured Interviews:

The conduction of this round was to reconsider the KT processes proposed and the techniques to be effectively used in each process, and to find solutions to tackle the issues found. Four of client members involved in first round were excluded from the participation in the second round because the analysis of data collected from the first round shows that they are under a misapprehension of KT practices so the data required in the second round cannot be provided by them. However, their participation in the first round was useful to provide valuable information about the interaction of the different parties involved in the Saudi Arabian Public Construction Projects. Participants in the second round had received a description summary of the findings revealed from the first round and the literature review in a form of tools, techniques, factors and processes incorporated intoa table.

The analysis of the second round responses revealed solutions recommended to tackle the issues found from the first round. There was a consensus among the expert panel participated about the following solutions proposed:
Establishment of National Project Management Office (PMO):

Based on the literature, Any Project manager, who can access an organization project management office, can have a good knowledge- sharing base [28]. This office, found in various project-lead institutions and controls knowledge and resource flow through a project and organization. The role of this office is ostensibly to serve, control and collaborate (Muller et al., 2013). Firstly it acts in a service role to support units involved in a project. Secondly, it controls and operates as a unit of managers in projects and thirdly the project management office collaborates with other offices and teams relevant to a project [28].

In Saudi Arabia, PMO office can be responsible for controlling every single relevant knowledge arisen from the public construction projects by having effective knowledge base. Most of the participants expected the PMO to be a legislative body that acts over all the issues faced in the in the public projects. They suggested that this office can be responsible for providing strategies of knowledge transfer to use in all the projects as a standardized where every party can follow. These strategies can be formulated based on competency assessment made specifically for every client team involved in the construction of public projects.
Official Obligations to Be Incorporated In the Contract:
The client acted by the PMO office can introduce specific requirements of knowledge transfer in the Request for Proposal to each party involved. This is to confirm commitment to knowledge transfer and this has to be clearly mentioned in specific clauses incorporated into the contract.

Based on the investigation made on the case of KT in the Saudi Arabian Public Construction Projects and based on a review made on the KT processes proposed and developed by ([29];[30];[31] and [21], this paper suggested five processes and stages where K has to go through to be transferred and managed.

These processes are Knowledge identification, Knowledge acquisition, Knowledge Storage and Retrieval, Knowledge Verification and development, knowledge Use, and New Knowledge Generation. First process is Knowledge identification to identify what types and forms of knowledge are needed by the client to transfer from those other parties involved and to identify the source of that knowledge. Then, the identification of the type of knowledge needed enables the selection of appropriate techniques and technologies that can be effectively used to successfully acquire that knowledge needed. This is the main purpose of implanting the process of Knowledge acquisition. Then, the process of Knowledge Storage and Retrieval is dedicated to store the knowledge acquired by the client team on their public organization as an intellectual asset in order to reuse it subsequently in future projects. Therefore, in this process different techniques and technologies can be applied to enable users easily reach knowledge whenever needed

Then, the process of Knowledge Development and Verification where the stored knowledge can be updated, revalidated and added value to be finally effectively and successfully applied in future projects. During the send round, the panel of experts reviewed and reconsidered the function of each process in order provide the typical form of the proposed KT processes as presented in Figure1. There was a consensus about appropriateness of these integrated processes for the use client entities in the Saudi Arabian public construction projects.

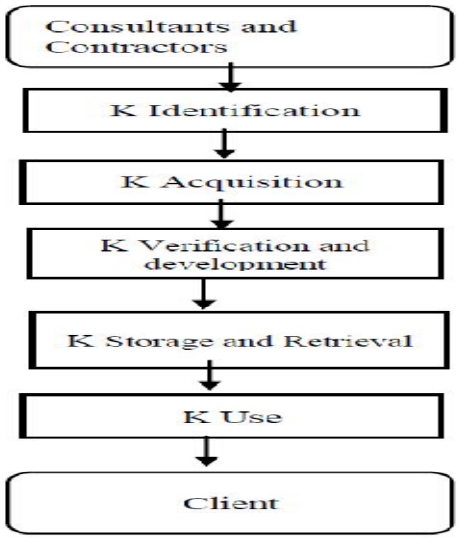


Figure1: KT Processes Proposed for the Governmental Party in the Saudi Arabian Public Construction Projects.

Each process needs for both non-IT and IT tools in order to effectively function. However, the selection of those tools required needs careful investigation into an organization needs and context. Therefore, a construction organization while implementing knowledge management strategy should take into account the flow of knowledge (internal or external), the ownership of that knowledge (owned by an individual, group or organization), and the type of knowledge (tacit or explicit)[32]. Organizations should have the capability to handle the interpretation, content and context of the information and not only information itself. No-IT and IT tools are called techniques and technologies respectively.

LIMITATIONS:

A difficulty faces any organisation to implement and apply a new system of KT because building and implementing a new KMS because there would be a need for an organisationto fundamentally change different aspects of practice, culture and infrastructure. This change might take considerable amount of time up to years in order to be fullyinvestigated. This is particularly true when the research is centered on the construction industry where the work nature is complex and the employees have limited time.

Each of the processes proposed needs to adopt different techniques and different technologies. The selection of these tools needs to be evaluated considered by IT system experts and other experts from the construction domain. This cannot be accomplished within a limited course of time. Further details of the results revealed could not be presented in this paper due to the limited number of pages allowed.

FURTHER WORKS:

the research problems identified in the relevant literature and field of KT that became motives conducting further research relevant to the development of a comprehensive and applicable model for the Saudi Arabian Public Construction projects. Therefore, further research works will be carried out to incorporate these processes into a model that have other major components. There would be a need to assess and enhance the research proposed processes of KT in order to eventually arrive at amulti-attribute model of KT proposed in order to make it a more structured, suitable, effective and applicable for the use of client entities in the Saudi Arabian Public Construction Projects.This model will be examined by conducting further rounds of data acquisition and analysis using semi-structured interviews with academics and specific participants, from the construction industry, who have knowledge of implementing and using knowledge transfer approaches to see their understanding and their

assessment of the model in terms of its applicability,simplicity, usefulness, function, feasibility,comprehensiveness and structure. This helps the study to gradually develop the KT model into a final developed version. This is to provide a new framework which includes a guidance for the client teams to identify knowledge sources of other parties. It also includes detailed processes with suitable techniques and tools to acquire, store, develop and reused this acquired organisational knowledge. This strategic framework is a stage by-stage- approach that methodically creates a collaborative construction environment where the client can capture ideas and suggestions of other parties. Terminology of knowledge management system used throughout this study is in reference to both technological and non-technological parts of knowledge management and transfer. This encompasses aspects of hardware and software, network, individual and organisationalresources, tool, procedures, tasks involved and in fact all actions relating to knowledge transfer in construction projects.

CONCLUSION

Based on the issues of performance, delays and cost escalation caused due to non-existent KT practices in the Saudi Arabian public construction projects, this paper sought to find out the basic needs of the KT practices between different organizations involved in the construction of a project. This was carried out to provide integrated processes of KT for the use of client involved with other parties in the Saudi Arabian public construction projects.

These processes built and proposed based on a review and analysis of other KT and KM processes incorporated in different models found in various studies existed in the pertinent literature of KT in the construction domain.

The Delphi technique was effectively used as the main research methodologies to conduct two rounds of data acquisition and analysis using semi-structured interviews conducted with a specific panel of experts who have considerable practical experience in the public sector of the Saudi Arabian construction industry. The analysis of the first responses revealed that the practices of KT is completely non-existent in the Saudi Arabian public construction projects. The interaction among the client team and other parties seems to be communication rather thanpractices of learning andKT. Four cultural factor were revealed as barriers to the implementation KT practices. Thesebarriers caused because of the non-transparent Communication provided by the other parties, vested interest of other parties in retaining that knowledge and that power, blame culture existed between all parties as well as the lack of client awareness about KT practices.The study also found other barriers resulted due to organizationalreasons which are the bureaucracy, shortage of staff versus a huge project and the time impact.

The analysis of the second round responses provided solutions to tackle these barriers. The proposed KT processes were also reviewed to reconsider for their integration and their function to be appropriate for the client use.

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