A Construction Clearing House Framework for Managing Construction Knowledge and Best Practice

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Abstract. This paper discusses a construction clearing house framework to bridge knowledge management gap in the Malaysian construction industry. A clearing house is an agreed upon mechanism for transferring knowledge, which includes a centralized repository of information and resources on a collection of specific topics that are accessible by interested stakeholders. The focus is on resolving the problem of managing domain knowledge of the construction industry in Malaysia, emphasizing on the knowledge management practices through the capturing and transferring of construction knowledge and best practices of the industry players. The knowledge management research framework used is improvised from the previous researchers, while the transfer and sharing of construction best practices is based on the adapted framework also proposed by the previous researchers. This paper briefly described five areas namely knowledge need analysis, knowledge inventory analysis, knowledge flow, knowledge mapping and the knowledge creation in clearing house framework for sharing/transfer of best practices. The construction knowledge and best practices clearing house framework would facilitate the development of a clearing house system in the future, which will enable players in the industry to both contribute and benefit from the resources contained in the clearing house system. This clearing house framework will enable knowledge management of governance inculcate a good environment for practicing conducive knowledge management through knowledge and best practices sharing in the Malaysian construction industry.

1. Introduction
Knowledge management implementation is a costly and time-consuming project that has to be well defined, coordinated and executed. Prior to embarking on any knowledge management project, the need to implement knowledge management and knowledge assessment processes must be conducted to access the current knowledge activities in any organizations. Furthermore, the knowledge and best practices that is valuable to the organization needs to be identified, captured, transferred, and shared. Therefore, the knowledge and best practices that are important to the construction industry are the successes and failures related to construction planning, designing, construction, and operations [1].

The knowledge and best practices in construction industry high achievers need to be captured, shared and learned by other players as this will increase the level of efficiency for the Malaysia construction industry. The captured knowledge and best practices must be managed by construction governing bodies such as the Public Works Department (PWD) and the Construction Industry...
Development Board (CIDB) by implementing construction clearing house system that can be accessed by the industry players. This study focuses on managing domain knowledge of the construction industry in Malaysia, emphasizing on capturing the knowledge and best practices amongst the Malaysian construction industry players.

2. Literature Review

The clearing house is meant to be a centralized location for practitioners, researchers, businesses, and government agencies of all construction related disciplines to exchange data pertaining to construction industry in Malaysia. It is a place to store data, information and knowledge obtained directly after execution of any construction project as well as to store longer-term projects materials such as presentations and papers on best practices and lessons learned. The vision is for a long-term, and accurate repository, which will become a unique and valuable resource center for those interested in learning from Malaysian construction projects. Those involved in the clearing house can gain competitive advantage by learning efficient approaches to constructing projects and gaining business networks in the process [1].

Managing construction knowledge and best practices can be grouped into 5 areas and these are: (1) capturing and transferring of knowledge, best practices and lesson learned by the industry players; (2) point of reference and initiative and coordination on construction industry knowledge by the relevant authorities involved in the industry; (3) knowledge sharing amongst industry players, even by industry award winners; (4) strategy for the development of construction industry skill based on knowledge management processes; and (5) implementation of knowledge management processes involving knowledge discovery, capture, retention, sharing and application amongst the construction industry players.

1) Capturing and transferring of knowledge, best practices and lesson learned by the industry players.

The construction industry in general heavily rely on works such as design, architecture, surveying and other construction services, which are considered knowledge intensive services sectors. The project-based construction knowledge that are used to perform these tasks by engineers, architects and surveyors are captured and leveraged by the organizations [1-3]. Having access to these know-how knowledge, best practices and lesson learned enable construction organizations to be more competitive and innovative as they can avoid ‘reinvent the wheel’ every time when the same situations arise. The knowledge, best practices and lesson learned can be captured and transferred by developing a construction industry clearing house framework that can be utilized by the authorities in the industry in developing the construction clearing house system.

2) Point of reference and information coordination on construction industry knowledge by the relevant authorities involved in the industry.

In capturing of construction specific knowledge across the industry, relevant governing authorities in the construction industry play a pro-active role as a point of reference in coordinating the industry knowledge amongst industry players as in the case of Irish Construction industry [4] and UK Architecture, Engineering and Construction (AEC) industry [2]. The coordination of information related to the best practices and knowledge of the construction industry established through PWD and CIDB will act as the owner of the clearing house system.

3) Knowledge and best practices sharing amongst industry players.

Knowledge and best practices sharing, and reuse of existing knowledge are important processes in managing knowledge in the industry. Since the nature of the construction industry where organizations compete to win project, view their knowledge as their strength and sharing it reduces their competitive advantage, even when there are partnership agreements [5]. Therefore, sharing of the industry’s generic knowledge as well as innovative approaches that are publicly funded are shared by players in the
industry especially if these sharing activities are listed as one of the criteria in the selection of industry award winners. The best practices and knowledge of the construction industry can be transferred and shared based on the framework on strategy to implement the transfer of best practices in Malaysian construction industry proposed by [6,7]. Such a framework is inclusive of the clearing house framework enabling the capturing of knowledge and best practices for sharing to take place through a clearing house system.

4) **Strategy for the development of construction industry skills and knowledge based on knowledge management processes.**

In an inclusive construction industry knowledge, the industry players collaborate by establishing an agreed upon industry standard skills and knowledge [8] and for continuous improvement based upon certain strategy. This is achieved by identifying and developing the skills and knowledge of the construction area and ways of leveraging the knowledge in developing the industry further [8]. Through the clearing house implementation, governing bodies could establish and implement the strategy for managing construction industry’s skills and knowledge systematically.

5) **Implementation of knowledge management processes involving knowledge discovery, capture, retention, sharing and application amongst the construction industry players.**

Many construction industry players are still struggling in understanding the concept of knowledge management and the processes involved [8]. Furthermore, construction organizations also do not have the relevant latest tools in managing knowledge [2,3] that reflects the evolving trend in utilizing technological approaches in managing organizational tacit and explicit knowledge. Implementation of knowledge management initiatives in any organizations involves implementing the knowledge management processes and the same is true for the construction industry. The implementation of knowledge management in organizations are based on well-defined knowledge management strategy framework. In promoting knowledge management between industry players, the construction industry governing bodies must introduce alignment framework for knowledge strategy amongst industry players through knowledge management assessment exercises. These exercises enable the development of comprehensive strategy framework suitable for knowledge sharing in the construction industry.

Through the implementation of a construction, clearing house system developed based on well-defined clearing house framework, knowledge and best practices of construction industry can be managed using appropriate knowledge management approaches and technologies.

3. **The Construction Clearing House Framework**

This study adapted two important frameworks on best practices management. The first framework shown in Figure 1 is the best practices process for transfer of best practices proposed by Jarrar and Zairi (2010) [9]. The stages in this framework are:

1. Searching - identifying the appropriate best practices to be captured and managed;
2. Evaluating - determining the appropriateness of the ideas based on the required needs;
3. Validating - ensuring that the selected practices is valid and acceptable to be established as best practices;
4. Implementing - adapting and adopting the selected practices through enabling the best practices and/or transferring the best practices; and
5. Review - ensuring that the implementation of the practices results in positive contribution.

This framework is useful in identifying the construction industry best practices and knowledge to be captured and managed using the clearing house system.
Figure 1. Best practices process for transfer of best practices [9].

The second framework shown in Figure 2 is the strategy to implement the transfer of best practices proposed by Hamid and Kamar (2010) [10]. The framework consists of three important components, which are:

1. Contributor - Best practices are identified and selected from contributors of the construction industry such as MCIEA winners, local collaborators, international collaborators and research & development initiatives;
2. Agent of Change - implementing changes in an industry requires agent of change, and this role can be played by members of the special interest group (SIG) at CIDB-CREAM involving MCIEA winners and CIDB-CREAM management; and
3. Recipient- players of the construction industry such as the contractors, industry clients and other stakeholders.

This framework helps identify the source of best practices and knowledge of the Malaysian construction industry players that will help in both contributing and benefiting from the contents of the construction clearing house system. However, the content of this system is highly dependent on the clearing house framework as this framework will be used to identify, classify, categorize and organize the content.
4. Experimental
The knowledge management research framework is adapted from Anumba et al. (2005) [11] and Nonaka & Takeuchi (1995) [12]. The phases in developing the construction knowledge and best practices clearing house framework is based on the components of knowledge audit as described in the KeKMa methodology shown in Figure 3.

Figure 2. Framework on Strategy to implement the transfer of Best Practices.

Figure 3. KeKMa Knowledge Audit process.
5. Creation of knowledge/best practices clearing house framework.
This will focuses on knowledge content for construction industry based on the best practices/knowledge gathered from the construction organizations. Knowledge audit is a step by step examination and evaluation of organization’s knowledge health that examines the following:

- Construction clearing house system requirements
- Malaysian construction industry knowledge requirements
- Identification of existing knowledge assets and resources
- Knowledge flow
- Future knowledge needs
- Knowledge gap analysis
- Industry players ways of discovering and sharing knowledge

The phases of knowledge audit are:
1. **Knowledge need analysis** - identify what knowledge construction organizations, its employees and team possess currently and what knowledge they require in the future in order to meet their objectives and goals.
2. **Knowledge inventory analysis** - the process of knowledge inventory checking is to identify and locate knowledge assets and resources throughout the entire construction organizations. This process involves counting, indexing, and categorizing of corporate tacit and explicit knowledge.
3. **Knowledge flow analysis** - determine how employees in construction organizations find the knowledge they need, and how do they share the knowledge they have. The analysis focuses at people, processes and systems.
4. **Knowledge mapping** - the knowledge map is a navigation aid to explicit (codified information) and tacit knowledge, showing the importance and the relationships between knowledge stores and dynamics. It is the mapping of knowledge assets and resources, and how it moves around construction organizations from where it is to where it is needed.

The research instrument to be used in this study is adapted from the Knowledge Audit questionnaire developed by KekMa methodology and the knowledge audit instrument developed by Liebowitz as cited by Makambe (2015) [13]. These questionnaires will be translated into Bahasa Malaysia (BM) if required, and to be administered amongst construction organizations. Two other questionnaires will be adopted from online source (Skyre Associate.com) and are used to gather data from the focus group discussion.

The knowledge audit is a qualitative research as the study is interested in obtaining the subjective perception of the respondents and the goal is to discover patterns that emerged after close observation, careful documentation and thoughtful analysis. Data for this study will be gathered from structured and unstructured face-to-face interviews and focus group discussion with construction organizations to obtain information on the KM initiatives. The population of this study is the construction industry players from the group G1 to G7. Samples will be selected through non-probability sampling method of quota sampling to ensure that certain groups are adequately represented in the study through the assignment of quota. Quota sampling will ensure all organizations from different levels (G1-G7) are adequately selected on a convenience basis.

Data collected in this study will be analysed using the content analysis method to analyse the responses. SPSS analysis of Cross-tabulation analysis and Distance analysis to be conducted to analyse the data objective data gathered. For the subjective data collected, it will be analysed using descriptive statistic method involving frequency tabulation and detailed content analysis.

The construction clearing house framework and prototype system will be developed using the Information Engineering (IE) methodology that is widely used in developing enterprise systems, which consist of five (5) stages as shown in Figure 4: (1) Strategic business planning (2) Data Modeling (3) Process Modeling (4) System design and (5) System implementation [14].
Based on IE methodology illustrated in Figure 5, the knowledge-based system of construction clearing house will be developed. This system will help users to find particulars information about the construction works in efficient and faster manner.

6. Conclusions
The aim of the clearing house is to collect important information in a specific area and to make the information available to people working in that field. It acts as a central access point by serving the needs of the users of a specific body of knowledge. The major function of a clearing house is in preventing the duplication of effort by those users, through identifying, describing and evaluating information relevant to their knowledge area. Therefore, a clearing house is similar to a library, repository, or a warehouse, as it receives, organizes and disseminates information. A clearing house uses the search and retrieve protocol of ANSI Z39.50.1995 (ISO 23950), widely used in the library community (FGDC, 1997).

Therefore, based on the discussion above, problems related to managing knowledge and best practices in the construction industry, it can be concluded that these knowledge and best practices of the construction industry in Malaysia can be managed through the establishment of a construction knowledge clearing house framework that enable the development of a construction clearing house system in the future for the benefits of the relevant parties involved in the industry.

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