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Tacit Knowledge Acquisition and Codification in Construction Industry: Evidence from Indonesia

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ABSTRACT

Tacit knowledge that dominantly exists in the construction project and embed in humans' minds could disperse after the project team is disbanded at the end of the project. As the result, repeated mistakes could occur, and lesson learned from the previous project is not optimally utilized for the benefit of future projects. Previous studies show that tacit knowledge is still not successfully managed in the construction industry. Hence, this study aims to (1) explore the process and method of tacit knowledge acquisition and codification and (2) explore the barriers of tacit knowledge acquisition and codification in the construction industry. The data was gathered through semi-structured interviews with employees from two leading construction companies that are classified as grade-7 (highest grade) in Indonesia. The data were analyzed using thematic analysis. The findings are expected to enrich the existing project knowledge regarding tacit knowledge acquisition and codification in which could become the basis for future research in the tacit knowledge management areas.

Keywords: Tacit knowledge, Knowledge acquisition, Knowledge capture, Knowledge codification

1. INTRODUCTION

Knowledge is more than data and information in which past learning or experience embed in it [1]. In today's knowledge-based economy, the position of knowledge is increasingly vital. Knowledge is now considered the most important source for productivity growth and business performance [1–3]. In the construction sector, knowledge management helps to reduce project duration, improve project manager competency and contribute to project success [4, 5]. Knowledge management helps engineers to find the solution of the project problems without wasting time and cost trying to reinvent the wheel for similar problems. Effective knowledge management enables construction companies to move faster in thriving innovation, improving performance, and creating competitive advantage [6, 7].

A well-known classification of knowledge divides knowledge into explicit and implicit knowledge [8].

Explicit knowledge can be codified as written documents such as specifications, manuals, textbooks. Meanwhile, tacit/ implicit knowledge is highly personal, residing in the individual's mind such as insight, intuition, know-how, and experience [1, 6]. Implicit knowledge has an important place in construction projects considering most of the construction knowledge is implicit and inherent in the individual [9, 10].

Managing and sharing implicit knowledge is more difficult compared to managing explicit knowledge. A characteristic of a construction project that is temporary makes the project team is normally disbanded after the project is completed. As the result, tacit knowledge that resides in the personnel's mind can move along with the movement of knowledge-owners to another team or resign [11]. As consequence, there will be a loss of knowledge if this tacit knowledge is not harvested from each personnel and stored in the organizational memory [12]. It is important to have effective tacit knowledge

management which makes previous project lessons learned inherently in the organizational memory, integrated into existing technology, and supports continuous learning.

Rapid globalization nowadays demands faster tacit knowledge learning [11]. IoT and Cloud computing help to facilitate the need of tacit knowledge in real-time and just-in-time to achieve efficiency [13]. Carillo et al. in Ahmad [1] explained the importance of sharing tacit knowledge in today's competitive era, however, most construction organizations are not successful in capturing and sharing tacit implicit [1]. Even though some studies discussed technology and revolution industry 4.0 such as IoT and Big Data and its relation with knowledge management, however, there is no previous study that comprehensively explore it [14]. Moreover, Sarka et al. (2019)'s study [15] involve 222 experts from academicians and practicians from various countries have recommended future topics of knowledge management research should involve technology aspect. This fact adding the need for knowledge management research focusing on tacit knowledge and involving technology aspects.

The previous study shows that some construction firms could not capture tacit knowledge successfully [6], and some of them have no mechanism to capture project lesson learned and embed it in the organizational memory. This condition leads to repeated mistakes which are costly and sometimes exacerbate project outcomes [16]. Moreover, only handful of research investigating the mechanism to capture project lesson learned and embed it in organizational memory for future uses [16]. Therefore, this paper attempt to fill the gap by investigating tacit knowledge capture/ acquisition and codification in the construction company. This paper aims to (1) explore the process and method of tacit knowledge acquisition and codification and (2) explore the barriers of tacit knowledge acquisition and codification in the construction firm.

A brief review of knowledge management is first presented, followed by an overview of tacit knowledge. Thereafter, the method employed in this study is then explained including data collection and analysis, followed by the discussion of the findings, conclusion, and suggestion for further study. This paper will contribute to the knowledge management literature especially in tacit knowledge implementation in Indonesia.

1.1. Knowledge Management

Knowledge is more than data and information in which knowledge is more structured, actionable, and programmable. It is context-dependent, high human participation, processed, and non-algorithmic [1]. Knowledge is acquired through learning and experiences and can improve the person's ability in evaluating and making-decision [1, 17].

Knowledge can be distinguished into two categories: explicit knowledge and tacit knowledge [17]. Explicit knowledge is easier to be captured, codified, stored, and transferred since it can be expressed in written format or documented form. Meanwhile, tacit knowledge is in individual's minds and is not easy to be transferred and managed since it is heavily influenced by human factors, i.e. communication, skills, interaction [8, 10].

There are some processes of knowledge management introduced in Knowledge Management literature. For instance, Alavi and Leider in Wiewora [18] categorized knowledge management process into 4 elements (1) create knowledge, (2) store knowledge, (3) transfer knowledge, and (4) apply knowledge. Knowledge creation is related to the capability of the organization to generate novel ideas and solutions by recombining existing knowledge to solve current problems. While organization creates knowledge, they can also forget. Thus, codifying and storing knowledge in organizational memory is required. Through codification, organizational knowledge is put into forms that are easier to be accessed by those who need it. Meanwhile, some of the tacit knowledge that cannot be codified can be shared directly to make the knowledge available to others within the organization [19].

1.2. Tacit knowledge

Although there are multiple definitions of tacit knowledge, general agreement has associated it with

personal know-how acquired through experience, training, and education [20]. It is regarded as the most important factor in recruiting construction project managers [21], mainly contributes to project success, and gives benefits to the organization.

Some studies had categorized tacit knowledge into some degrees of tacitness from tacit knowledge that can be easily communicated, codified, and shared until tacit knowledge that inaccessible to others [22]. The process of capturing knowledge can be conducted at the individual level, project team, and organizational level. Some of the tacit knowledge can be codified into explicit form before being stored and disseminated widely in the internal organization.

2. RESEARCH METHODS

Data were collected by semi-structured interviews to get information related to (1) current implementation of tacit knowledge acquisition and codification and (2) barriers of tacit knowledge acquisition and codification. A qualitative method was employed in this study as it is an appropriate approach to explore phenomena [23]. To ensure a qualified sample, data was acquired from leading Indonesian construction companies from grade 7th (the highest grade of construction companies) in Indonesia. The invitation letter was sent to three leading construction companies in Jakarta, Indonesia, however only two construction companies were willing to participate during the period given. Both construction companies are large size companies and have experience of around 60th years.

Semi-structured interviews were adopted. A total of eight participants from middle-level engineers to top-level managers participated in the interviews. Participants were selected from the knowledge management team to ensure an adequate understanding of the knowledge management system in the companies. The number of interviews follows theoretical saturation, and the interviews were conducted through teleconference. The length of each interview lasted between 1 and 1.5 hours. All of the interviews were recorded and transcribed.

Thematic analysis was employed to analyze the data since it is appropriate for exploratory research.

The analysis includes familiarizing yourself with data, generating initial codes, searching for potential themes, reviewing themes, defining and naming themes, and producing reports [24]. To enhance the validity and reliability of the results, triangulation was employed by using multiple methods: sources, interviews, and theories to corroborate the evidence [25].

3. RESULTS AND DISCUSSION

3.1. Results

After analyzing all of the data, some findings were obtained.

Finding 1: Three levels of capturing tacit knowledge in the construction firms

The acquisition of tacit knowledge can be classified into three sources: individual source, project team source, and organizational source. In the Individual level, tacit knowledge can be gathered through several methods: interviewing (1) project personnel who represent the knowledge i.e. project manager, (2) subject matter experts, and (3) project members who are near their retirement ages. Both participants from two construction firms informed that exit interview was conducted to capture experiences from knowledgeable employees who are about to leave the organization. The following opinions provide some insights for these methods:

> "[to obtain knowledge] in individual level, project manager commonly shares their experiences about problems, or innovation or construction methods".

> "…three until six months near the employee retirement age, we [human capital] obliged them to share their knowledge accumulated over their year of experiences."

> "..we've retention learning [program] in which employees close to retirement will have exit interview… commonly it's used to ask feedback for the company, but in this retention learning, they have to share what they have and give to the company, and we store it in book or video."

Additionally, learning from coach/ mentor and professional staff recruited by the company are also used as other methods to capture knowledge from the individual. The following statements provide some insight into the above methods:

"..The employees who have [certain] organizational position are obliged to couch his subordinate.."

"[to obtain tacit knowledge] we also hire professional staff with the contract clause contains the obligation to share knowledge, at least once, about know-how that we didn't know or this organization doesn't know. "

The acquisition of tacit knowledge from the team/group level can be gathered from (1) Peer Assist (2) After Action Review (AAR). Peer Assist was conducted prior to carrying out a construction project, meanwhile, AAR is performed after a project is finished. The following information provide some information regarding these methods:

"In the past, we just give [previous] project data to a new project team…" this is the data, learn from it but peer assist has a target to support. The engineering department would say pay attention to this and that… for this work type, you have to do this and that. So, it's not one direction but two directions."

"After Action Review occurs after a project is completed. The engineers were expected to make a report on how the project was carried out. If the project stays on schedule, then it's noted. If there's raining that led to project delays, then it must be noted. If it isn't delayed, how is the method? That's our [knowledge management team] need to record."

Meanwhile, tacit knowledge capture at the organizational level can be obtained through (1) hiring consultants (2) join venture with another company (3) apprenticeship program to another company, and (4) benchmarking best practices from other companies. These methods are best described by the informant's comment:

"There were projects that we haven't got basic capability yet, for instance toll road project. Our

basic capability for example was just IDR 500 billion, meanwhile we bid tender IDR 2 trillion. We did joint operation with another contractor that fulfil the basic capability. As the result, first, we did tender with that certain amount and second, we obtain knowledge from another contractor that has bigger size than us."

"We've assigned employees to become an apprentice in another company to learn the system. Then, everything that's good can be implemented in our system."

"We did benchmark about light rail transit project and BIM to company X which has bigger size and start their knowledge management first than us…So we captured knowledge from them and implemented it in our company as they implemented in their companies."

Finding 2: The type of tacit knowledge captured is inseparable from the business strategy of the company.

The type of knowledge captured depend on the target or business strategy of the organization want to achieve. This finding best described by an informant's comment:

"what is the knowledge needed by our company?. Besides past projects that we've gathered, it depends on the direction of our organisation strategy in the future. For example, our business strategy is participating in the international road tender. Then, we're not only capture technical aspect on the road, but also legal aspects and human resource management."

This finding aligned with Kivrak et al. [6] in that developing tacit knowledge management strategy that fits organization objectives will benefit the organization.

Finding 3: The need of knowledge mapping to filter tacit knowledge captured.

Filtering information is particularly important in knowledge management to reduce information overload [26]. To obtain tacit knowledge required by the construction company, there must be alignment of KM strategy with the organisation business strategy [17]. Then, knowledge mapping is conducted to

determine the required tacit knowledge. Tacit knowledge that contains innovation and construction method are also used as consideration to filter knowledge to be stored in organization memory. An informant informed:

> "We're from knowledge management division have been collaborated with HCM division in mapping what's the knowledge that we want to prioritize in this year."

Finding 4: The need of validation mechanism to improve the quality of tacit knowledge captured.

To ensure tacit knowledge captured has the highest quality/ credibility, validation of the knowledge is required. Tacit knowledge that gathered from the individual can be validated through subject matter experts:

> "We, honestly haven't got many of this case. Even though the sources of tacit knowledge are from individuals, but they asked to share technical aspect, so it's much easier to be validated. We still only validate the technical aspect…Subject matter experts will assess the contents. If it's individual aspect, we haven't [validate it] yet...in the end, it's just hard competency that we've gathered. If it's leadership aspect or others, the managers or leadership experts will evaluate it."

Tacit knowledge that has been validated will be classified and added some required information before being stored in the knowledge base.

> "Data we've gathered is stored in the knowledge management portal based on the taxonomy that we've classified: technique and non-technique with many categories under technique classification…."

> "We've added narration before being uploaded in the system."

Finding 5. The main barrier in tacit knowledge capture and codification

Based on the informants, the main barrier that hinder effective tacit knowledge capture is accumulated in the individual. It needs some time to gather the data and encourage people to share it:

> "The barrier is tacit knowledge resides in the head of individuals for many years before our system is digitalized as nowadays. Data were scanned, but brought by the owner without being stored in the organization system."

3.2. Discussion

There are several methods applied by construction companies surveyed to capture tacit knowledge. The source of tacit knowledge acquisition can be categorized into individual, team, and organizational levels. Findings suggest that tacit knowledge acquisition in the individual level can be gathered from project personnel who represent the knowledge, subject matter experts, and project members who are near their retirement ages. The acquisition process can be obtained through interviews, training, coaching, or mentoring. These results are similar to those informed by Addis [20] that tacit knowledge can be obtained through training, education, and experience. These findings are also congruent with that of Dalkir [26] who outlined three main approaches to capture tacit knowledge in the individual level: interviewing experts, learning by told, and learning by observation. These are also consistent with finding obtained by Savelsbergh et al. [27] that sharing experiences regularly, the availability of training, and mentoring was found as the top three helpful guidance for project managers' development. Also, a previous empirical study conducted by Kivrak [6] reported that colleagues, the company's experience, and personal experience are the most important knowledge sources in the construction project. The findings of this study complement those previous studies and explain further the source of tacit knowledge based on categorization in the construction companies.

Another finding of this study revealed that the acquisition of tacit knowledge at the group level can be obtained from Peer Assist and (2) After Action Review (AAR). These results are in line with the explanation of IDB [28] despite its different area of study. IDB/ Inter-American Development Bank [28] explained that learning from project experience should be done before, during, and after project. 'Learning before' project discusses what do we know, what has been

done before, whereas 'learning during' project emphasizes on what are we learning during implementation, and the 'learning after' project talks about what lessons learned and experiences can be shared. Peer Assist was conducted before commencing the construction project. It facilitates a new team to exploit lessons learned from the previous projects. It provides specific knowledge, therefore it can be applied directly [29]. Meanwhile, AAR or Post Project Review is performed after completion of the project to evaluate project performance and provide recommendations for future projects [30]. Although Chou [32] revealed that AAR is rarely used in the Indonesian Construction Industry, especially in the Public-Private Partnerships Project, the finding of the current study revealed that some Indonesian Construction Companies acknowledged the importance of AAR to capture tacit knowledge.

This study also found that tacit knowledge acquisition at the organizational level can be captured through (1) hiring consultants (2) joint venture with another company (3) apprenticeship program to another company and (4) benchmarking best practices from other companies. Hiring a consultant with relevant experience can assist construction companies to obtain experiential knowledge. This finding is in accord with the findings from Fletcher and Harris [33] which showed consultants as one of sources to acquire experience in Taiwanese manufacturers.

Meanwhile, joint venture or joint operation is another way to obtain tacit knowledge in the construction project. Organizational knowledge acquisition in the joint venture has a positive relationship with join venture performance [34]. In addition, benchmarking is also a way to acquire tacit knowledge, it provide deeper understanding on the area learned [35]. All of these findings are in agreement with the explanation of Huber (1991) in Dalkir [26] which outlines grafting, vicarious learning, experiential learning, and inferential process as ways of organization to obtain knowledge.

To be effective in leveraging tacit knowledge, the organization need to determine the type of tacit knowledge to be captured. The finding suggests that there should be alignment of tacit knowledge strategy with the organization business strategy. The type of

knowledge captured is depended on the target or business strategy of the organization want to achieve [17]. Tacit knowledge management should add value to organization, thus, the direction of business strategy should determine the direction of the KM activity [17].

Tacit knowledge captured needs to be filtered and validated. The validation of tacit knowledge is required to differentiate knowledge management from document management [26]. It also improves the credibility of the source. [36]. Finding suggests the construction companies to have a comprehensive method for validating tacit knowledge since tacit knowledge is not limited to the technical aspect. Some of tacit knowledge can be codified to make easier in disseminating knowledge [37].

Finally, the finding shows that there is a lack of employees' awareness to share their experiences. The result match those observed in earlier study. Hari, Egbu and Kumar [37] investigate 26 construction organizations and found many experiences engineers are reluctant to share their knowledge. Thus, individuals should be encouraged to fully participate in knowledge management practices [7].

4. CONCLUSION AND SUGGESTIONS

This paper explores in-depth the practice of tacit knowledge acquisition and codification in the Indonesian construction industry. Since the companies surveyed are the leading construction companies, knowledge management system has been established. However, there are some impediments faced. Construction companies need to create systematic tacit knowledge validation and comprehensive strategies which is more favorable for tacit knowledge sharing. Thus, having a systematic strategy is required to manage their knowledge asset better. It is expected that the findings may contribute to more effective tacit knowledge management in construction companies.

These findings are limited by samples of only two leading construction companies and using a qualitative method. Despite its exploratory nature, this study offers in-depth insight into the practice of tacit knowledge acquisition and codification in the construction industry. It also lays the groundwork for future

research into tacit knowledge validation and tacit knowledge sharing in the construction industry.

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