

THE APPLICATION OF KNOWLEDGE MANAGEMENT IN TAIWAN

CONSTRUCTION INDUSTRY

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Abstract: Knowledge management has already demonstrated a number of benefits and has offered justification for further implementation. The Internet facilitated its development and growth via fast and timely sharing of knowledge. By sharing knowledge, an enterprise can create exponential benefits from the knowledge and experience as employees learn from it. In Taiwan, the construction industry is attempting to take a further step to apply knowledge management (KM) to capture, store, share, and reuse past information and knowledge in their projects. A survey is made to identify the application and problem of knowledge management in public sector and private sector in the A/E/C industries of Taiwan. This paper focuses on the current implementing and problem of the public and private sections in construction knowledge management. The purpose of the paper is helpful to further understand the strategy and problem solving for implementing construction knowledge management successfully. Finally, suggestions and strategies based on the survey are provided in the paper to help and apply the future implementing of knowledge management in the A/E/C Industries.

Keywords: Knowledge Management; Knowledge Sharing; Strategies; Construction Project

1. INTRODUCTION

The construction companies in Taiwan are facing rising competitive pressure after the entry to WTO. On the other hand, government is launching Industrial Automation & Electronic Business Program for advance of the Electronic Business. Therefore, the construction industry (A/E/C industries) starts to apply information technology (IT) to improving their business process and efficiency of management in the purpose of enhancing competitive advantage such as ERP, SCM and KM systems.

As the growth of the computerized construction data, the construction industry begins to collect and store the data in the center repository. For the effective reuse of the data, the construction industry apply rate of knowledge management (KM) is arising. For the better understanding of this trend, a survey is made to identify the application and problem of knowledge management in public sector and private sector in the A/E/C industries of Taiwan. Finally, suggestions and strategies based on the survey are provided in the paper

for the future implementation of knowledge management in the A/E/C Industries.

Scope of work

The scope of this research project included reviewing literature of KM and its implementation, investigating application of KM in Taiwan Construction Industry, and offering suggestions and strategies for the KM implementation. The scope of this survey is including public sector and private sector (A/E/C companies) in the purpose of investigating the Application of KM in Taiwan construction industry.

In addition, the survey was distributed to 2206 organizations among the construction industry in the entire island of Taiwan. A survey was used to reduce the time required while investigating comprehensive opinion.

The questionnaire used for this survey included for sections and 21 questions. The different sections were divided into (1) demographic questions about survey participants and the organizations they work for, (2) application of KM including percentage, situation and

problem of KM implementation, (3) the scope of KM implementation including types of knowledge and knowledge management system, (4) the expected benefits of KM implementation.

Of the 2206 questionnaires was distributed, a total of 465 responses were returned. The response rate is 21%. Due to the space limitation, the article does not include the questionnaire. The paper focuses primarily on the responses obtained for each question.

2. LITERATURE REVIEW

The construction industry fragmentation is caused by (1) separate design and construction functions and (2) the specialization of designers and builders into more specific fields of operation [1]. And the project teams in the construction industry are temporary organizations involving individuals in several companies. Therefore, many individuals and companies are joining among the life cycle of any project and besides, the knowledge is distributed and lost at the end of project.

The primary benefit of KM for staff in organization is capturing and reusing knowledge to create knowledge and benefits. Specifically, reusing knowledge can lead to greater competitive advantage, reduce rework time, and act as a learning resource for novices [2]. However, KM is not homogeneous because there are two types of knowledge: tacit and explicit. According to Polanyi's definition tacit knowledge is highly personal, context-specific, and therefore hard to formalize and communicate [3]. Explicit knowledge refers to codified knowledge that is transmittable in formal, systematic language and is easily transferred by using IT [4]. And the different type of knowledge will lead different efficacy. Furthermore, AEC firms have been successful at collecting and storing explicit information in enterprise databases, but they are not always good at tacit knowledge retrieval and sharing[4]. This is because tacit knowledge is stored in the expert brain. In the construction industry tacit knowledge is very important for a novice. Usually, a novice asks a experienced workers or engineer in order to get the specific tacit knowledge. In the construction industry, finding the reusable item and exploring both its context and evolution history are the two key activities in the reuse process [2]. And the context is housed in the brain of experienced workers or engineer. Although tacit knowledge is very important for the construction industry, AEC organizations are often ignoring it for it's difficult to capture. In the other word, the AEC organizations adopt the explicit knowledge strategy. In the past studies, dynamic knowledge map [4] and community of practice (COP) [5] are helpful for the

problem of the reuse of tacit knowledge. The term COP is defined as an informal network or forum where tips are exchanged and ideas generated [5].

Another typical strategy in the construction industry focuses on the knowledge management system (KMS). Actually, many of the AEC organizations in Taiwan only built a KMS for collect ing and storing explicit knowledge while they implement KM. However, the framework for organizational readiness for KM includes not only KMS (IT tools), but also organizational context such as metrication and culture [6].

But the IT tools such as KMS still play a critical role in KM process. KMS could be a substitute for face-to-face contact. Thus, KMS can reduce the time and geographical barriers that limit KM activities. And KMS could also be the knowledge repository in which knowledge is stored in the organization. The key is therefore to understand how technology is most appropriately deployed and aligned to the knowledge activities in the organization [7]. In the purpose of intending to bridge the gap between KMS and KM process, a three-tiered KMS architecture is proposed include presentation services (Two common features of presentation services are personalization and visualization), knowledge services (The two main infrastructure services provided by technology are storage and communication), and infrastructure services (The underlying knowledge processes of these three KM goals are knowledge creation, knowledge sharing and knowledge reuse) [7]. Besides the application of KMS, further IT application research includes: KDD (Knowledge discovery in databases) technologies that discover Predictable patterns that help manager to predict potential problems[8], and information retrieval algorithms that can support effective knowledge reuse[9] is developed for construction industry. And these technologies can assist in building effective and efficient next generation digital knowledge management environments.

3. SURVEY RESULTS

This section contains the result obtained from the data collected from questionnaires that returned.

Demographic information

The survey results of the demographic information included company type and the years of employment of the respondents. The company type and its percentage were

- General contractor and specialty subcontractor (37.27%)
- Professional supplier (23.28%)
- Public sector (14.63%)

- Engineering/consulting companies (13.30%)
- Architect (8.42%)
- Other types of companies (3.1%)

The number and percentage of years of employment of the respondents were

- less than 2 years (4.90%)
- 2-5 years (19.15%)
- 5-10 years (22.05%)
- 10-20 years (38.08%)
- 20 years or more (15.81%)

The application of KM

The application of km obtained the implementation level of KM in the construction industry. The survey responses indicated that only 21.3 % of the respondents had already applied KM to their organization. Most of the respondents are on the stage of building or planning KM. The results of the responses were tabulated in Table 1.

Table 1. Implementation level of KM of the respondents

implementation level of KM	Percentage of respondents (%)
Already apply KM	21.3
Building of KM	20.4
Planning of KM	31.8
Not consider yet	26.5

The knowledge sharing ways

The survey obtained the information from the respondents about the knowledge sharing ways of the organization. And the major types were: ask coworker directly, training program, applying KMS, and meeting. The items and the percentage were

- No exchange/share (0.91%)
- Ask coworker directly (20.20%)
- Phone (8.92%)
- E-mail (10.06%)
- Meeting (18.67%)
- Study forum (1.45%)
- Conference (6.02%)
- Internet forum (3.05%)
- Training program (19.89%)
- Apply KMS (7.93%)
- E-learning program (2.29%)
- Others (0.61%)

Knowledge store methods

The survey obtained the information from the respondents about the Knowledge storing methods. And the major types were system archive, paper archive, and Store by the individuals. The results of the survey

were shown in Table 2.

Table 2. Knowledge storing methods of the respondents

Knowledge storing methods	Percentage of respondents (%)
No Knowledge storing methods	1.46%
Store by the individuals	24.30%
Paper archive	22.51%
System archive	27.77%
Common IT repository	17.13%
KMS repository	6.61%
Others	0.22%

Difficulties of implementation of KM

The survey also asked respondents to identify the Difficulties of implementation of KM. And the results shown in the responses were in the following area:

- No systematically implementation (21.07%)
- Misfits of KMS (13.99%)
- No taxonomy of knowledge to refer (13.21%)
- No reward system for KM (13.21%)
- Current KM taxonomy is confusing (13.05%)
- No knowledge dissemination methods (8.81%)
- No knowledge extraction (8.65%)
- No COP (5.97%)
- Other (2.04%)

The content of knowledge demand in KM activities

The survey also obtained the information regarding the content of knowledge demand in KM activities. The responses from the respondents were in the following content

- Codes and Specification (CNS and ASTM)
- Applicable Law
- Standard Drawing
- Technic and Methods
- Material price

Application of KMS

The survey requested information about the Application of KMS, and the responses indicated that much of the respondents (61.72%) developed KMS by themselves. Furthermore, the survey also investigated the function that KMS provided. Table 3 shows the results.

Table 3. KMS function of respondents

Provided function	Percentage of respondents (%)
Knowledge content structure	18.81
Announcement Management	17.01
Automatically knowledge capture	12.24
Full-text retrieval	10.45
Automatically categorized	10.15
Group forum	8.36
Personalized assistant	7.46
E-learning	7.16
Multimedia supported	5.07
Knowledge Map	3.28

Expected benefit of KM

The survey also requested both the individual and organizational expected benefit of KM. The Likert-type Scale was used in the two questions of this section, and the scale was from 1 to 5. The responses and the average score were in the following.

Individual Expected benefit of KM

- Capture the needing knowledge rapidly (4.45)
- Learning experience from others (4.39)
- Enhance the efficiency of job (4.29)
- Accumulate personal knowledge rapidly (4.29)
- Facilitate knowledge sharing and reuse (4.27)
- Increase personal ability of recreation (4.18)
- Decrease mistakes (4.03)

Organizationally Expected benefit of KM

- Collecting and storing knowledge (4.20)
- Building consistent taxonomy (4.12)
- Enhancing organizational efficiency (4.12)
- Accumulate Organizational knowledge rapidly (4.11)
- Enhancing competitive advantage (4.06)

4. SURVEY ANALYSIS

The responses of the survey show that only 21.3% of the respondents had already applied KM. Among all types of the company, public sectors and Engineering/consulting companies had better application rate in 29.2% and 25%.

The interviewee uses two main methods to share knowledge: face-to-face and training program. Taiwan construction industry rarely utilizes the IT tool such as KMS or group forum for COP. Thus, the time and geographical barriers limit KM activities. The survey results indicated that of the organizations had already applied KM, 43.8% of the individuals will utilize the KMS to obtain knowledge than 31.5% of the

organizations that Building KM.

The results of the survey also show that most of the organizations are still storing knowledge by individuals and System archive. This will cause the dissemination problem of knowledge because it is not easy to obtain the knowledge.

Two main issues about the difficulties of implementation of KM are identified as the KM issue and the organization issue. KM issue includes No systematically implementation and Misfits of KMS. In Taiwan construction, KMS often take as a quick solution to implementing KM without helping from KM consultant. The survey results also show that most KMS developed by technologists are not well integrated into the construction industry process. On the other hand, 61.7% of the responses decided to develop their particular systems; however, most of those systems were not well designed. The major functions provided by KMS developed by technologists and AEC organizations focus on Knowledge content structure, Announcement Management, Automatically knowledge capture, and Full-text retrieval. Based on the responses, the paper identified KMS functions applied in the respondent organization focus on categorizing and capture knowledge. According to the literature mentioned above, there were some failures in the following: (1) communication function such as collaboration and group forum of COP, (2) Knowledge Map (K-map), (3) learning function such as E-learning and multimedia supporting.

Organization issue is the lack of KM reward system. Past studies and practice discover that reward system is very important for implementation of KM. Since Taiwan construction industry doesn't emphasize on reward system, the tacit knowledge is difficult to capture in that employee do not want to share it considering personal competitive advantages.

The information regarding the content of knowledge demand obtained from the respondents show that KM strategy of Taiwan construction industry is explicit knowledge strategy. Compare with Individual Expected benefit of KM, the demand of tacit knowledge is not matched. Consequently, individuals must obtain tacit knowledge by face-to-face way instead of utilizing KMS.

5. RECOMMENDATIONS

Based on the survey results and analysis, the suggestion and strategies for KM implementation of Taiwan construction industry offered:

- (1) The strategy of knowledge should include both explicit and tacit ones.

- (2) The knowledge-distributed condition should be improved and utilized Web-based technology to improve the access of knowledge.
- (3) Reward system is important to KM, especially to the capture of tacit knowledge.
- (4) COP and group forum can help the dissemination of tacit knowledge.
- (5) KMS should add more function such as communication, K-map, and learning function.

6. CONCLUSIONS

Taiwan construction industry has a consensus about benefit of KM. Based on the survey and past studies, the implementation of KM need to improve for better benefit of reuse knowledge.

The tacit knowledge strategy must be emphasized in the purpose of individually expected benefit, of enhancing the working efficiency, and advance of knowledge repository. The sharing and reuse of knowledge can also be improved through the tacit knowledge strategy. Thus, the application of well-developed KMS can decrease the time and geographical barriers limit KM activities. Consequently, KM can really lead to greater competitive advantage.

The suggestion for future research is the implementation process of KM should be addressed since the paper has discussed the benefits and strategies of KM for Taiwan construction industry. Furthermore, the culture issue has not included in the scope of the survey needs to be addressed for clarifying how culture affect. Research on the new IT application and its benefit are also needed for the KM.

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