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Industry-wide Knowledge Management Initiatives: Best Knowledge Management Practices of Construction Organizations

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Abstract

Knowledge management implementation is a costly and time-consuming project that has to be well-defined. Coordinated and executed. This study focuses on domain knowledge management of the Malaysian construction industry. Thirty-one respondents from various categories of construction organizations have participated in this concurrent mixed-method study. A purposive sampling procedure has been used to obtain the required data. Before that, an instrument was prepared, consisting of measurement on four constructs, namely Perception about Organization Environment (POE), Perception about Knowledge Management in Organization (PKO), Knowledge Discovery Practices (KDP), and Appreciation System (AP). Since the ordinal scale was used, the qualitative descriptive analysis was done based on median, maximum, and minimum values. Additionally, a Spearman Correlation analysis was conducted, revealing several significant correlations, including those between PEO and KMO, PEO and KDP, KMO and KDP, KMO and AP, as well as KDP and AP. During the survey, suggestions from the respondents regarding the best practices for knowledge management were also sought. This qualitative data was later analyzed using thematic analysis. As a result, it is revealed that most of the sampled construction organizations provide encouraging environments for good knowledge management practices. They support knowledge discovery and acquisition while implementing an appreciation system to maintain the good practice of knowledge management. The thematic analysis has also indicated that knowledge management applications are crucial for these organizations. Overall, this study has expanded the existing body of knowledge by providing insights into implementing scalable and sustainable knowledge management practices tailored for construction organizations.

Keywords: Best Practices, Construction, Knowledge Applications, Knowledge Management, Knowledge Sharing, Knowledge Discovery.

Introduction

The challenges of managing construction knowledge can be classified into several key areas. One major issue is the failure to effectively capture best practices, knowledge, and lessons learned within the industry. Additionally, there is a lack of coordination and initiative among the relevant authorities involved in the sector for managing construction knowledge. Another problem is the absence of knowledge sharing among industry players, even those who have received awards for their achievements. Furthermore, there is an inadequate strategy for developing construction industry skills based on knowledge management processes. Lastly, implementing knowledge management processes such as knowledge discovery, capture, retention, sharing, and application remains minimal among construction industry participants. The construction industry, in general, heavily relies on work in design, architecture, surveying, and other construction services, which are considered knowledge-intensive services sectors. However, the project-based construction knowledge that is used to perform these tasks by engineers, architects, and surveyors is not properly captured and leveraged by the organizations (1–3). Having access to these best practices, lessons learned, and know-how would enable construction organizations to be more competitive and innovative, as they can avoid "reinventing the wheel" whenever the same situations arise.

Knowledge Management

The need to manage knowledge in organizations has become the key factor for success in the

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knowledge economy. Construction organizations throughout the world are also engaging with knowledge management projects and strategies to harvest the value of knowledge in order to stay competitive and be innovative (1, 3, 4). Knowledge management is the process of systematically managing individual, group, and organizational knowledge. This is possible because knowledge can be viewed as 'information about the information (5). Research in the field of knowledge management concentrates mainly on finding effective ways of managing this knowledge through social and management perspectives, as it resides in human memories; managing is seen as a human-oriented process rather than one that is technology-based. Nevertheless, information communication technology (ICT) provides a technological means of managing organizational knowledge. The process of managing knowledge involves the execution of such actions as knowledge gathering and acquisition, knowledge structuring, knowledge refining, and knowledge distribution (6). These processes are implemented using a combination of organizational, social, and managerial initiatives as well as appropriate deployment of technology (3). Knowledge management is an evolving trend that spans across different domains such as business, organizational studies, construction, management, human resources, and information technology (6). In recent years, many large organizations have engaged with knowledge management (KM) projects either to improve profits, to be competitively innovative, or simply to survive (7). Knowledge management involves the systematic management of knowledge resources within the organization in order to create value from its knowledge assets by creating, coding, storing, distributing, and exchanging knowledge using technology as an important contributor and enabler (8, 9).

The Need for Knowledge Management

Knowledge as a resource has to be managed from the following perspectives: delivered at the right time, available at the right place, present in the right shape, satisfying the quality requirement, and obtained at the lowest possible cost (10, 11). The need to manage knowledge differs between organizations as business processes vary between them. A survey of senior executives in Western Europe conducted by the Economist Intelligence Unit (EIU) reported similar benefits as to what companies hope to obtain through knowledge management projects (12). However, most organizations need continually to improve business process effectiveness, and this is shown in the Survey conducted by the Ernst and Young Center for Business Innovation and Business Intelligence of 431 U.S. and European companies in 1997 (13). Almost three-quarters of respondents in the survey agreed that knowledge management would benefit them by improving decision-making processes (89%), customer responsiveness (84%), people and operations efficiency (73%), innovation (73%), and delivering better products and services (73%). These clearly indicate that knowledge management needs to infiltrate every aspect of the enterprise to improve business efficiency and productivity. This has resulted in knowledge emerging as the most important commodity. what is bought and sold have knowledge elements in them, and managing knowledge has become a crucial task for organizations (12). Another important need for engaging in KM projects is to overcome the problems of human turnover in organizations. A lifetime's accumulation of facts, events, procedures, and so on is stored in personal memories that enable people to work in and make sense of the world that surrounds them. However, with the ending of the single-job-for-life culture, businesses lose much of that knowledge when an individual leaves the organization. Some have argued that this threat of "lost knowledge" is the principal driver behind KM's emergence, and several authors have argued that KM provides the answer to the brain drain problem (14, 15). In sum, the existing body of literature has emphasized the importance of KM in enhancing organizational performance in various fields, including construction. Existing studies emphasized the need for structured KM practices to capture and leverage project-based knowledge (1, 3). However, much of the literature remains focused on technological solutions, often overlooking the human and cultural dimensions of KM (2). Another significant gap is the limited scalability of proposed KM practices across diverse organizational contexts. While Nonaka and Takeuchi's SECI model has been influential in framing KM processes, its application to project-centric industries like construction remains

underexplored (7). Moreover, the absence of standardized metrics for evaluating KM effectiveness further complicates efforts to generalize findings across different organizations (6). Considering the aforementioned importance of knowledge management, especially for construction organizations, this study aimed to examine KM's best practices based on construction industry organizations' best practices. By integrating findings from quantitative analysis and thematic exploration, this research contributes to the theoretical understanding of KM and offers practical solutions adaptable to diverse project environments.

Methodology

Knowledge management in the construction industry is a multifaceted challenge. To capture this complexity, the study employed a concurrent mixed-methods design, combining quantitative and qualitative data to provide a comprehensive understanding. Both data types were gathered through a survey, adapted from the Knowledge Audit questionnaire developed by KekMa (htto://kekma-audit.com) and the knowledge audit instrument (16). The quantitative insights were captured through Likert-scale items (ranging from 1: Strongly Disagree to 4: Strongly Agree). These items were designed to measure four key constructs: POE, KMO, KDP, and AP. The survey instrument also collected qualitative data through open-ended questions, allowing respondents to share detailed perspectives and experiences related to their organization's KM practices. Furthermore, the data collection was done based on purposive sampling using online platforms such as email and WhatsApp. This ensures a diverse representation of construction organizations and increases the participation of individuals with substantial field knowledge and experience. During the analysis phase, both quantitative and qualitative data were integrated to triangulate findings and facilitate a comprehensive interpretation. The quantitative analysis employed descriptive statistics using SPSS software, while qualitative data underwent thematic analysis to identify key themes and patterns relevant to knowledge management practices. The synthesis of these analyses allowed for well-rounded conclusions to be drawn from the data.

Results

Most of the organizations that are represented by the respondents were established in 2009, followed by five responses for 2012, two responses for 1985, and one response for 2014 and 2010. Furthermore, the maximum experience given by the respondents is 21 years, while the minimum is 3 months. There are four categories under Civil Engineering (KA), and the highest number of respondents involved in General Civil Engineering Works (KA 01) with 17 responses, followed by three respondents for Cleaning and Desludging of sewer lines, septic tanks, pumping stations, and treatment works (KA 04) and one respondent for each Marine, Coastal and offshore Construction Works, and Maintenance (KA 02) and Micro-tunnelling and Pipe Jacking Works (KA 03). For Mechanical Engineering (M), there are 14 respondents involved in Air-Conditioning and Ventilation System (M 01), followed by four in Workshop, Mill, Quarry System and three in Mechanical Equipment. For mechanical specialists (KPME), most respondents (n=11) engaged in Power Generation (KPME 03), and the last category is Specialized Plant (KPME 04), with only one response. Meanwhile, for building construction (B), there is only one category, which is Building Works (B 01) with 20 respondents involved in it. Next, Janitorial Services (S 02) is the highest category in Services (S), as they collected 21 responses from the respondents. The other two categories were only represented by one and four respondents, each for Environment and Solid Waste Management Services (S 01) and Slides Maintenance and Clearing Works (S 03). For Electricals (E), Electrical Wiring Installation (E 01) has the highest number of respondents (n=15), followed by Cable Jointer Specialize (E 05) (n=2), Telemetry (E 06) (n=2) and Low Voltage Electrical Works (E 02) (n=1). Finally, the demographic analysis has indicated that most of the respondents for Construction Specialist (KPB) are from Plumbing and Sanitary Works (KPB 04) (n=4). The other categories only contribute three or fewer responses.

Descriptive Statistics

The reliability of the questionnaire showed an excellent internal consistency with Cronbach alpha, $\alpha = 0.919$ for POE, $\alpha = 0.925$ PKO, $\alpha = 0.854$ for KDP and $\alpha = 0.954$ for AP. Overall, the questionnaire demonstrated substantial

reliability with α = 0.913. Furthermore, the quantitative analysis was carried out using descriptive analysis. From the perspective of POE (Table 1), the respondents found that the environment in their organizations encourages the creation of new knowledge (Med.=3.0, Max=4), facilitates the storage/search of knowledge related to projects (Med.=3.0, Max=4), and facilitates knowledge transfer among members (Med.=3.0, Max=4). Above all, they perceive that the environment of their organizations accelerates the decision-making process (Med.=3.0, Max=4).

Table 1: Perception about Organization Environment (POE) Descriptive Statistic

Perception About the Organization Environment	Med.	Max	Min	n
Encourage the creation of new knowledge on projects	3.0	4	3	31
Facilitate the storage/search of knowledge	3.0	4	3	31
Facilitate knowledge transfer	3.0	4	3	31
Accelerating decision-making	3.0	4	3	31

From the perspective of PKO (Table 2), in order to acquire knowledge, the respondents prefer to speak to knowledgeable co-workers or superiors than to refer to the related documents (Med.=3.0, Max=4). They also doubt the relevancy of knowledge obtained from the stored documents as such sources need continuous updates (Med.=3.0, Max=4). In addition, the majority of contractors involved in this study stated that they did not document or store their knowledge, and thus, knowledgeable colleagues are the only available source of knowledge (Med.=3.0, Max=4). Although this practice might seem like a deficiency, they also mentioned that their organizations provide support to create and share knowledge (Med.=3.0, Max=4).

Table 2: Perception about knowledge Management in Organization (KMO) Descriptive Statistic

Perception About Knowledge Management in Organization	Med.	Max	Min	n
It is easier to refer project-related knowledge to knowledgeable colleagues than to refer to documents	3.0	4	3	31
Knowledge of the project in the form of documents should be reviewed before being used to ensure it remains relevant	3.0	4	3	31
I need to refer the knowledge regarding the project to a skilled person because my organization does not document it	3.0	4	2	31
Do you think members in your organization provide support to create and share knowledge	3.0	4	3	31

In terms of knowledge discovery practices among contractors (Table 3), the participants stated that they consistently seek the right knowledge to improve their organizations and businesses (Med.=3.0, Max=4). They also claimed that they have enough knowledge to execute the projects (Med.=3.0, Max=4). Due to that, they were satisfied with the knowledge available for use in the organizations (Med.=3.0, Max=4).

Table 3: Perception about knowledge Discovery Practices (KDP) Descriptive Statistic

Knowledge Discovery	Med.	Max	Min	n
The right knowledge	3.0	4	3	31
Enough knowledge to enable me to execute the project	3.0	4	3	31
I have been satisfied with the knowledge available for use in my organization	3.0	4	2	31

Finally, the respondents also believed that proper appreciation should be given to the members of their organizations in order to promote the production of reusable knowledge on projects (Med.=3.0, Max=4). Furthermore, this knowledge could further be re-used in their projects (Med.=3.0, Max=4). Their responses are presented in Table 4.

Table 4: Perception about Appreciation System (AP) Descriptive Statistic

Appreciation System	Med.	Max	Min	n
To produce reusable knowledge on projects	3.0	4	3	31
To re-use existing knowledge regarding the projects	3.0	4	2	31

Correlation Analysis

Normality testing was conducted to assess the distribution of the constructs using skewness and kurtosis values. For skewness, values outside the range of ±1 indicate potential non-normality, while for kurtosis; values beyond ±2 suggest significant deviation from normality (17).

Table 5: Normality Test of the Items

Construct	Items	Skewness	Kurtosis
Organization Environment	PEO1	1.379	-0.109
	PEO2	1.937	1.868
	PEO3	1.163	-0.697
Knowledge Management in Organizations	KMO1	0.972	-1.134
	KMO2	1.631	0.702
	KMO3	0.296	1.065
	KMO4	1.631	0.702
Knowledge Discovery Practices	KDP1	0.972	-1.134
	KDP2	0.972	-1.134
	KDP3	0.826	2.170
Appreciation System	AP1	1.631	0.702
	AP2	0.711	1.265

The analysis in Table 5 revealed that several items exhibited non-normal distributions. Specifically, items PEO2, PEO3, KMO2, KMO4, and AP1 had skewness values exceeding the acceptable range, indicating asymmetry. Additionally, KDP3 displayed kurtosis slightly beyond the acceptable range, suggesting heavy tails. Given the small sample size (n = 31), the deviations from normality necessitate the use of non-parametric methods for further statistical analyses. Consequently, Spearman's rank correlation was selected for subsequent correlation analysis to account for the non-normality and ensure robust results.

Table 6: Spearman Correlation Matrix

		PEO	KMO	KDP	AP
PEO	r	1.000	0.851	0.954	0.669
	p	.	0.000	0.000	0.000
KMO	r	0.851	1.000	0.900	0.850
	p	0.000	.	0.000	0.000
KDP	r	0.954	0.900	1.000	0.709
	p	0.000	0.000	.	0.000
AP	r	0.669	0.850	0.709	1.000
	p	0.000	0.000	0.000	.

r: Correlation Coefficient, p: Significance

The result in Table 6 indicated several significant correlations between the constructs. First, a strong, positive correlation between PEO and KMO was statistically significant ($r(29)=0.851$, $p=0.000$). Similarly, there was a very strong, positive correlation between PEO and KDP, which was statistically significant ($r(29)=0.954$, $p=0.000$). A moderate, positive correlation was

found between PEO and AP, which was also statistically significant (r(29)=0.669, p=0.000). For KMO, there was a very strong, positive correlation with KDP, which was statistically significant (r(29)=0.900,p=0.000). A strong, positive correlation was observed between KMO and AP, which was statistically significant (r(29)=0.850, p=0.000). Finally, KDP showed a moderate to strong positive correlation with AP, which was statistically significant (r(29)=0.709, p=0.000).

Thematic Analysis

In sum, the descriptive statistics in the previous section have revealed that the majority of the respondents and their organizations implement good knowledge management practices. This notion is based on their positive responses to the four constructs of knowledge management practices measured in this study. Additionally, to explore deeper these contractors' perceptions of the knowledge management best practices, the questionnaire is also designed to capture qualitative responses on this matter, as described in the following section. Table 7 and Figure 1 summarize the thematic analysis findings of their responses.

Table 7: Thematic Analysis of the Qualitative Responses

Code	Theme	n
1	Knowledge application to promote safety in work	4
2	Accountability with the knowledge	32
3	Knowledge application to promote innovation and creativity	7
4	Sustainable knowledge sharing practices	1
5	Knowledge application to support teamwork	18
6	Knowledge application to support organization growth	9
7	Knowledge application for disciplined working practices	11

The analysis revealed that the respondents perceived accountability with knowledge as the most important knowledge management practice in construction organizations (n=32). This includes attitudes such as trustworthiness, honesty, and responsibility, which are derived from the gained knowledge. Furthermore, teamwork is the next important aspect that is related to knowledge management among contractors (n=18). The knowledge related to works or projects should be shared among them, thus, promoting a good teamwork culture. Next, the respondents also mentioned that the available knowledge should be used to exercise disciplined working practices (n=11), support organization growth (n=9), and promote innovation and creativity (n=7).

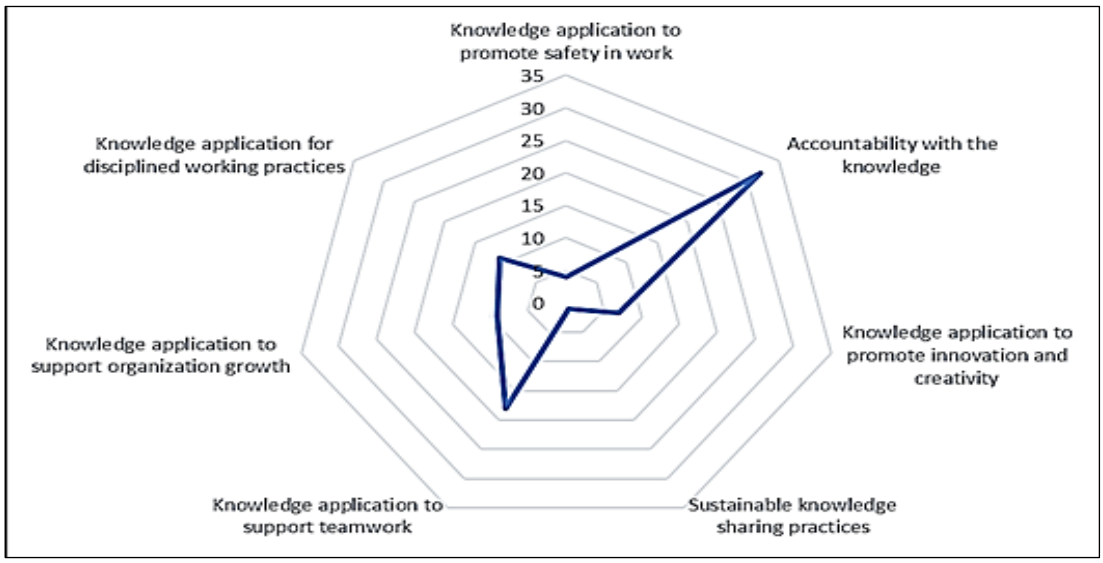

Figure 1: Best knowledge Management Practices among Malaysian Contractors

Discussion

The findings of this study reveal several best practices for implementing effective KM strategies within construction organizations. However, the success of these practices often depends on their scalability and adaptability to different project environments and organizational structures. Scalability is critical in ensuring that KM practices can be applied across projects of varying sizes and complexities. For instance, the use of standardized documentation processes and digital knowledge repositories can benefit both small-scale projects and large, multi-stakeholder construction initiatives. Organizations can facilitate seamless knowledge sharing irrespective of project scale by ensuring that these systems are flexible and user-friendly. Construction organizations, including general contractors and specialized engineering firms, require tailored knowledge management approaches due to their diverse natures. For example, smaller organizations may prioritize informal knowledge sharing through team meetings, while larger firms might benefit from more structured systems, such as enterprise-wide knowledge management platforms. The findings suggest that integrating technology with human-centric practices, such as mentorship programs, enhances the adaptability of KM systems. Moreover, real-world scenarios further illustrate the applicability of these findings. For example, in infrastructure projects involving diverse teams, creating cross-functional knowledge-sharing forums can bridge gaps between technical and managerial knowledge domains (18). Similarly, the use of mobile applications for on-site knowledge capture ensures that critical information is documented in real-time, improving decision-making processes (19). Beyond individual projects, the insights from this study have broader implications for the construction industry. By adopting scalable and adaptable KM practices, organizations can improve their overall efficiency, foster innovation, and enhance collaboration across the sector. Furthermore, these practices contribute to building a culture of continuous learning and improvement, positioning organizations to better respond to future challenges. The finding of this study could also be related theoretically to Nonaka and Takeuchi's SECI model (7). The significant correlations observed in this study illustrate the dynamic process of knowledge conversion between tacit and explicit forms through Socialization, Externalization, Combination, and Internalization. Specifically, a strong positive correlation between PEO and KMO highlights the role of a supportive organizational climate in facilitating interpersonal interactions that promote tacit knowledge transfer, aligning with the socialization phase. Furthermore, the strong correlation between PEO and KDP emphasizes the need for environments that effectively articulate and document tacit knowledge into explicit formats, which is critical for externalization. The significant correlation between KMO and KDP also suggests that organizations with established knowledge management practices usually successfully combine existing explicit knowledge to create comprehensive repositories and actionable insights, echoing the combination phase of the model. Lastly, the correlation between KDP and AP illustrates how recognizing and valuing knowledge contributions can enhance the application of explicit knowledge into tacit understanding, reflecting the internalization phase. These findings provide empirical support for the SECI model and affirm its importance in understanding knowledge management processes within construction organizations. The findings of this study illuminate the distinctive challenges and opportunities involved in applying these theories within the construction industry. The SECI model posits that knowledge conversion occurs seamlessly; however, the observed correlation between KMO and AP suggests that explicitly acknowledging knowledge-sharing efforts may enhance motivation and facilitate these conversions in practice-oriented sectors such as construction. While communities of practice typically flourish through informal exchanges, the robust relationships among the constructs identified in this study highlight the imperative for structured mechanisms. Establishing mentorship programs and implementing digital platforms are crucial strategies that can support these practices in larger, more fragmented organizational contexts.

Conclusion

In conclusion, this study has successfully achieved its objective of developing KM best practices based on construction industry organizations'

best practices assessments. The findings in this study could provide some insights for stakeholders in the industry, especially in terms of sustaining good knowledge management practices. As evidenced by the quantitative findings, most of the sampled construction organizations provide encouraging environments for good knowledge management practices. Moreover, they support knowledge discovery and acquisition while also implementing an appreciation system to maintain good knowledge management practices. The findings align with some recent KM research in the construction industry, particularly those emphasizing informal knowledge sharing over formal documentation (20, 21). However, some findings diverge from existing literature. For example, while a past study advocated for integrated information systems to boost productivity, this study reveals a continued dependence on tacit knowledge and informal networks in Malaysian construction organizations, possibly due to limited technological infrastructure and cultural preferences (22). Overall, this study validates existing theoretical frameworks while identifying opportunities for future research focused on developing innovative KM strategies tailored to the unique needs of project-based environments.

This study also yielded an interesting finding, which is these construction organizations rely more on knowledgeable individuals, instead of documented knowledge. This practice is somehow less sustainable, as the individuals are subjected to many possibilities and risks including quitting the job, transferring to another company, or fatality. Therefore, there should be some mechanism to store their knowledge for future reference. Finally, the thematic analysis of the contractors' responses regarding the best practices has indicated that knowledge management applications are vital for organizations that operate on a profit basis. These organizations aimed to make their knowledge usable for the projects and help them to grow. Despite this, the aspects of knowledge discovery, capture, and sharing might be overlooked by them. Hence, to support sustainable knowledge management practices, some mechanisms should be provided to increase awareness on the matter to them.

Abbreviations

POE: Perception About Organization Environment, PKO: Perception about Knowledge Management in Organization, KDP: Knowledge Discovery Practices, AP: Appreciation System, ICT: information communication technology, KM: knowledge management, EIU: Economist Intelligence Unit.

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Author Contributions

Mazida Ahmad led the development of research instruments and contributed to data collection. Hapini Awang played a key role in data analysis and drafting the report. Huda Ibrahim assisted with both data collection and report writing. Mazni Omar, Azman Yasin, and Azizah Ahmad provided additional support for data collection and contributed to the report's preparation. All authors reviewed and approved the final manuscript.

Conflict of Interest

The authors of this publication declare no conflicts of interest.

Ethics Approval

Not applicable.

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