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Mapping Relationships among the Enablers of Knowledge Management within Hong Kong Construction Organisations

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Abstract

This paper reports on a research study that investigates the existence and strength of relationships among the enablers of effective knowledge management (KM) within leading construction organisations operating in Hong Kong. The literature suggests seven KM enablers namely, Leadership, Strategy, Organisational Culture, Business Innovation, Business Processes, Technology and People. Their interactions, however, are seldom made explicit in KM research and writing. This paper aims to present a model that consists of a set of seven enablers for successful KM implementation to obtain desired results.

The paper hypothesises that for knowledge-driven construction organisations to perform well, the seven KM enablers need to be aligned and mutually reinforcing. The paper, therefore, adopts and applies interpretive structural modelling to better understand how the enablers interact. Utilising industry data collected during 2007-09, the developed model shows that many of the enablers are inter-related and cannot be dealt with, in the KM context, in isolation. The model findings provide a road-map to managers in order to improve the implementation of their KM activities to maximise the achieved benefits.

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1. Introduction

Knowledge has become one of the critical driving forces for business success and it is increasingly becoming obvious that organisations should have the right knowledge in the desired form and context to be successful. As such, KM is first and foremost a management discipline that treats intellectual capital as a managed asset. Primary tools applied in KM are organisational dynamics, process engineering and technology. These work in concert to streamline and enhance the capture and flow of an organisation's data, information, and knowledge and to deliver it to individuals and groups engaged in accomplishing

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specific tasks. The primary goal of KM is, therefore, to deliver the intellectual capacity of the firm to those making day-to-day decisions which, in aggregate, determine the success or failure of a business.

Any construction organisation is a business built by knowledge people and its competitive edges are driven by innovation and value creation. Innovation is about breaking away from traditional mental frameworks that inhibit new thinking. It is predominantly learning and knowledge-driven. Research conducted by Bilderbeek, et al. (1998) identified design, architecture, surveying and other construction services as knowledge-intensive service sectors. An important feature distinguishing such sectors from manufacturing firms is the type of ‘product’ they supply. Whereas manufactured products and processes contain a high degree of codified knowledge, knowledge-intensive sectors are characterised by a high degree of tacit ‘intangible’ knowledge. Specialised expert knowledge and problem-solving know-how are the real products of knowledge-intensive services. Construction activities can be highly knowledge-intensive. To demonstrate, a new modern office complex has a high proportion of its development cost attributable to knowledge-based elements such as design, an assessment of cost alternatives of different components of the building, advice on contractual aspects, risks and buildability of the project, quality, health and safety issues on the project, to mention but a few.

KM success factors can be seen as facilitating enablers for a KM initiative and measurement of any system established to understand how the initiative should be developed and implemented (Jennex and Olfman 2004). This paper briefly reviews the critical success factors for KM implementation as identified in the literature. Utilising a focus group discussion drawn from experts representing Hong Kong construction organisations has refined the list of identified critical success factors which was then combined to present a set of enablers “Const-KM enablers” for successful implementation of KM initiatives. The following sections report on the identified enablers and attempt to explore the underlying contextual relationships among enablers using the interpretive structural modelling (ISM) technique; finally, the paper discusses the managerial implications of this research and suggests directions for further research.

2. Success Factors for KM Implementation

A board range of general factors influencing the success of KM implementation has been reported in the literature. KM is considered as a complex process that is supported by enablers such as strategy, leadership, organisational culture, measurement and technology (Okunoye and Karsten 2002). IT infrastructure also plays a role in facilitating knowledge creation and transfer, specifically where technology is not readily available and mastered (Okunoye and Karsten 2002). Contending that KM success is driven by KM infrastructure and processes capabilities, a research study (Gold et al., 2001) proposed that technology, structure, and culture drive the infrastructure capability. Other success factors include leadership, investing in people, developing/supporting organisational conditions like technical infrastructure and securing knowledge structure (Chourides et al 2003; Jennex and Olfman 2004).

Another research study (Hariharan 2005) – acknowledging that KM would help share knowledge and eliminate reinvention – proposed seven enablers of KM. They are: Strategic focus, Alignment with objectives, KM organisation and roles, Standard KM processes, Culture and people engagement, Content under scrutiny, and Technology enablement.

While the literature findings helped to identify general KM factors, understanding how these factors interact and influence each other is considered critical to better develop methods and strategies for successful KM implementation.

3. Proposed Const-KM Enablers

Previous studies of success factors for KM implementation have been heavily focused on large IT and high-technology companies. Directly applying these factors to the construction industry environment may not be wise due to the industry's very own and specific business conditions. Previous studies fall short of studying and identifying the enablers from construction perspective.

In the context of Hong Kong construction organisations, it was deemed necessary to present all identified factors to the industry via focus group discussions to identify a number of KM enablers reflecting the features and characteristics of the local construction organisations.

Following industry consultation, a number of general factors were integrated giving rise to seven (7) Const-KM Enablers; namely, Leadership; Organisational Culture; Technology, Strategy, Business Processes, People, and Business Innovation. These proposed seven enablers are the result of a systematic effort that identified the enablers in a holistic, integrative and comprehensive manner. Although there are some similarities with previous studies, two new enablers have been introduced in this study namely; *People* and *Business Innovation*.

4. Research Methodology

To achieve the key research objective, this paper employs Interpretive Structural Modelling (ISM) method originally developed by Warfield (1973). The ISM methodology involves structuring of goals and objectives into a hierarchical framework. It helps to impose order and direction on the complex relationships among elements of a system (Sage 1977). The method is interpretive in the group's judgement to decide whether and how identified enablers – affecting KM implementation – are related; the direct and indirect relationships between the enablers describe the situation far more accurately than the individual factors taken into isolation. It is structural in that, on the basis of the relationship, an overall structure is extracted from the complex set of items; and it is modelling in the specific relationships and overall structure are portrayed in a diagraph model (Warfield 1974).

4.1 Questionnaire survey

In this study, after establishing the set of Const-KM Enablers, a questionnaire based survey was developed and distributed among industry experts to better understand the shared underlying mental model in which these enablers operate. As such, the main objective of the questionnaire survey was to facilitate capturing experts' opinions of the relationships existing (or otherwise) among the identified enablers. This was essential to develop a relationships matrix as a first step towards developing as ISM-based model. Respondents were asked to indicate the importance of seven enablers "Const-KM Enablers" on a five-point Likert scale. On this scale, 1 and 5 correspond to 'strongly disagree' and 'strongly agree', respectively. Pearson correlations among the enablers, as obtained from the survey, were used.

The questionnaire was administered to 50 addressees working for contracting organisations operating in Hong Kong. The sample was selected from the directory of Hong Kong construction association classified as approved Group C Building Constructors on the Hong Kong Government lists of approved contractors for public works. Follow-up letters were forwarded to those who had not replied within the given deadline. In total, 12 useable replies were received (24 percent response rate), which was considered to be normal response to mailed surveys (Kanuk 1975). Although this is a very small sample that will not allow a proper and meaningful statistical analysis to be carried out, the following sections demonstrate the methodology to be adopted in the research study. Pearson's bivariate two-tailed correlation test was conducted to find correlations among the enablers on SPSS (Version 12.00) software.

4.2 Model development

The fundamental concepts of the process of model development are an 'element set' and a 'contextual relation'. The process starts with the identification of elements which are relevant to the problem or issue; this could be done by any group problem-solving technique. Next, a contextually relevant subordinate relation is chosen. The contextual relationship 'leads to' was chosen for this study to identify the interacting position of each enabler for further analysis.

Having decided on the element set and the contextual relation, a structural self-interaction matrix (SSIM) is developed based on pairwise comparison of elements. In the next step, the SSIM is converted into a reachability matrix and its transitivity is checked. Once transitivity embedding is complete, the conversion of an object system into a well-defined representation system (i.e. the matrix model is obtained). Then the partitioning of the elements and the extraction of the structural model, called ISM is done. The above steps, which lead to the development of ISM model, are briefly illustrated below.

4.3 Formation of structural self-interaction matrix (SSIM)

As mentioned above, for analysing the criteria a contextual relationship of "leads to" was chosen. This means that one criteria leads to another. Based on this contextual relationship, a SSIM has been developed. To obtain consensus, the SSIM was sent to four experts. Since past literature does not contain any reference about the minimum number of experts to be contacted during this phase for their opinion, it is presumed that responses from four experts would suffice, provided they are consistent. Combining the results of correlation analysis and expert's opinions has resulted into the SSIM shown in Table 1. To capture and analyse the relationships among enablers, the following four symbols were used to denote the direction of relationship between enablers (i and j):

Table 1: Structural self-interaction matrix (SSIM)

Const-KM Enablers	7	6	5	4	3	2	1
1 Leadership	O	A	O	X	X	O	
2 Strategy	A	O	X	O	O		O
3 Organisational Culture	O	O	O	X		O	X
4 Business Processes	O	V	O		X	O	X
5 People	A	V		O	O	X	O
6 Business Innovation	A		V	V	O	O	A
7 Technology		A	A	O	O	A	O

Legend: V – enabler i will lead to enabler j;
A – enabler j will lead to enabler i;
X – enablers i and j will help lead to each other; and
O – enablers i and j are unrelated.

4.4 Reachability matrix (RM)

The SSIM has been converted into a binary matrix, called the reachability matrix by substituting X, A, V and O by 1 and 0. Then its transitivity is checked. If element i leads to element j and element j leads to element k, then element i should lead to element k. By transitivity embedding, the modified reachability matrix is obtained.

4.5 Classification of enablers

Different criteria for classifying the enablers have been classified into four groups, namely autonomous, dependent, linkage and driver/independent, based on their driving power and dependence. Following this stage, the driver power-dependence matrix is developed.

4.6 Level partitions

From the final reachability matrix, the reachability and antecedent set (Warfield 1974) for each enabler are found. The reachability set consists of the elements itself and the other elements which it may help in leading to, whereas the antecedent set consists of the elements itself and the other elements which may help in achieving it. Thereafter, the intersection of these sets is derived for all the enablers. The enablers for which, the reachability and the intersection sets are the same occupy the top level in the ISM hierarchy. The top-level element in the hierarchy would not help achieve any other element above its own level. Once the top-level element is identified, it is separated out from the other elements. Then, the same process is repeated to find out the elements in the next level. This process is continued until the level of each element is found. These levels help in building the final model. Readers interested in ISM should refer to Sage (1977) for much more detailed description of the methodology.

4.7 Model formation

From the final reachability matrix, the structural model is generated. If there is a relationship between the enablers i and j, this is shown by arrow which points from i to j. This graph is called a directed graph, or diagram. After removing the transitivities of the ISM methodology – the diagram is finally converted into the ISM-based model shown in Figure 1 which pictorially interprets the contextual relationships between each enabler and its hierarchies as derived by the analysis.

5. Results and Discussion

These results represent the mental models of the respondents and in that sense they are subject to interpretation, hence the name interpretive structural modelling. It can be seen that each of these relations (arrows in the diagram) are tenable. The ranks of the enablers based on their driver powers indicate that *leadership* is the key enabler. Next is the *strategy*, followed by *business processes* and *organisational culture*. Technology seems to be a weak driver. Other weak drivers but strongly dependent enablers are people and business innovation.

In the context of construction organisations, the results could be interpreted in that, competent leadership directing KM initiatives would lead to strategic planning for KM initiatives and *Leadership* is the main driving enabler based needed for building a successful KM efforts. KM initiatives will gain support of, and active participation by, senior executives. Top management involvement would also ensure that KM initiatives will have a strategic focus and planning, in which it is driving the business strengths to pursue this strategy, including its capital, organisational culture, business processes and people.

The elements of *organisational culture* and *business processes* would definitely help in developing KM initiatives and continuous improvement - both are closely linked to *people* engagement which in turn will build the corporate innovative thinking and creative mindset that drives business innovation. Moreover, *business processes* would also facilitate *technology infrastructure* for sharing and archiving knowledge. Technology is the enabler that allows *business processes* improvement to work. By removing unnecessary tasks and providing smart support, *technology* gives people the opportunity to do what they are supposed to in quality execution manner.

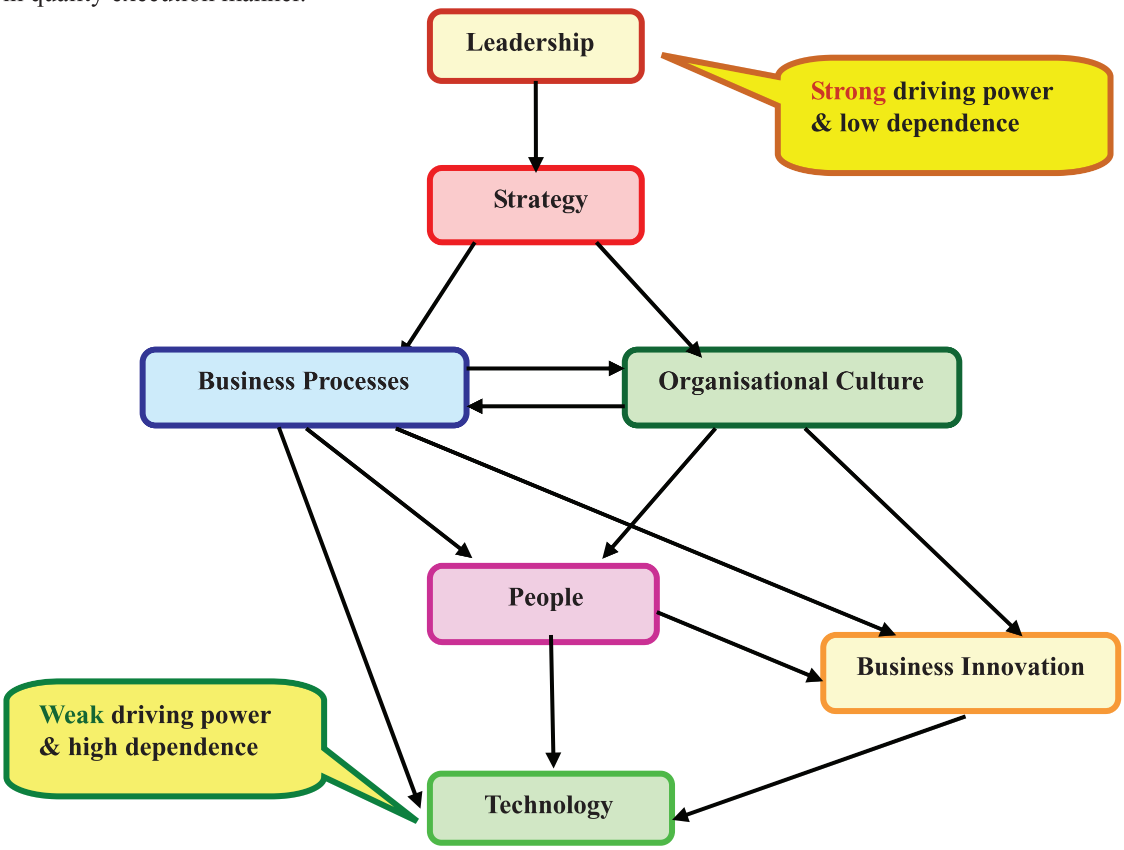

Figure 1: ISM Conceptual Model for Const-KM enablers

Business processes promote the right skills; develop standard processes and best practices for people to perform their job well. The standardisation of these business processes is aimed at improving efficiency and effectiveness. Organisational culture that encourages open and transparent communication among the employees would lead to increased collaboration and knowledge sharing at hierarchical levels of an organisation, which in turn leads to knowledge sharing. The smart way of doing things is driven by organisational culture and it is closely linked to the establishment of standard business processes.

To strengthen the link between *business processes* and *business innovation*, an organisation can foster and engage employees in launching a business processes improvement programme which in turn should be aligned with organisational objectives. Such objectives are usually intended to achieve specific outcome(s), such as improved standards, reduced costs or increased revenue. To be successful, the organisation must set its own course to promote business innovation. With the support of *business processes* and *organisational culture*, it is relatively easier for engaged employees (*people*) to learn and master the proposed innovation. Organisations need also to instill an innovative thinking mindset equipped with relevant knowledge in order to solve problems and generate creative ideas. In addition, through effective use of enabled technology infrastructure or office automation facilities, enhanced collaboration gets developed leading to better flow of information and knowledge. Ultimately, employees should be able to carry out their tasks professionally thus boosting overall productivity.

6. Study Limitations

One of the limitations of the approach adopted by this study is that the revealed hierarchical structure may not be generalisable across organisations operating in a different country. It would be therefore appropriate to limit our discussion to Hong Kong construction organisations.

7. Future Research

Using ISM, this model has not been statistically validated. Structural equation modelling (SEM), has the capability of testing the validity of such a hypothetical model. As such, the first author is currently validating the ISM model using SEM.

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