KNOWLEDGE MAPPING: A CONTINGENCY APPROACH

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Knowledge management has been recognised as a potentially useful approach to enhancing competence and competitive advantage of firms through efficiently managing knowledge assets. However, it has been asserted that knowledge management is still at an immature phase and furthermore, its resultant benefits and advantages have not been clearly identified or substantiated. Within this context, knowledge maps have been proposed as a useful mechanism for successful knowledge management for projects and organisations. A knowledge map concept model was developed through a single case study of a large construction project consulting firm. Further four types of knowledge maps were distinguished, including narrow-based knowledge map, strategic construction actor-based knowledge map, specific construction work process-based knowledge map and broad-based knowledge map. It is concluded that no one knowledge map model type will be appropriate for all construction project organisations and each type has its unique context, components, potential benefits and key constraints.

KEYWORDS: contingency approach, knowledge management, knowledge mapping, knowledge transfer.

INTRODUCTION

Knowledge management (KM) is recognised as a key capability to enable construction companies to capture, structure and transfer project-based knowledge to achieve effective project performance (Hoffman et al., 2005, Meroño-Cerdan *et al.*, 2007). However, in spite of the proclaimed value of KM, a number of problems and barriers have been revealed in which have eroded the actual benefits of KM. These include knowledge and KM strategy-based problems (Zack, 1999), human resource-based problems (Thite, 2004), KM technology-based problems (Koch, 2003) and process-based problems (Davenport et al., 1996).

Above all, it has been argued that the major problem is the lack of effective integration of key components and technologies for successful KM. The 'integration view' is consistent with the relevant literature. Robinson *et al*. (2005), for example, highlighted that people and processes must be integrated for successful KM in projects and organisations. Similarly, Kamara *et al*. (2002) and Maqsood *et al*. (2006) stressed that construction actors, processes and technologies must be considered and integrated for successful KM.

In the construction industry, there are few empirical studies which have focused on integration. This paper makes a contribution to this agenda by offering a contingency-based view of knowledge mapping.

KEY ISSUES FROM THE LITERATURE

There is a diverse range of definitions of knowledge mapping in the literature. Knowledge maps are generally seen as the processes, methods and tools to effectively visualise the sources and flows of tacit and explicit knowledge (Driessen *et al*., 2007; White, 2002). This definition is further expanded by Gomez *et al*. (2000) who define knowledge mapping as a visual architecture of knowledge which enables users to more easily and quickly access relevant knowledge. In summary, knowledge maps are an interactive and open system for dialogue that defines, organises and builds on the intuitive, structured and procedural knowledge used to explore and solve problems (Wright, 1993).

There are a variety of knowledge map types which can be identified. First, 'procedural knowledge maps', commonly referred to as 'process-based knowledge map', are used to visualise knowledge and knowledge resources within project or business processes (Kang et al., 2003). These maps are seen as being particularly useful for process-based projects, such as in construction. Second, 'conceptual knowledge maps' are for content management of knowledge which are used as a method of hierarchically organising and classifying contents of knowledge (Caldwell, 2002). These maps can be used for content management of knowledge, for example for web-based systems with taxonomies. Third, 'competency knowledge maps' are employed to document skills, techniques, positions, job experiences and career path of individuals (Bish, 1999; Gorseline, 1996). These knowledge maps can support users to find right knowledge owners at the right time in projects and organisations (Tiwanna, 2002). Finally, a range of other knowledge maps have been proposed including wed-based knowledge maps, strategy-based knowledge maps and cognitive knowledge maps. An important question which emerges from such a diverse range of knowledge mapping types is what type of map should be used in any given context? This contingency question is explored here.

RESEARCH METHODOLOGY

A single case study approach was adopted in this research (Yin, 2003). The data collection techniques consisted of a literature review, company documentation and semi-structured interviews (Bell, 1993). Twelve interviews were conducted. The sample set consisted of two knowledge managers, nine project members and one project manager / knowledge manager. Each interview was between one and a half and two hours long. All the interviews were recorded by a digital voice recorder and then subsequently were transcribed. Each transcript was sent to each interviewee to check for accuracy. The data analysis techniques consisted of content analysis technique and cognitive mapping technique (Fraser, 1999).

KEY FINDINGS

Background of the case study firm

The case study company (here labelled as company A for confidentiality reason) is a large construction project consulting firm in the Republic of South Korea. The company was established in 1996 through a joint venture with an international engineering and construction management company based in the United States of America. The strategic

aim of the joint venture is to develop its market competitiveness in the Republic of Korea and, in so doing, increase its market share.

Knowledge map concept model

A knowledge map concept model emerged from the results. This model consisted of four components: knowledge capital, construction actors, construction processes and knowledge transfer technologies (see Figure 1). In the centre, knowledge capital (e.g. Lu and Sexton, 2009) is defined as the dynamic synthesis of 'construction actors', 'construction processes' and 'knowledge transfer technologies' to enhance project-based learning and to improve project performance within temporary construction project organisations. As a consequence, these three components (construction actors, construction processes and knowledge transfer technologies) must be adopted and integrated for successful knowledge mapping.

The key findings further asserted that these three components must be configured into different types depending on the circumstance in which knowledge map model modes are formed: 'strategic' knowledge maps and 'operational' knowledge maps. Each component is presented below.

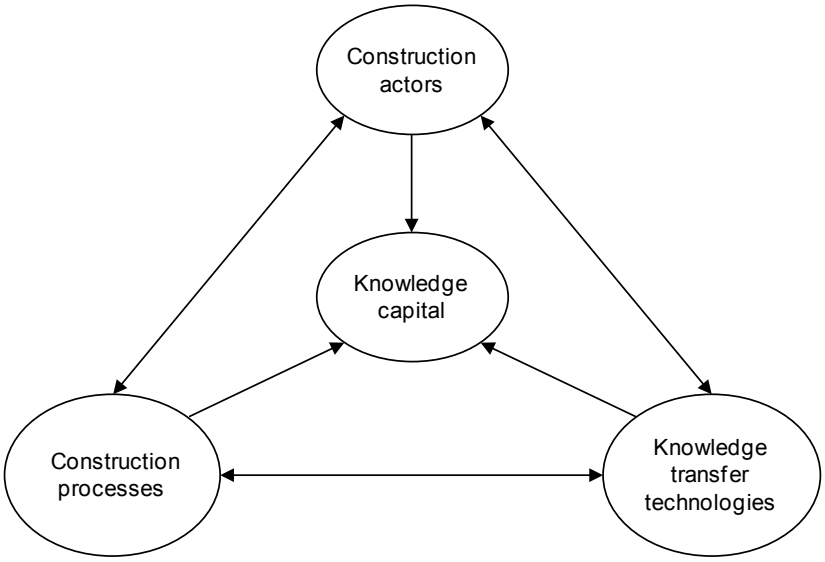


Figure 1: A knowledge map concept model

(1) Construction actors

The research results distinguished between two actor groups. First, generic actor groups who have a corresponding generic 'strategic' body of knowledge. Second, specific actor groups on a particular project who need specific knowledge within an 'operational' context.

(2) Construction processes

Two different types of construction processes were identified which need to be integrated in the knowledge mapping process: generic management system-based processes and specific construction work-based processes. Table 1 summarises the two types of construction processes.

Table 1: Types of construction processes in the knowledge mapping

	Broad-based knowledge maps	Specific knowledge maps
Key aim	• Effective management system-based process knowledge and skills sharing • Effective management system-based process performance • Effective management system-based process knowledge improvement of construction actors	• Effective specific construction work-based process knowledge and skills sharing • Effective specific construction work-based process performance • Effective specific construction work-based process knowledge improvement of construction actors
Indicated processes	• Generic management system-based processes (e.g. cost management processes, time management processes and quality management processes)	• Specific construction work-based processes (e.g. roofing work processes, piling work processes, tiling work processes and concreting work processes)

(3) Knowledge transfer technologies

The research results recognised that different technologies were appropriate to the transfer of tacit knowledge and explicit knowledge. Table 2 describes the types of knowledge transfer technologies.

Type 2: Types of knowledge transfer technologies in the knowledge mapping

Type of knowledge transfer technologies	Explicit knowledge	Tacit knowledge
Information communication technologies	Homepages, question and answer system, e-mail system, knowledge management (KM) system and MSN	Mobile phone, telephone, personal digital assistant (PDA) and radio
Internet-based technologies	Homepages, question and answer system, e-mail system, KM system and MSN	Mobile phone and PDA
Mobile environment-based technologies	Mobile phone, PDA and radio	Mobile phone, PDA and radio
Social Networks	Organisational network systems	Social gathering, meeting and mentor systems

Contingency approach to knowledge map types

No one knowledge map model type will be appropriate for all construction project organisations, and each type has its unique context, components, potential benefits and key constraints. This means that knowledge map types can be flexibly created by the knowledge mapping components determined according to the business and project needs. This position is shown in Figure 2.

The key findings identified different loci for each of the knowledge mapping components identified in the concept model: strategic construction actors and operational construction actors; generic management system-based processes and specific construction work-based processes; and, tacit knowledge transfer technologies and explicit knowledge transfer technologies. Based on the different loci, four types of knowledge maps were distinguished: type A: narrow-based knowledge map; type B: strategic construction actor-based knowledge map; type C: specific construction work process-based knowledge map; and, type D: broad-based knowledge map (see Figure 2).

Table 3 summaries the four types of knowledge map: context, components and example of each component. Each type of knowledge map is discussed below.

Type A: narrow-based knowledge map

'Type A' represents a situation in which strategic construction actor-based and specific construction work-based process knowledge transfer motivation is high. This type of knowledge map consists of strategic construction actors (e.g. architects), specific construction work-based processes (e.g. design processes) and both tacit knowledge transfer technologies and explicit knowledge transfer technologies (e.g. social gathering and meeting and mobile phones).

Type B: strategic construction actor-based knowledge map

This type is appropriate for strategic construction actor-based knowledge mapping approach in which project-based knowledge owned and used by strategic construction actors is mapped in the general management system-based processes. In this type, strategic construction actors (e.g. quantity surveyors), generic management system-based processes (e.g. cost management processes) and both tacit knowledge transfer technologies and explicit knowledge transfer technologies (e.g. telephones, e-mail systems and personal digital assistants (PDAs).

Type C: specific construction work process-based knowledge map

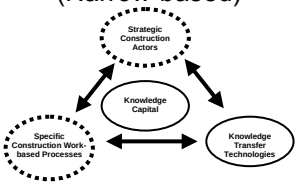
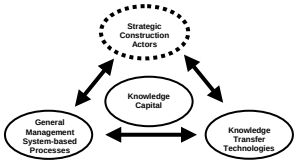
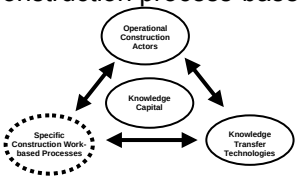
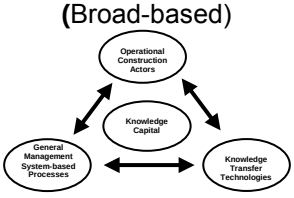
This type is appropriate for specific construction work process-based knowledge mapping in which specific construction work process-based knowledge owned and used by operational construction actors.

Type D: broad-based knowledge map

This type is appropriate for a broad-based knowledge mapping approach in which operational construction actors, general management system-based processes (e.g. quality management processes) and both tacit knowledge transfer technologies and explicit knowledge transfer technologies (e.g. mobile phones, social gathering and meeting, KM

systems and project management information systems) are used. This type represents a context in which the general management system-based knowledge is owned and used by operational construction actors.

Table 3: Attributes, components and examples of each component for four types of knowledge map model within construction project organisation

Mode / attributes	Components	Example of each component
Type A (Narrow-based) 	Strategic construction actors	Architects
	Specific construction work-based processes	Design process
	Both tacit and explicit knowledge transfer technologies	Social gathering and meeting, mobile phones and PDAs
Type B (Construction actor-based) 	Strategic construction actors	Quantity surveyors and project managers
	Generic management system-based processes	Cost management processes
	Both tacit and explicit knowledge transfer technologies	Telephones, e-mail system and KM system
Type C (Construction process-based) 	Operational construction actors	All construction actors
	Specific construction work-based processes	Concreting work-based processes
	Both tacit and explicit knowledge transfer technologies	Telephones, e-mail systems, mentor system and radio
Type D (Broad-based) 	Operational construction actors	All construction actors
	Generic management system-based processes	Quality management processes
	Both tacit and explicit knowledge transfer technologies	telephones, e-mail systems, mobile phones, PDAs, social gathering and meetings, mentor system and radio, KM system and project management information system

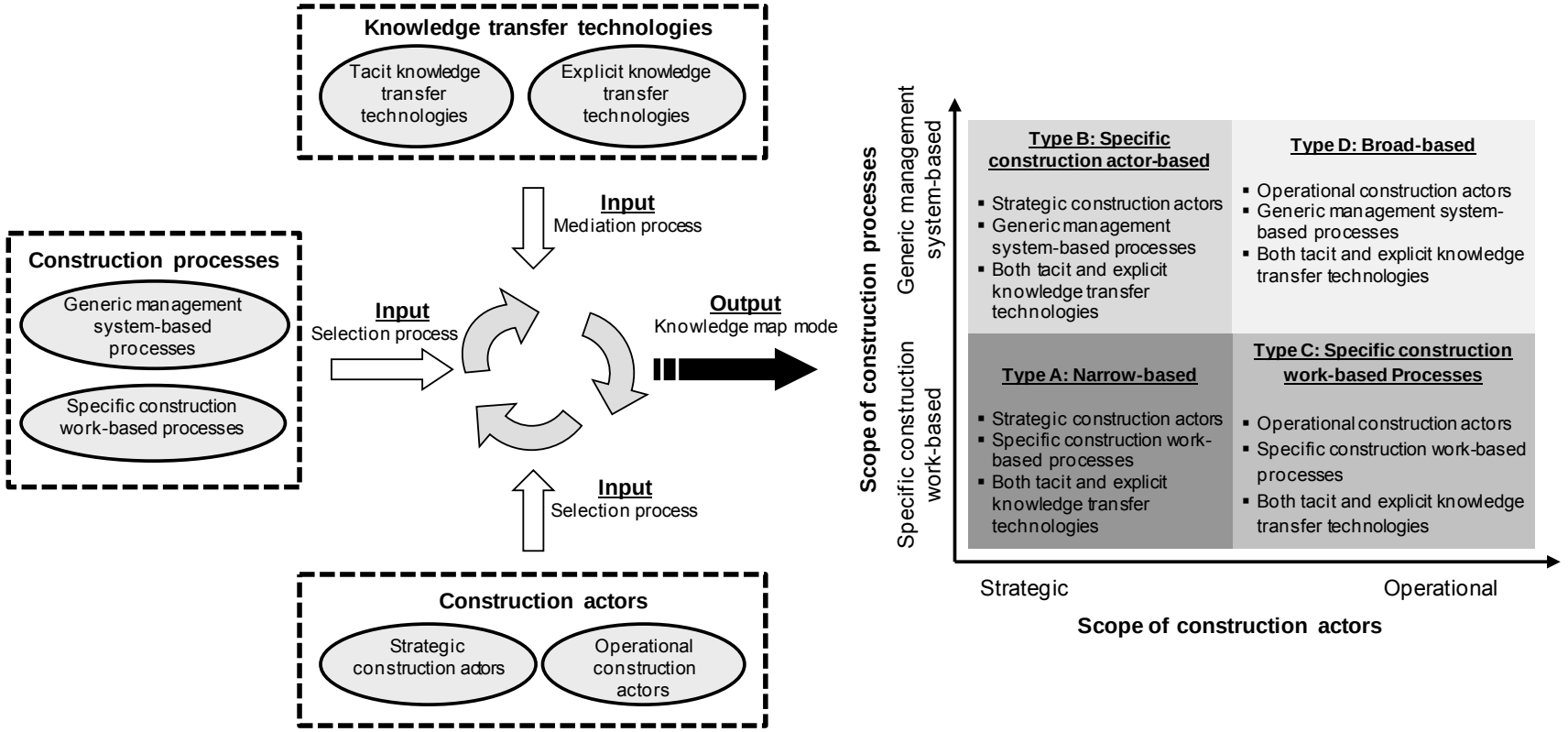


Figure 2: Fundamental principle of knowledge mapping

CONCLUSIONS

The paper has presented exploratory results and proposed a contingency approach to match knowledge map types to particular contexts. Further empirical work is required to extend this contingency-based knowledge mapping approach. This would provide nuanced guidance for future knowledge map design and operation.

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