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## Integrated knowledge management model and system for construction projects

L. Kanapeckiene<sup>a</sup>, A. Kaklauskas<sup>b,\*</sup>, E.K. Zavadskas<sup>c</sup>, M. Seniut<sup>d</sup><sup>a</sup> Department of Construction Economics and Property Management, Vilnius Gediminas Technical University, Sauletekio av. 11, Vilnius LT-10223, Lithuania<sup>b</sup> Institute of Internet and Intelligent Technologies, Vilnius Gediminas Technical University, Sauletekio av. 11, Vilnius LT-10223, Lithuania<sup>c</sup> Vilnius Gediminas Technical University, Sauletekio av. 11, Vilnius LT-10223, Lithuania<sup>d</sup> Institute of Internet and Intelligent Technologies, Sauletekio av. 11, Vilnius LT-10223, Lithuania

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### ABSTRACT

In the past there has been no structured approach to learning from construction projects once they are completed. Now, however, the construction industry is adapting concepts of tacit and explicit knowledge management to improve the situation. Top managers generally assume that professionals in enterprises already possess tacit knowledge and experience for specific types of projects. Such knowledge is extremely important to organisations because, once a project is completed, professionals tend to forget it and start something new. Therefore, knowledge multifold utilisation is a key factor in productively executing a construction project. This paper discusses the benefits of knowledge management to construction industry organisations and projects and emphasises the significance of tacit knowledge. The main purpose of this paper is to present the integrated knowledge management model for the construction industry as well as system architecture and system of the Knowledge Based Decision Support System for Construction Projects Management (KDSS-CPM) which the authors of this paper have developed. Different knowledge management models that are presented in scientific literature are discussed and compared, and the proposed new, KDSS-CPM model, as developed by this paper's authors, is introduced.

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## 1. Introduction

In recent decades, the scenario of construction projects has become more complicated, dynamic and interactive. Project managers are constantly required to speed up reflective decision-makings on time. Knowledge, therefore, is noted to be one of the most important resources contributing to managerial decision-making and enhancing the competitive advantage of organisations carrying out such projects (Carrillo, 2004; Nonaka and Takeuchi, 1995).

The construction industry is a workplace that is dominated by heuristics. Construction companies and their personnel prefer to carry out their project management tasks on the basis of their past experiences rather than on a textbook approach or established analytical approaches (Maqsood, 2006). Indeed the costs of attracting, recruiting and retaining talented employees are expensive. This is further complicated by the fact that, in coming years, the construction industry is expected to lose a large portion of its skilled and knowledgeable workforce. Conversely,

there is no single strategy in place to handle the construction management problems that arise. One of the most effective and powerful tools for strengthening industrial and organisational competition is through systematic identification, as per the best practice of knowledge utilisation and distribution (Bahra, 2001; Kamara et al., 2002).

Knowledge has been described as information which has been used and integrated with a person's knowledge-based experience and behavioural patterns (DeTienne, 2001). Individuals have different knowledge-based capacities and experiences, and these lead to different approaches for problem-solving and decision-making. Knowledge and experience are significant when choosing a construction project manager (Ogunlana et al., 2002). Therefore project managers must be capable of knowing how to use, manage and utilise such knowledge.

A traditional practice in project management is to analyse alternatives based on economic, legal/regulatory, technical, technological, organisational and managerial approaches. Social, cultural, ethical, psychological and educational aspects of project management are less important. In order to make an integrated analysis of a project management life cycle, such a cycle must be analysed in an integrated manner using the system of criteria (see Fig. 1).

\* Corresponding author. Tel.: +370 5 2745234; fax: +370 5 2745235.  
E-mail address: Arturas.kaklauskas@st.vgtu.lt (A. Kaklauskas).

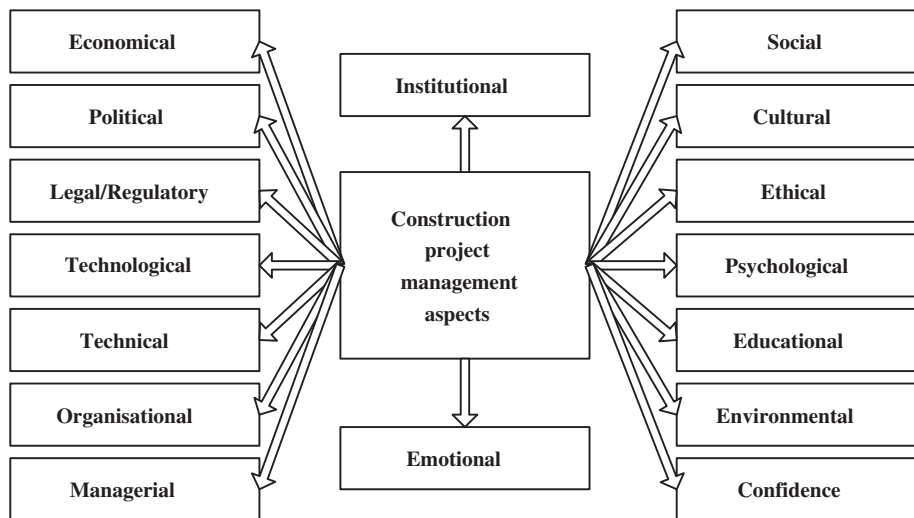


Fig. 1. Construction project management aspects.

Before specifying knowledge management (KM) models, first the KM concept has to be defined. However, KM has been defined in different ways in scientific literature. According to Quintas et al. (1997), KM means to manage all knowledge continuously to meet various requirements in an organisation. Coleman (1999) defines KM as an umbrella term referring to a wide variety of interdependent and interlocking functions consisting of knowledge creation, knowledge valuation and metrics, knowledge mapping and indexing, knowledge transport, storage and distribution and knowledge sharing. Gurteen (1998) comprehensively defined KM as an emerging set of organisational design and operational principles, processes, organisational structures, applications and technologies that helps knowledge employees dramatically leverage their creativity and ability to deliver business value.

According to Robinson (2005), knowledge management relates to unlocking and leveraging different types of knowledge so that it becomes available as an organisational asset. Implementing KM enables an organisation to learn from its corporate memory, share knowledge and identify competencies in order to become a forward thinking and learning organisation.

Other authors mentioned additional KM benefits to project management. Kamara et al. (2002) and Love et al. (2003) state that the role of effective management of knowledge is evident in producing innovation, reducing project time and improving quality and customer satisfaction. According to Siemienuch and Sinclair (1999), through knowledge management, an organisation's intangible assets can be better exploited to create value, while both internal and external knowledge are being leveraged to the benefit of the organisation. In projects knowledge management can improve communications within teams and provide more informed knowledge by sharing best practice documents, lessons learned, project management and system engineering methodologies, examples of review packages and rationales for strategic decisions. It is possible to distinguish KM benefits such as productive information use, activity improvement, intelligence enhancement, intellectual capital storage, strategic planning, flexibility acquisition, best practice gathering, success probability enhancement and productive collaboration. The authors here used the systemised approach to KM definition (see Fig. 2).

The different definitions of KM in literature result from the various perspectives and contexts that are specific to the authors and their research fields. Within construction KM can be difficult to define precisely, as there is no general consensus on a single

unified meaning of the concept. However, Egbu (2004) explains that knowledge is an important resource for construction organisations due to its ability to provide market leverage and contributions to organisational innovations and project success. The idea of knowledge as a competitive resource within project-oriented industries is a concept shared by numerous authors such as Nonaka and Takeuchi (1995), Egbu (2004), Egbu et al. (2001), Oltra (2005) and others.

The potential benefits of effectively utilising their knowledge has meant that an increasing number of construction companies have identified the need to implement KM initiatives. However, the difficulties associated with understanding and managing organisational knowledge has meant that organisations experience numerous problems in successfully implementing and sustaining their initiatives (Egbu, 2004; Oltra, 2005). Egbu et al. (2001) state that, due to the project-oriented nature of construction organisations, cultural considerations are important for successful KM. They continue by stating that short-term, task-focused work can promote a culture which inhibits continuous learning.

It can be concluded that, though academics and industrial organisations have recognised the need for KM, there can be confusion over specific definitions of knowledge and KM within construction organisations. As a result there is the danger that KM initiatives can become misguided and not serve their desired purpose. It is important for the entire organisation to understand what KM is and why it is important. The organisation should adopt a recognised and accepted generic definition, apply it to its specific context and tailor it to accommodate specific business objectives. This will require support, agreement and communications from the top. To ensure an alignment with its business objectives and strategies, an organisation should consider the type of work they carry out, their culture, dynamics and policies and practices, as well as the added value that is required from the KM initiative (Bishop et al., 2008).

Based on these assumptions, the authors of this paper are aiming to develop a generalised and easily adaptive Integrated Knowledge Management model which is presented further.

Various scientific works describe knowledge management through structured models. Models introduced by various authors and used in various activities have been analysed (see Table 1).

Most of the presented models are usually activity oriented. Four major dimensions for the process of KM activities presented by Nonaka and Takeuchi (1995) and Davenport and Prusak (1998)

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