

KNOWLEDGE MANAGEMENT IN CONSTRUCTION SMEs: COPING WITH THE ISSUES OF STRUCTURE, CULTURE, COMMITMENT AND MOTIVATION

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There is an increasing acceptance that the economic and producing power of a modern organisation relies more on its intellectual and service capability than in its hard assets, such as land, plant and equipment. Effective knowledge management (KM) is seen as offering market leverage and competitive advantage to organisations. This paper addresses knowledge management issues in SMEs, with particular reference to the construction industry. It presents the major factors that influence effective knowledge management practices in SMEs and puts forward a framework for addressing KM issues in construction SMEs. Lessons to be learned for the construction industry are also presented. The paper highlights the importance of structure, culture, commitment and motivation as important variables in the effective management of organisational knowledge. It concludes that effective knowledge management in construction SMEs is not just about the supply side (data and communication systems) but also involves the demand side (business goals, strategy and people issues).

Keywords: construction SMEs, knowledge management, organisational structure, culture.

INTRODUCTION

Knowledge is increasingly being recognised as a vital organisational resource that gives market leverage and competitive advantage (Nonaka and Taekuchi, 1995, Leonard-Barton, 1995). It is also seen as fundamental to organisational competence, which Sanchez et al (1996) define as an ability to sustain the co-ordinated deployment of assets and capabilities in a way that promises to help a firm achieve its goals. A host of factors has given impetus to the growth in knowledge management in the last decade. These include the extensive organisational de-layering and downsizing in the 1980s and 1990s, which resulted in the loss of 'corporate memory'. Another factor is the convergence of computing, electronics, broadcasting and telecommunications into multimedia technology. Thirdly, global and trade liberalisation has changed the rules of competition in the last decade by opening up new sources of supply.

In the late 1980s and the early 1990s, lower costs and higher productivity were seen as key influences on corporate competitiveness. Now, these two dimensions are no longer seen as differentiators but only qualifiers. They ensure survival not growth. The changing markets and nature of competition demand accelerated innovation supported by the dynamic core capabilities of organisations (Egbu, et al 1999, 1998).

The importance and the value of the organisation's or project's knowledge has been recognised by the significant increase in attention that the subject has received (Scarborough, Swan and Preston 1999). Prominent organisation leaders, such as Bill

Gates, identify the knowledge worker as the employee of the future. However, whilst tacit knowledge resides within individuals, the real potential for the organisation is to transform individual knowledge into organisational knowledge. The role of a learning organisation is useful in this regard. Similarly, the potential of a project's knowledge base is only achieved when the 'knowledge experts' or specialists exchange their expert opinions (and the information that forms their opinions), building a deeper understanding across specialist disciplines and thus expanding the knowledge base of the project. When knowledge is exchanged and utilised the decision making potential increases.

METHODOLOGY

The information presented in this article has come from three main sources. Firstly, some of the materials presented are based on a two-year research project funded by the Economic and Social Research Council (ESRC) under its innovation Programme. The study (Egbu, 1999a), which was completed in 1998, was aimed at developing a prototype-training simulator that will provide experiential learning of the cultural aspects of the innovation process in organisations. The study involved four case studies from four different innovative construction organisations; over 50 ethnographic interviews, company archive documents and video capture of innovative processes and products. The second source is a current research study – 'A Knowledge Management Exchange' sponsored by the European Social Fund (ESF) under the ESF Objective 4 bid of which the author is involved. The ESF study ends in June 2000, and addresses the exchange of knowledge and the auditing of knowledge assets in Small and Medium Enterprises (SMEs). The study employs interviews, questionnaires and workshops in the elicitation of relevant research information. Finally, a thorough review of the relevant literature on innovation, knowledge management, learning organisations and intellectual capital assets has also informed this paper.

Knowledge Management and the Learning Organisation in Context

Knowledge management is about the processes by which knowledge is created, acquired, communicated, shared, applied and effectively utilised and managed, in order to meet existing and emerging needs, to identify and exploit existing and acquired knowledge assets. Knowledge consists of truth, beliefs, perspectives, concepts, judgements, expectations, methodologies and know-how, and exists in different forms such as tacit, explicit, symbolic, embodied, embrained and encultured knowledge (see Egbu, 2000).

An examination of the knowledge management literature highlights an overwhelming bias towards articles on the role of Information Technology (IT) with relatively few considering the role of people. This is the case both in the general literature and in the construction literature on knowledge management. This has been noted elsewhere by Egbu (2000, 1999b).

It is the case that information and communication technologies (ICTs) are now becoming increasingly pervasive in today's business environments and have, in many ways, provided the technological basis for the shift from 'multi-domestic' to 'global' corporate operations. Some of these technologies which can also allow the exchange and storage of knowledge across space and time, together with their potential for managing knowledge in construction have been documented elsewhere (Egbu, 2000). However, the set-up costs, maintenance costs and the level of expertise associated

with some these knowledge management technologies can be prohibitive for many small size construction organisations, especially those with fewer than eight employees.

Knowledge management is, however, more than technology. The author argues that knowledge management is ten percent (10%) technology and ninety percent (90%) people issues. Some of the factors, which promote knowledge sharing in small and medium enterprises, are documented later in this paper and are more to do with the people issues. Knowledge management is a complex social process. The author has argued, elsewhere (Egbu et al, 2000), that the communication of knowledge is possible and effective between people who, to some extent at least, share a system of meaning.

Senge (1990) defines a learning organisation as 'where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn'. From the above definition, it could be argued that a learning organisation is likely to be supportive to the management of knowledge. Learning occurs in various ways in all organisations but not all organisations are learning organisations. A learning organisation should be able to discover what is effective by reframing its own experiences and learning from that process; by developing skills of its people it should continuously transform itself (Pedler, *et al*, 1991).

'Knowledge management' and the 'learning organisation' are not independent realities and should be seen as language constructions used to articulate a view of the vision of the world. They should be best understood as multi-layered, multi-faceted concepts in driving organisational innovations for gaining competitive advantage.

Organisational Structure, Culture, Commitment, Motivation and Knowledge Management

In the organisational innovation literature, four organisational structural variables have received the most attention. These are centralisation, formalisation, complexity and stratification. Centralisation refers to the extent to which authority and decision-making is concentrated at the top of the organisational hierarchy. Formalisation is the degree of emphasis placed on following rules and procedures in role performance. Complexity refers to the amount of occupational specialisation and task differentiation in the organisation. Stratification refers to the number of status layers or levels within an organisation. A thorough review of the general literature on knowledge management reveals a meagre amount of empirical research on how the above four structural variables impact upon knowledge management in organisations. The situation is even grimmer in the knowledge management literature with a construction industry perspective. From an innovation perspective, however, Zaltman *et al* (1973) have argued that the four structural variables noted above have contrasting effects at the initiation and implementation stages of the innovation process (the so-called 'innovation dilemma'). Low levels of centralisation and formalisation, and high level of complexity facilitate the initiation stage of the innovation process. The implementation stage is facilitated by high centralisation and formalisation and low complexity (West and Farr, 1990). The consensus view is that high level of stratification inhibits innovation, because it leads to too much preoccupation with status and insufficient freedom for creative thinking. The consensual view is illustrated by Kanter (1983), who points out the deleterious effect on creativity of the

'elevator mentality' of organisations dominated by rigid vertical relationships and 'top down dictate'. Similarly, Lovelace (1986) concludes that 'an organic, matrix and decentralised structure will provide the creative individual with freedom sufficient to be creative'.

Typically, the construction industry contains a small number of relatively large firms and a very large number of quite small firms. About 95% of construction firms employ fewer than eight people. The fragmentation of the construction industry reflects the economics of production, encouraging small firms organised by trade or craft. Construction firms typically involve relatively low capital investment. There are also relatively low barriers to entry and exit of firms within the construction industry.

There are characteristics of small firms which impact upon their ability to access and transfer knowledge. Firstly, this is related to their perceived technological weakness (specialised range of technological competencies, inability to develop and manage complex systems, inability to fund long-term and risky knowledge management programmes). Again, investment in formal and informal training and education in the acquisition and sharing of requisite knowledge is more challenging for smaller than for larger organisations. Other perceived advantages of small organisations include little management experience, power imbalance if collaborating with large firms, difficulty in coping with complex regulations and associated cost of compliance (Rothwell and Dodgson, 1994). However, small size organisations could be said to have organisational strengths, which could stand them in good stead for managing knowledge assets. In the main, small firms often do not need the formal strategies that are used in large firms to ensure communication and co-ordination. This less-formal strategies in small firms, it could be argued, ease the communication of knowledge, improve informal networks, increase speed of decision-making, improve the degree of employee commitment and receptiveness of novelty (Rothwell and Dodgson, 1994). Smaller organisations also tend to react faster to changing market requirements.

The construction industry is characterised by projects, by short-term employment and by temporary coalitions of contractors and subcontractors. It is also perceived to have an adversarial culture (Egan, 1998). The final stages of construction work are normally carried out on site, out of doors and in public. The working conditions are sometimes unpleasant, dirty and dangerous making recruitment of capable workforce difficult. The site labour force tends to be drawn from the lower strata of educational achievement. According to the Egan (1998) report, "there is crisis in construction training". The proportion of trainees in the workforce appears to have declined by half since the 1970's. Too few people are trained to replace the ageing skilled workforce, and too few are acquiring the technical and managerial skills required to get full value from new techniques and technologies. Many innovation processes in the management and procurement of construction activities are becoming increasingly interactive, requiring simultaneous networking across multiple 'communities of practice' such as professional groups, functional groups and business units. This networking involves communication and negotiation among different social communities with distinctive norms, cultural values and interest in the innovation process. This therefore means that knowledge needed for innovation is distributed within organisations and across organisational boundaries through different supply chains. In the UK construction industry, there is a steady increase in collaborative working practices, such as partnering, alliances and joint ventures. In addition, projects are growing in complexity and cost, and clients' demands and expectations are also increasing more than ever before. This presents a situation where organisations have to collaborate and

share knowledge, skills and expertise, in order to meet the needs of the clients. In sharing knowledge, however, organisations need to be both mindful of the communicative behaviours and practices associated with knowledge exchange as well as the 'knowledge paradox'. Organisations will have to be open to formal and informal information and knowledge flows from both networks and markets. At the same time, they must protect and preserve their intellectual capital and knowledge base because it is upon this latter point that survival depends.

Construction organisations need to recognise the importance of an active process management of knowledge creation, gathering, storing and exploitation. The culture and climate and the mechanisms in place should allow for the possibility for knowledge to be readily shared and transferred from project to project, across project teams and organisational boundaries. In the ESRC study involving four innovative construction organisations certain characteristics associated with culture and climate were shown to be favourable to innovation and knowledge management by all four innovative organisations. These include a culture where there is openness and willingness to share knowledge and information, support from top management and the presence of a 'knowledge and innovation champion'. In addition, a culture where people feel secure in their jobs and genuinely feel valued with some form of 'ownership' of, or 'involvement' with the knowledge management processes is seen to be conducive. Similarly, a no blame culture and a risk tolerant climate where continuous improvement is achieved through learning from mistakes, and flexibilities in the lines of communications allowing top-down, bottom up and lateral flow of information and knowledge support knowledge management in organisations.

If the construction industry is to build and maintain capability, it has to change its adversarial culture to a sharing culture. It also has to learn from each project and transfer knowledge from project to organisational base. The industry will also need to invest in long-term relationships.

The ESRC study also noted specific mechanisms which innovative organisations put in place for transferring knowledge across project teams and for embedding knowledge management into their organisational culture. These are presented in no order of importance in Table 1.

Table 1: Mechanisms for transferring knowledge and embedding knowledge into organisational culture

Creation of knowledge teams, i.e. staff from all disciplines to develop or improve methods and processes
Shareware – The provision of platforms, occasions and locations that encourage knowledge exchange
The introduction of knowledge webs (networks of experts/ communities of practice who collaborate across divisions/strategic business units)
The establishment of intellectual capital teams whose roles include the identification and auditing of intangible assets such as knowledge
The provisions of collaborative technologies such as Intranets or GroupWare for rapid information access.
Define and communicate knowledge performance behaviours
Make knowledge performance company policy
Identify key knowledge workers and knowledge performance positions
Rewarding knowledge-sharing behaviours and incentivize key knowledge management actions
Take action on poor knowledge performance

Discussions in workshops organised as part of the ESF sponsored research on Knowledge Management revealed some interesting issues with regard to the factors that promote and inhibit knowledge sharing in small and medium enterprises. These are presented in no order of importance in Tables 2 and 3.

With regard to the factors that promote knowledge sharing, it can be seen that it is important for organisations to have a coherent vision of knowledge as well as to link their knowledge management programmes to the strategic direction of the organisation. Similarly, having robust organisational infrastructure, flexible knowledge structures, knowledge friendly culture and positive motivational practices are seen to promote knowledge sharing. In contrast, lack of appreciation of knowledge as an important asset is seen as inhibiting knowledge sharing in organisations.

Table 2: Factors that promote knowledge sharing

Link to economic performance and strategy and coherent knowledge vision
Senior management support
Technical infrastructure (systems to obtain, organise, restructure, warehouse or memorise and distribute knowledge) – including intranet, internet, repositories, databases and videoconferencing
Organisational infrastructure (teams, relationships and networks)- including face-to-face meetings, brainstorming sessions, apprenticeships, job rotation, coaching and mentoring, communities of practice and quality circles, reports and project summaries, help desks and bulleting boards
Standard, flexible knowledge structures
Knowledge friendly culture
Clear purpose and shared language and meaning of knowledge management
Change in motivational practices (including performance management and team based rewards)
Multiple channels of knowledge transfers/dialogue with functional departments, interaction with clients/customers and suppliers
Formal education and training.

Similarly, lack of an information sharing culture and inflexible organisational structures are seen as factors that inhibit the sharing of knowledge within organisations.

Table 3: Factors that inhibit knowledge sharing in organisations

Incoherent knowledge vision/ lack of ownership of the knowledge vision
No appreciation/ Lack of appreciation of knowledge as an important asset
Lack of an information sharing culture and climate
Lack of/ or inappropriate methods/tools for measuring and valuing knowledge
Lack of/ inadequate standardised processes
Rigid /inflexible organisational structures
Time constraints and pressure on key staff/knowledge 'experts'
Fear of the use and application of IT tools for knowledge management (Technophobia)
The 'knowledge is power syndrome' and failure to see the 'law of increasing returns' associated with knowledge creation - shared knowledge stays with the giver while enriching the receiver.
Lack of a clear purpose and shared language and meaning of knowledge management

A FRAMEWORK FOR ADDRESSING KNOWLEDGE MANAGEMENT ISSUES IN CONSTRUCTION

From the ongoing discussions, it follows that if construction organisations are to develop coherent knowledge management programmes, five integrated dimensions are worthy of consideration. These are the knowledge content, people, culture, process and technological infrastructure.

Defining the knowledge that is strategically relevant to the organisation (knowledge that meets the business needs of the organisation, now and in the future) should be seen as the first step in knowledge management implementation. Ensuring that key personnel have access to know-how and best practices can enhance knowledge sharing. In addition, efficient and accurate mapping of knowledge can be accomplished with the help of people who informally act as the organisation's memory.

The knowledge transfer media chosen by the organisation must be such that it is appropriate to its culture. In terms of processes, an organisation should identify the knowledge that it has after defining the knowledge it needs. If requisite knowledge is not available within the organisation, then this must be generated, perhaps, by acquisition. The introduction of knowledge management needs to follow a logical sequence of tasks to minimise effort and cost. This is more the case with small and medium enterprises that do not have as much financial backing and investment on knowledge management programmes as larger organisations. Any technological infrastructure that is put in place to support knowledge management must be adapted to the organisation's needs and not the other way round. It must also specify updating responsibilities, data structure, access rights and security since knowledge gets old and can 'decline in value' over time. Tentative findings from the on-going ESF study, which *inter-alia* considers the use of knowledge management technologies by SMEs would suggest that financial constraints and the nature of SME businesses limit the type of technology employed for managing knowledge. They are less concerned with 'data mining' tools for tuning data into knowledge such as artificial intelligence and neural networks. Similarly, Cased-Based Reasoning (CBR) technologies and Video-conferencing technologies do not feature highly. They are, however, more concerned with telephones, faxes, Intranet and e-mail facilities.

The interdependence of the five important dimensions for knowledge management is illustrated in Figure 1. Technology (collaboration and knowledge leverage tools) is an important enabler. Its linkage to other KM dimensions is depicted as dotted lines in Figure 1. There are, however, many things which technology cannot do in a coherent and robust strategy for managing knowledge.

Knowledge management cannot effectively take place without extensive behavioural, cultural and organisational change. The issues of leadership, motivation and communication are vital for the long-term sustainability of a robust knowledge management strategy. Equally important, is the continuous review of KM strategy and its benefits. Successes and changes would need to be communicated to all. This would help to sustain interest and improve motivation among those involved in KM activities.

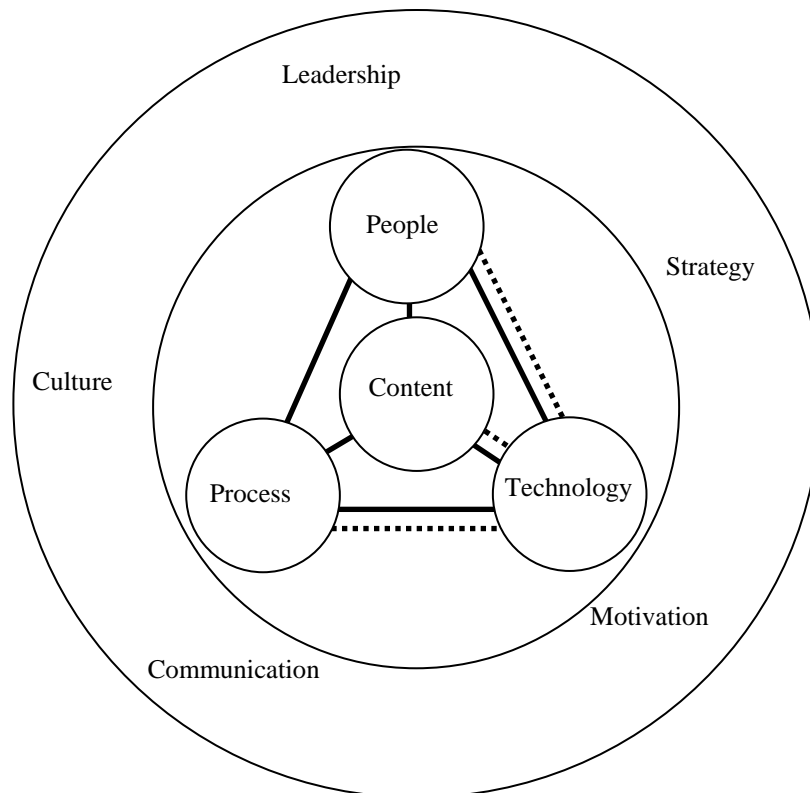


Figure 1: A Framework for managing knowledge in construction

CONCLUSIONS AND RECOMMENDATIONS

The paper discussed the growing importance of knowledge as a source of competitive advantage. It also considered the role organisational structure, culture, commitment and motivation in the management of organisational knowledge in small and medium enterprises in construction. In addition, it presents a framework for managing knowledge in construction organisations. The paper concludes that managing knowledge in a construction industry environment is not easy. It is not just about the supply side (data and communication technologies). It also involves the demand side (business goals, strategy, organisational structure and people issues).

A thorough consideration of the knowledge content, people, processes, culture and technology and their interdependence is vital in any coherent and robust strategy for managing organisational knowledge in construction.

A culture where there is openness and willingness to share knowledge and information, where people feel secure in their jobs and genuinely feel valued with some form of 'ownership' or 'involvement' with the knowledge management processes is seen to be conducive for knowledge management.

A variety of knowledge management technologies exist, ranging from telephone and Intranet to 'data mining' technologies such as artificial intelligence and neural networks. The nature of the businesses in which SMEs find themselves as well as financial constraints impact upon their choice of technology for managing knowledge.

Knowledge management should be seen as a long-term investment and should involve commitment (including financial) from top management as well as from all other members of the organisation. The regular communication of the benefits of knowledge management is important in sustaining the co-operation of all those involved in knowledge management activities.

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