

KNOWLEDGE CAPTURE IN SMALL AND MEDIUM ENTERPRISES IN THE CONSTRUCTION INDUSTRY: CHALLENGES AND OPPORTUNITIES

Subashini Hari¹, Charles O Egbu and Bimal Kumar

School of the Built and Natural Environment, Glasgow Caledonian University, Glasgow G4 0BA, Scotland, UK

There is now a great deal of interest among researchers and practitioners regarding the importance of knowledge management (KM) in an organisational context. Few large construction organisations have implemented and reaped the benefits of formal KM approaches. However, there are very few empirical studies on KM geared towards small and medium enterprises (< 250 employees). This paper is part of on-going PhD research on small and medium enterprises (SMEs), focusing on KM. A pilot study was conducted, involving twelve professionals from eleven organisations, prior to the main study. The pilot study revealed that, for SMEs, knowledge capture was the most challenging process in the 'knowledge management cycle'. Hence, this paper discusses the importance and challenges of knowledge capture from a social and technological perspective. It will also discuss appropriate methodology for knowledge capture. In addition, the paper documents the nature of training provisions that will benefit SMEs through their knowledge capture initiatives. It also notes that SMEs can benefit from effective knowledge capture practices. Capturing knowledge within an organisation helps in problem solving, managing change, organisational learning, succession planning and innovation, to name a few. The paper concludes that capturing knowledge in SMEs is not easy. It is an integrated and complex social process, which has culture, people, technology, communication, leadership and organisational structures at its core. The paper recommends that more research effort needs to be targeted at improving knowledge capture practices in SMEs, and that there is ample scope for empirical research in this area.

Keywords: knowledge capture, knowledge management, small and medium enterprises.

INTRODUCTION

Knowledge, unlike natural resources and other physical capital, is not depleted when it is used; indeed, it is expanded and open to further growth, refinement and marketability. Knowledge management (KM), according to Newman (1996), cited in Frey (2001), directs and enhances organisational decisions as to how, where, and when to create and account for new knowledge. It facilitates education, training, technical refreshment and on-the-job experience. Capturing knowledge prevents the loss of critical knowledge due to retirement, downsizing, and outsourcing. The Small Business Service (2004) statistics reveal that 91% of Small and Medium Enterprise (SMEs) that registered themselves for VAT in 2000 were still surviving 12 months after they registered. Sixty Four percent (64%) of businesses registered in

¹ S.Hari@gcal.ac.uk

1998 were still going three years after registration. Hence organisation sustainability is an issue because 36% of the SMEs perish after 3 years. Some of the reasons for the closedown include the fact that the business ceased to be lucrative, the death or retirement of the proprietor and changes in the personal motivation and aspirations of the owner. This raises the issue of how capturing knowledge could enable a sustainable competitive advantage in SMEs.

Sparrow (2001) suggested that KM requires an appreciation of individual and collective understanding. Developments in KM in smaller businesses have to stem more from a fundamental conceptual grasp of the role of knowledge in business and the basic principles of KM. An empirical study by McAdam and Reid (2001) revealed that the SME sector was less advanced, with a mechanistic approach and a lack of investment for KM.

Construction is a knowledge-based industry. Over 90% of organisations in the UK construction industry are SMEs. They deliver 52% of the construction industry's workload in monetary terms (DETR, 2000) and contribute to one tenth of the UK GDP. Construction organisations have been managing knowledge informally for years, but the challenges facing today's industry mean that most organisations now need a more structured, coherent approach to KM (Construction excellence, 2004). Literature review suggests that SMEs face several unique barriers in KM implementation, especially not having the vision of KM development, thinking only in terms of tangible cash flow and not having knowledge capture, access and re-use processes well-thought through or embedded in daily practice. There are very few empirical studies on knowledge capture geared towards small and medium enterprises (< 250 employees) in construction.

This paper is part of on-going PhD research on SMEs, focusing on KM in construction. The aim of this paper is to discuss the importance and challenges of knowledge capture from a social and technological perspective. It will also discuss appropriate methodology for knowledge capture. In addition, the paper documents the nature of training provisions that will benefit SMEs with their knowledge capture initiatives. It also notes that SMEs can benefit from effective knowledge capture practices. Prior to this, the research methodology on which this paper is based will be discussed.

RESEARCH METHODOLOGY

Denzin *et al.* (1998) suggest that when there is a high degree of unpredictability, a pilot study is a good means to add value to the research. In this PhD study, prior to the main study, a pilot study was undertaken which helped with refining data collection plans with respect to both the contents of the data and the procedure to be followed. The pilot study explored the main challenges faced by construction SMEs in the knowledge management process. Eleven construction organisations, involving 12 professionals in Glasgow, Scotland, UK, were interviewed. The pilot study was interview-based and semi-structured in format. The sample consisted of four architects, four engineers and four contractors. Interviews with personnel across organisational hierarchy allowed some insights on knowledge management at organisational, group and individual levels. The interviews in the pilot study lasted between thirty minutes and one hour. Interviews were taped and later transcribed. As part of the analysis of the interviews, content analysis was employed. The results of the study indicated that knowledge capture seemed to be the main challenge. The main study involves qualitative research methods using a grounded theory analysis in a case study context.

According to Strauss and Corbin (1990), grounded theory denotes a set of well-developed categories (e.g. themes, concepts) that are systematically interrelated through statements of relationship to form a theoretical framework that explains some relevant social, psychological, educational or other phenomenon. The discovered grounded theory is generally called a theory (Chen, 1996) or a model (Backman and Hentinen, 1997). Work done by Turner (1976), Locke and Golden-Biddle (1997), has led to the development of a theoretical model in management research, using grounded theory which has focused on the process within an organisation. This research investigates the process of knowledge capture within an organisation, along with the following objectives:

1. Investigate the main challenges associated with implementing knowledge capture initiatives.
2. Investigate the efficacy of different tools (technologies and techniques) for knowledge capture in SME's.
3. Examine and document the nature of training provisions that will be of benefit to SME's with their knowledge capture initiatives.
4. Explore the extent to which knowledge capture contributes to competitiveness in SME's (real and perceived).
5. Develop and test a prototype IT based awareness tool for knowledge capture in SMEs.
6. Develop and test requisite training materials to support knowledge capture awareness in SMEs.

To achieve the above objectives it is intended that the case study approach be used as a research strategy and semi-structured interviews as the research technique. The method of analysis for the interviews will follow the grounded theory approach. The outcome of this will be the theoretical model. The model developed will provide a perspective on, phenomena and will also focus an individual on one perspective or set of ideas for facilitating knowledge capture initiatives.

Strauss and Corbin (1990) suggest that a researcher does not begin a project with a preconceived theory in mind. The researcher begins with an area of study and allows the theory to emerge from the data. Theory derived from data is more likely to resemble the "reality" than is theory derived by putting together a series of concepts based on experience or solely through speculation. However, Smith (1997) suggested that general reading of the literature may be carried out to obtain a feel for the issues at work in the subject area, and to identify any gaps to be filled using grounded theory. Glaser also believes that the literature should be used to gain an overall picture of the research problem. Hence this paper is based on the literature review after the pilot study and before investigations in the field for the main study.

The next section deals with the importance of knowledge capture. Subsequent sections focus on the challenges for knowledge capture from a social and technological perspective.

THE IMPORTANCE OF KNOWLEDGE CAPTURE

Knowledge is a complex concept which consists of information and skills acquired through experience. Knowledge is truth and belief, perspective and judgments, expectations and methodologies. Knowledge exists in individuals, groups and in organisations, in various forms. The capture of an employee's knowledge is vital for

the organisation. Key decisions are made based on experience and information which is usually shared informally.

The Information Technology Construction Best Practice (ITCBP, 2004) suggests that discussions about knowledge management usually refer to the need to capture one or both of two distinct types of knowledge - explicit and tacit. Explicit knowledge is the very factual information that is relatively easily to document, i.e. a list of experts; telephone numbers, and details of previous contracts for a particular client; methods of repairing a common fault, and so on. Tacit knowledge is much harder to address. It refers to the more subjective approaches people take in situations where there may be no single right or wrong answer. Tacit knowledge is often the key to why a particular organisation is successful. Explicit knowledge represents only part of an organization's intellectual landscape; it is crucial in an organisation's overall knowledge strategy. Brooking (1996), states that only 20% of knowledge available to an organisation is actually used. What happens to the remaining 80% of the employee's knowledge is open to question. Hence the capture of an employee's knowledge is important for the organisation.

In SMEs, the attempts made to transform tacit knowledge into explicit knowledge are, in the main, unsuccessful. The ability to survive and thrive relies, to some extent, on an organisation's ability to maintain and retain old and new knowledge in the face of complexity, uncertainty and rapid change. Much of the knowledge within SMEs is tacit and held by experienced people. Eleven organisations participated in the pilot study suggested that tacit knowledge appeared not to be effectively passed on to others and was lost when key individuals left the organisation. This caused problems in succession planning.

Knowledge capture may be a relatively new term, and most organisations can benefit from the fresh impetus it gives to thinking about fundamental processes, but every organisation already manages knowledge, as organisations have done for centuries. Through knowledge capture processes, the construction SMEs could identify and leverage organisational knowledge to enhance their market niche. Quintas (2004) suggests that Information and Communication Technologies (ICT) have a place which is unquestionable. But ICTs must work with and not against the key fundamentals that make human beings knowledgeable in social contexts. All the organisations involved in the pilot study agreed the emphasis on the need for transformation of tacit to explicit knowledge which could be made effective and efficient through the use and exploitation of ICT and reduce the number of mistakes been made. Time would be saved, if everyone had the information they need immediately; quality would be improved as lessons learned from past experience are documented; job satisfaction increases as people spend less time searching for information and more time applying it. There is less dependency on an individual, as some of their knowledge is available to most of the staff/ employees.

A few benefits of knowledge capture could be: less duplication of work, faster and better problem solving, more effective team work, more innovation and better ideas, higher client satisfaction and improvement in employees' motivation, management support, proper training, leadership and a committed effort is needed to capture knowledge. The following section highlights some of the challenges of knowledge capture.

CHALLENGES OF KNOWLEDGE CAPTURE

Collison and Parcell (2001) suggest that knowledge capture means capturing know-how in such a way that it can be reused. There needs to be a link between capturing

knowledge before, during and after the event/project/task has been executed; and in terms of accessing what has already been captured. A few challenges have been identified through a thorough review of literature from the social and technology perspective for knowledge capture as well as from the pilot study concluded. These are:

Social Issues:

Some of the challenges related to social issues are: culture, people, motivation, communication and network issues, and the structure of the SMEs.

Culture of the Organisation:

- The biggest barrier to knowledge capture in most construction organisations seems to be culture. Many experienced construction professionals see knowledge as power and are reluctant to share it. Most people are also reluctant to learn from others' experience – 'not invented here'.
- Employees (8 out of the 12 interviewees of the pilot study) suggested that they avoid admitting mistakes; they are scared of negative effects for them in the organisation.
- Over 60% of the organisations agreed that efforts seem to be needed in failed projects to uncover what they can teach, whereas successful projects can only affirm that the methods used are sufficient for that specific task.

If these problems are not solved, organisations are at risk from losing knowledge, as experienced individuals retire without passing on what they know.

People Issues:

Knowledge capture challenges can involve potential knowledge sabotage and the difficulty in capturing this in a knowledge base. In small organisations, most knowledge capture is done through informal networks, but as organisations grow these networks cannot possibly be aware of the entire knowledge. A few experts may be called or contacted repeatedly, never having time to fully respond to their duties. For example, employees could rarely find key documents without the help of experts within each programme area, leaving the experts feeling overwhelmed by calls that make poor use of their time. A key step here is to capture the knowledge of experts to guide seekers to their appropriate documents and experts.

Knowledge capture initiatives are intended to be implemented in stages. Wherever possible, it should be intended that drastic change is not imposed on people. However, ownership could be given to encourage them to suggest some changes in the process of knowledge capture. This way the employees are aware of the importance of knowledge capture and its benefits for their job.

Motivation Issues:

Knowledge capture activities are to be rewarded in an appropriate and meaningful way. This is a challenge for SMEs. This may leverage what knowledge is already in place in the organisation and determine if it can be expanded to other areas. A host of factors, from the pilot study appear to motivate construction personnel to exploit knowledge capture. These include the probability that work tasks conducted within an organisation are made easier and the genuine interest construction personnel have for their jobs. The implication of this for organisations, team leaders and those involved in job design and matching skills to jobs, is that they should endeavour to make construction personnel interested in their jobs. They would also need to understand and accommodate the needs and expectations of staff. The opportunity to be trained in the use of existing knowledge could be seen as a motivator for employees/ staff.

Communications and Networks Issues:

The geographical separation of sites, both from one another and from the regional offices, would have a detrimental effect on the capture of knowledge because of the importance placed on social networks and contacts. The establishment of a network throughout the organisation (each with its own internal and external, networks and contacts) provides a base of knowledge and support that individual employees could draw upon to help them diffuse ideas and expertise within their own context of work. This seemed to be a challenge for four organisations in the study that had regional offices spread across UK.

Organisational Structure:

Egbu's (2000) investigation revealed that organisational structures were found to influence IT exploitation in many complex ways. Fostering IT learning and sharing of 'good/best' practices involves cultivating an environment where IT information can be exchanged freely, and where structures are flexible and decentralised. There were quality assurance systems in place for over 60% of the organisations, where best practices was incorporated. The size and structure of the organisation enables the use of certain tools (techniques and technology) for knowledge capture that may encourage/discourage cross-regional and cross-project codification.

Technological Issues:

There is a dominating Information Technology perspective with an overemphasis on explicit knowledge. Technology provides for the transfer of knowledge that is codified and packaged into formats that allow its transmission within and across organisations. Some of the technological issues identified from the pilot study are:

- Lack of standardisation of the system, practical difficulties in accessing the intranet and web-site from site offices, and the lack of IT related resources such as software's and technical support.
- The technologies developed to capture and publish knowledge have had to compromise one way or another between simplicity and specificity.

For SMEs, for whom even a basic intranet may not be suitable or affordable, a growing number of public websites are available to help employees get direct access to news resources, markets (e.g. for buying and selling advice online) and links to helpful sources.

Financial Issues

Cost may be in conflict with the pressures of a specific project, such as completion on time and within budget. If there are inappropriate or non-existing incentive structures to address this inherent conflict, knowledge capture policies would be inadequate. The process of accumulating and documenting (i.e. capturing) 'lessons learned', is more tactical in nature, as it involves costs attributable to a specific project (for example employee time to document and compile reports).

SMEs cannot afford to hire extra employees to deal with basic necessities such as legal administration, and most rely on outsourcing to a third party to provide a solution which can often be more costly in the long run.

Process Issues:

Determining when to make tacit knowledge explicit and when to leave knowledge in its "native" form (respecting both the inherent strengths and limits of tacit knowledge) is central to managing an appropriate balance between tacit and explicit knowledge.

- A knowledge base should not merely be a set of rules, but a framework of process planning that can be controlled and customized.

- Some organisations may need to ensure that everyone has access to explicit, factual information about mandatory procedures and processes. Others may aim to share more creative, tacit approaches. No single approach to knowledge capture can suit every organisation.

Codification of knowledge is important. Without codification, the ability to allow explicit knowledge to disseminate is severely limited. From an organizational perspective, the capture and maintenance of knowledge can be time-consuming, labour intensive, and costly. It is a challenge to keep track of discussions, decisions, and their rationale when teams work on short term projects.

METHODOLOGY FOR KNOWLEDGE CAPTURE: REIFBD PROCESS

Schulz and Jobe (2001) point out that “One could argue that firms are codification machines” which, in far too many cases, may be true. Without a clear focus on what the knowledge capture system has to deliver, many firms charge down the path of storing everything within the knowledge capture system. The end result is often information overload. A proposed methodology for knowledge capture has been suggested, as shown in Figure 1. It consists of six stages: recognise, examine, implement, filter, bank and disseminate knowledge (Figure 1).

Stage One: Recognise (R) the knowledge to be captured

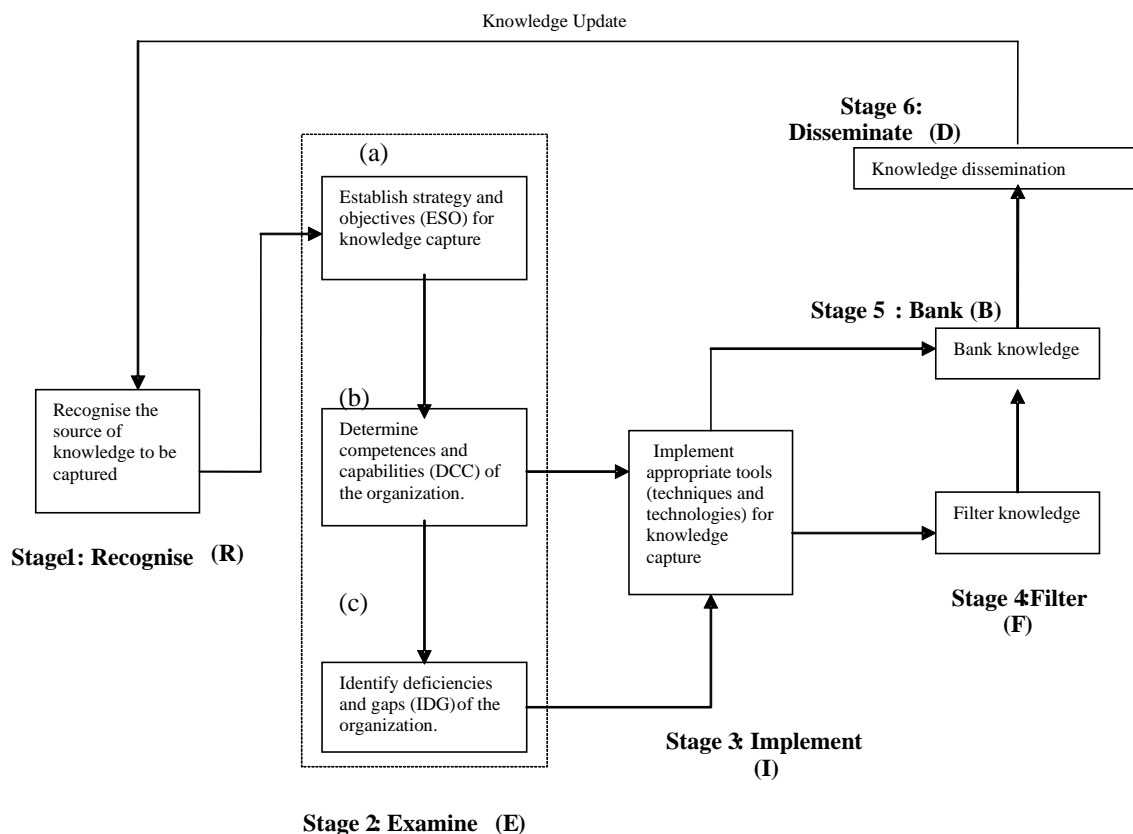
To successfully capture the knowledge in an organisation, the organisation must understand its core business strategy, understand what it doesn't know and allow adequate funding. The source of knowledge could be internal and external to the organisation. Internal could include the people/staff/employees, documents, contents from the internet, and apprenticeships, to name but a few. External knowledge could be from professional bodies, external seminars, workshops, etc.

The next stage involves the examination of knowledge that has been identified from the different sources.

Stage Two: Examine (E) the knowledge to be captured

According to (Zack, 1999) organisations that are managing knowledge effectively should understand their strategic knowledge requirements, devise a knowledge strategy appropriate to their business strategy, and implement an organisational and technical architecture appropriate to the organisation's knowledge-processing needs. This stage consists of three phases i.e. (a) establish a strategy and objectives for knowledge capture in the organisation. (b) determine the competences and capabilities of the organisation (c) identify deficiencies and gaps in the organisation.

Figure 1: Knowledge Capture Process



Phase A: Establish a strategy and objectives for knowledge capture in the organization

Establishing a strategy and objectives for knowledge capture in an organisation enables the organisation to exploit its knowledge and learning capabilities. It includes the extent to which the members of an organisation believe that superior knowledge is a competitive advantage and how they explicitly link strategy, knowledge, and performance. In SMEs, the owner/manager’s personality, skills, responsibilities, attitudes and behaviour have a decisive influence on the organisation strategy. He/she has a significant influence in supporting organisational knowledge programmes and practices.

Phase B: Determine the competences and capabilities of the organization

Construction SMEs should be able to articulate the link between the strategy of their organisation and what members at all levels of that organization need to know, share, and learn to execute that strategy. This articulation guides how they deploy organisational and technological resources and capabilities for explicating and leveraging knowledge, which increases the probability of their adding value. This could be implemented with appropriate tools (as shown in Figure 1); if a deficiency and gaps are not examined within the organisation.

Phase C: Identify deficiencies and gaps in the organization

Existing knowledge can be compared to what an organisation must know to execute its strategy. Where there are current or future gaps, knowledge capture efforts should be directed towards closing the gaps, assuring a strategic focus. Critical areas should be identified where expertise is being lost that is strategic to the organisation’s strategy and where appropriate tools could be implemented to capture knowledge

Stage Three: Implement (I) appropriate tools (techniques and technologies) for knowledge capture

There are often ways to capture some information explicitly, even where the core knowledge is of the tacit kind. Staff can be encouraged to put together notes about their work. These need not necessarily be comprehensive; they may be designed to highlight topics they are familiar with. Similarly, people can enter their details into a staff directory, spelling out their areas of expertise and areas where they can offer help. Writing of short case studies of successful and unsuccessful projects can be encouraged. A facilitator to the project team could elicit tacit knowledge from the project team members, typically in the form of lessons learned, successes, and bittersweet stories. Other techniques could be used to extract knowledge, such as brainstorming, nominal group techniques, focus groups, qualitative text analysis, and task environment analysis.

The knowledge capture process will have a direct impact on technology. Emails, video/tele conferencing, and the Internet/Intranet/Extranet could be used.

Stage Four: Filter (F) the knowledge

An organisation’s ability to either create information and knowledge or acquire it from various tools is checked with respect to Stage 2 in Figure 1, namely the ‘examine stage’. Once captured, a knowledge bank tends to grow, reaching a point at which it begins to collapse under its own weight, requiring major reorganisation. Its rejuvenation requires deleting obsolete content, archiving less active but potentially useful content, and reorganising what remains. Hence, knowledge has to be collected and analysed. Organisations could create small priesthoods of knowledge administrators responsible for virtually all contents in the repository.

Before adding captured knowledge to a knowledge bank, an organisation subjects it to value-adding processes of filtering and refining, such as cleansing, labeling, indexing, sorting, abstracting, standardising, integrating, and recategorising.

Stage Five: Knowledge Bank (B)

This stage bridges the stages ‘knowledge filter’ and ‘knowledge dissemination’. A knowledge bank could have a life cycle that an organisation must manage. Liebowitz (2000) suggested four approaches: knowledge attic, knowledge sponge, knowledge publisher and knowledge pump (Table 1).

Table 1: Types of Knowledge Bank

	Active analysis	Passive analysis
Active collection	Knowledge pump	Knowledge sponge
Passive collection	Knowledge publisher	Knowledge attic

The next stage comprises the mechanisms an organisation uses to make a knowledge bank’s content accessible.

Stage Six: Knowledge Dissemination (D)

Relatively unsophisticated techniques such as text search are easy and cheap to apply; gather up a collection of documents and point a search engine at them. Organisation’s news would be an option for knowledge transfer that includes upcoming community events, recent successes and failures, and newly published best practices and lessons learned. Bulletin boards, portals, wireless devices, E-mail, Intranets, Extranets and web sites all help to improve communications between people and can assist in information management. Knowledge is perishable. The shelf life of expertise is limited because new technologies, products, and services continually pour into the

marketplace. No one can hoard knowledge. People and companies must constantly renew, replenish, expand, and create more knowledge. This requires a radical overhaul of the old knowledge equation: knowledge equals power, so hoard it. The new knowledge equation is knowledge is equal to power, so share it and it will multiply.

Knowledge Update Issues:

Once the knowledge is disseminated, new knowledge would be created and thus the six stage process is considered to be an on-going one.

Henrie and Hedgepeth (2003) identify four pitfalls of the process: one of the pitfalls is the failure to maintain the KM system. As the organisation's knowledge assets change, methods and procedures are required to update the system to reflect the new knowledge and to delete the invalidated knowledge sources.

Getting a handle on the social and technical resources of knowledge in the organisation is a necessary step. Certainly knowledge capture is a big picture issue. Deficiencies in knowledge capture expose the organisation to the risk of not recognising opportunities or threats. If it is not known where knowledge assets are and how they are being utilised, much of their potential value may be wasted.

Organisations may need people to train users to critically interpret, evaluate, and adapt knowledge to new contexts.

NATURE OF TRAINING

The purpose of training is to improve employee's performances in their current jobs and prepare them for more demanding roles, making use of organisational knowledge as well as creating and exploiting new knowledge. Anecdotal evidence and empirical results (Curran and Stanworth 1981) suggest that the lack of training in small firms hinders growth. Through the process of knowledge capture, training programmes can help trainees to understand an organisation and themselves. By reading a document or manual about their jobs and the organisation, and by reflecting upon it, trainees can internalise the explicit knowledge written in such documents to enrich their tacit base (Nonaka and Toyama, 2003). Workshops, on-job training, job rotation, and inductions for new recruits can be some of the mechanisms of training in knowledge capture.

Thiry (2004) suggests that training programmes are embedded into a complex context where cultural and competitiveness issue are often at odds with each other. There is a need for more focus on training for SMEs, as this is important for knowledge capture in the construction industry. One of the objectives of the on-going PhD study is to develop and test a prototype IT based awareness tool for knowledge capture in SMEs which could be used as a training tool, and also provide requisite training materials to support knowledge capture awareness in SMEs.

CONCLUSION

This paper discusses the importance and challenges of knowledge capture from a social and technological perspective; and the appropriate methodology for knowledge capture. In addition, the paper documents the nature of training provisions that will benefit SMEs with their knowledge capture initiatives.

The paper concludes that capturing knowledge in SMEs is not easy. It is an integrated and complex social process. Capturing knowledge within an organisation helps in problem solving, managing change, organisational learning, succession planning and innovation, to name a few. The effective implementation of knowledge capture could reduce costly mistakes and ensure improved services to clients. Knowledge capture enables rapid absorption and diffusion of new ideas, organisational agility, operational efficiency, and growth in core capabilities. It also enables organisational growth.

Knowledge capture is not about a one-off investment. It is a future-oriented investment that requires consistent attention over a substantial period of time, even after it begins to deliver results. More research effort needs to be targeted at improving knowledge capture practices in SMEs in the construction industry.

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