USING PERSONAL CONSTRUCT THEORY TO CHALLENGE KNOWLEDGE MANAGEMENT PRACTICE IN CONSTRUCTION

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The construction environment has time and cost pressure which forces staff to seek immediate solutions. Thus, staff and managers expect the same instant solution capability from knowledge management (KM). KM can to some extent fulfil this task by identifying, capturing, filing, storing and accessing solutions against problems from a database, however, this may not be effective nor even what is really needed. It is argued that the true value of KM lies in its ability to change the way individual's undertake tasks to make wider and longer term improvements and to develop individuals' learning capability so that they can face the ever-changing world and solve the unique problems they will face. Indeed, one of the industry's failures identified is that it keeps making the same mistakes based on reproducing past practice which it adopts pragmatically without an overarching critical appreciation. This gap between the industry's wants and what it needs in KM needs to be explored. A new technique of KM, called Knowledge-Event Management (KEM), uses audio diaries to capture knowledge from day-to-day events and debriefing to analyse and transfer knowledge. The output from the study allows an analysis of the gap between the usefulness of the industry's wants and needs because the technique works on the real problems both at an immediate and at a deeper level. This paper uses personal construct theory to explain the gap and to demonstrate how new techniques such as KEM need to work on many levels of knowledge to be effective and to face the emotional consequences that changing construction requires. This paper uses a real-life example to demonstrate how this is achieved. This way, new KM practices can ensure that individuals will be motivated and empowered to undertake their practice differently and that their organisations can best benefit from KM practice.

Keywords: knowledge event, knowledge management, personal construct.

INTRODUCTION

In the construction industry, most companies are SMEs. Their managers, who are often the owners of the companies, tend to focus on their core business and pay less attention to other issues (Lim and Klobas, 2000). Their main concern is always about the bottom-line, cash flow and survival in the fiercely competitive market, which leads to short-term thinking (Davey *et al*., 2004). People in construction, especially in SMEs, are normally very busy. Site managers are constantly interrupted by telephone calls or visits from clients, subcontractors, suppliers, labourers, and even just strangers coming in looking for jobs! They also need to walk around the site to supervise various kinds of operations. As a result, they hardly have an uninterrupted period of

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time on their own. To them, the pressure to finish projects on time and within budget is constant. Thus, if problems occur they are forced to find instant solutions and 'fire fighting' is common practice on construction sites. Therefore, people develop skills to find quick fixes for the symptoms rather than tackling the root causes and searching for long-lasting solutions.

It has been widely accepted that knowledge management (KM) (i.e. knowledge identification, creation, acquisition, organising, transfer, sharing and exploitation) can promote innovation, improve efficiency and organisational competitiveness, as well as empower employees (Nonaka and Takeuchi, 1995; Egbu, 2000). There are some good KM practices readily available. For example, a computer system called Knowledge Worker System (KWS) was developed by Georgia Institute of Technology under a contract from the US Army Construction Engineering Research laboratories (CERL) for deployment in the Pentagon in order to capture and organize activity information and help people (called Knowledge Worker) learn, prioritize and execute tasks more efficiently and effectively (Kamara *et al*., 2002). Arup, a global engineering consulting company, designed 'Electronic People Finder' and 'Communities of Practice' on their company's Intranet to connect people and promote dialogue and debate to exchange tacit knowledge (Payne and Sheehan, 2004). To some extent, the aim of KM practices such as these mentioned above is to identify, capture, file, store and access solutions against problems from a database, and provide instant solutions to the problems people are facing. More and more organisations have realised the importance of knowledge and the benefit KM can bring to them. However, SMEs cannot compete with large companies in terms of tangible resources such as capital, labour, equipment and physical commodities, but their intangible knowledge assets can still provide them a leverage to survive in the fiercely competitive market.

However, seeking instant solutions from a database of past problems and solutions may not be effective or even what is really needed in construction industry. This is because each construction project is unique and the construction process is so dynamic and complex that some of the solutions tested and proven in one project may not be readily applied to another. Most of the time, even if the solutions are recorded and documented, the more valuable decision-making process is missing. Knowledge resides in people and can only be applied through people. The long-lasting solution is to change the way individual's undertake tasks so as to make wider and longer term improvements and to develop individual's learning capability so that they can face the ever-changing world and solve the unique problems they will face. It can be argued that this is where the greater value of KM lies. Indeed, one of failures of the industry often identified is that it keeps making the same mistakes based on reproducing past practice which it adopts pragmatically without an overarching critical appreciation (Boyd and Wild, 1994). As mistakes are repeated, resources are wasted, and organizations find themselves reinventing the wheel (Flar, 2002; Robertson, 2002). This gap between the industry's wants and what it needs in KM needs to be explored.

This paper will use Personal Construct Theory to explain the gap and to demonstrate how new techniques need to work on many levels of knowledge to be effective and to face the emotional consequences that changing construction requires. After briefly introducing Personal Construct Theory, the paper will demonstrate how this theory is applied in developing a new approach to KM. A real-life example will be presented to show how people's learning can be improved and how both individuals and organisations can benefit from this.

PERSONAL CONSTRUCT THEORY

Personal Construct Theory was established by American psychologist George Kelly (1955) to analyse individuals' personality and explain their normal action. According to Kelly's theory, we all create our own ways of seeing the world in which we live. Just like scientists, we explore the world using our own hypotheses and theories generated through our life experience, which become personal constructs. These constructs are our mental models or mental maps which we use as a frame of reference to interpret the world and deal with new confronting situations. As we all have different life experiences, we each have different constructs to understand our situation and so act on it differently. We use our constructs to predict and control the world around us which is essentially a course of events. Those constructs may not always correctly represent and interpret the real world. But without them, the world appears to be such an undifferentiated homogeneity that we are unable to make any sense out of it.

In general, we seek to improve our constructs by increasing our repertoire of mental models and by altering them to provide better fits. If the confronting events fit our constructs, the constructs will be considered valid and be further confirmed and consolidated, and will be reused in the future until they fail the test. If our constructs are proven incorrect by the events, they will have to be revised and/or replaced in order to better fit the future events. This way, as we experience the continuous course of events in our life, our construct system undergoes a progressive evolution and we continuously revise our existing constructs in the general direction of increasing our predictive efficiency, or extend our constructs when we meet a new situation for which a well defined construct does not exist. However, one characteristic of when our constructs are challenged by events and shown to be inadequate is that we feel and display emotions ranging from guilty to anger. Kelly claimed that such a construct system can be communicated and widely shared.

Corresponding to Kelly's Personal Construct Theory, Argyris and Schön (1974) proposed two types of behavioural learning: single-loop learning where the existing constructs are utilised without questions to suppress emotions, and double-loop learning where a construct is surfaced and revised to deal with new situations. They argued that most organisational learning is single loop, i.e. error detection and correction. This is because single-loop learning is easier and individuals tend to slip into the single-loop mode (Stacey, 2003). What is really required is the double loop learning which changes current operating assumptions, norms and values, and involves deeper enquiry and questioning. However, any situation of double-loop learning, as it involves challenging and revising constructs, exhibits emotions. These existing data-base KM systems fail to address the emotion of changing practice and there is a tendency to use safe solutions rather than ones that affect significant improvement. Indeed, many of the critiques of construction which advocate radical change fail to acknowledge the need to move away from existing solutions and face the emotions of changing constructs.

A new knowledge management (KM) approach has then been developed and tested to achieve such a purpose and is introduced in the next section.

KNOWLEDGE-EVENT MANAGEMENT

This new technique of KM, called Knowledge-Event Management (KEM), has been developed (Boyd and Xiao, 2006) to not only access the abstract factual knowledge of

an activity but also the process knowledge concerning how people involved in the activity think and make judgments in practice, i.e. use and revise their personal constructs. It is based on both cognitive learning theory (Kolb, 1984) and the theory of organizational behaviour (Argyris and Schön, 1974), and developed by Boyd and Robson (1996). KEM focuses on 'events' and stories about the events. Events are occurrences that can be distinguished from the general flow of experiences that people normally expect (Hommel *et al.*, 2001). It is this break with expectation that makes events particular and also very useful for learning and KM. In people's expectations, they have in their minds a model, i.e. personal construct, of what they believe should happen (Boyd and Wild, 1996). In an event, they find that their model is not quite right. What they do at that point then is a critical skill involving making 'sense' of the event and managing the consequences (Weick, 1995). It is this very skill which embodies the judgment of practice and also what provides the basis for identifying the essence of professional practice. At this time, their personal constructs are challenged and altered, double-loop learning is achieved, and their learning capability can be improved.

The KEM Approach has three stages: event-collection, debriefing-analysis, and dissemination. An audio diary is used for event-collection in order to capture the richness of the day-to-day events and minimise the disruption to participants' daily job. This relating of the story in this way also captures the emotions of the event indicating the challenge to personal constructs and the potential for deeper learning. After a few diary entries, the participants are debriefed, which establishes the immediate impacts of the events (i.e. the consequential issues which is experienced and the contributing issues which produce the event), and the deeper and wider issues which set the way that the organization does things generally or even the way that the industry operates. Debriefing involves a dialogue where the personal constructs of the event can be explored. In its skilled use, debriefing can involve assisting the practitioner to face the challenge to their constructs and work through the emotions of their revision in an environment of understanding. The skill of debriefing is equivalent to a catalytic intervention in counselling (Heron, 1990). Debriefing exposes the previous ineffective construct and surfaces a new effective construct. This is what makes this KM practice unique. It delivers better value than merely capturing the solutions adopted in the event, which is often based on the ineffective construct, by fully investigating the technical, organisational and human context of the event. The whole event and its analysis is the knowledge that can be and needs to be shared with others for effective dissemination. It is these wider issues which cause events to be repeated and KEM can find interventions which prevent the event happening again. This KEM provides a golden opportunity in which people's personal constructs can be challenged and double-loop learning can be carried out.

This KEM approach has been tested with 28 site managers, quantity surveyors, contract managers or project managers from 12 construction companies across the UK, and 316 knowledge events have been captured in audio form, and 110 debriefings have been undertaken. A number of the companies involved in the research are practicing this KEM approach, or developing their own self-operation based on this KEM approach.

In the next section, a real life event and its debriefing will be presented to demonstrate how the gap between the industry's wants and what it needs in KM is explained through Personal Construct Theory and how the gap is bridged by this KEM approach.

CASE STUDY

M is a site manager of a medium sized contractor and he recorded the following story while he was in charge of the construction of new changing rooms for a school playing field:

> *My job is progressing well with internal screeding starting next week. On arrival this morning, I found out there has been a break-in on site and the metal shower channels have been stolen. Although not a particularly expensive item, these are bespoke items that fit the particular size of the changing room and there is a 5-week delivery time to replace them. This has dramatic consequences on the programme. The screeding cannot be undertaken as planned in the shower area. The metal stud partitioning was designed to be fixed to the screed, and this cannot take place as planned either. This partitioning also carried the mechanical services for the showers, and this also cannot take place as planned. In addition, the partitioning has to be plasterboarded and tiled. All this means work cannot be started and needs to be left half finished for later completion. I think the solution is to fix the partition to the sub-floor, leaving the screed out until the channels arrive but allowing the partitioning, tiling and most of the pipe work complete. On top of this, I have to report to the police and my company and do a lot of paper work for the insurance claim.*

During the briefing, he summarised the consequential impacts from this incident:

- *Time and effort spent on reporting and paper work;*

- *Higher insurance premiums in the future;*

- *Reduced profit or even loss from this project;*

- *The work had to be rescheduled;*

- *Rescheduling work into smaller chunks irritates trades as they do not get a flow of work and increases their time overhead.*

When asked why this incident could happen, he identified some of the contributing factors:

- *Theft from site is commonplace;*

- *Sites cannot be made completely secure and are left unattended at night;*

- *Thieves steal items merely for their scrap value;*

- *Subcontractors and craftspeople like significant work flows that comprise full day's attendance because travelling and setting up time can be long;*

- *Small bits of work out of sequence are more difficult to coordinate and may not appear sufficiently important to subcontractors for them to attend as planned;*

- *Leaving work half done is not satisfying and so may not be done with the highest quality;*

- *Leaving work half done makes it vulnerable to damage which takes additional time to rectify and also can cause cross trade arguments;*

- *Leaving work half done creates a joint (screed, pipe work etc.) which is vulnerable in the future as the location of these makes them more difficult to form successfully.*

When asked about his feeling about this incident, he admitted that he was:

- *Shocked*He did not expect this happen. After all, they were just drainage! If he had known they were expensive and would have a long leading time, he would have stored them in the container to reduce the risk.

- *Pissed off*

  He could have finished the job on time and made money from it, but now the money may be lost. Even though this wouldn't damage his image in the company much as it is a norm that company will issue a memo to remind the project managers but they will not name names, it is still not a good thing. The company would not be happy as the insurance premium will increase.

From the above, M's initial mindset, i.e. his personal construct, does not exactly align with what had happened. From his story and his reflection afterwards, his initial personal construct can be summarised as:

- *Theft on site is not uncommon, but it may not happen on my site;*

- *I have put all the valuable stuff such as machines and tools in the containers, so nothing serious will happen;*

- *They are just bespoken drainage and cannot be used at any other places so they are useless to others;*

- *I have done what I can and should, so no one will blame me on this;*

- *It will disrupt the project. I have to reschedule the project and coordinate the subcontractors and suppliers;*

- *Some subcontractors may have to revisit the site, which they don't like;*

- *It may cause delay and loss to this project;*

- *The company would not be happy as the insurance premium will go up;*

- *There is no 'blame culture' and the company will issue a memo to report this incident without naming names.*

To challenge his construct and facilitate him to revise it, he was asked what he has learned from this incident and what he would do differently next time, he concluded:

- *Theft from sites needs to be considered strategically, and risk assessment is needed at the beginning of the project as well as at different stage of the project;*

- *Long lead items, even of low value, need to be protected as high value items;*

- *The loss of apparently insignificant items can have a dramatic effect on programme;*

- *Interdependency of activities can have a major effect on production.*

To disseminate and promote this KEM approach, a workshop was held at M's company, which was attended by the company's Construction Director and other site managers. With M's permission, his story was presented and the other managers were

asked to discuss it. Not surprisingly, they all knew immediately which incident they were discussing as they had already known it through the company's memo. Besides those similar consequential effects and contributing factors having been identified, more wider issues which were related to the operation of the company as well as the whole industry emerged from the discussion:

- *Use off-the-shelf stock items as much as possible to minimise the possible disruption and to reduce the cost in general;*

- *M & E services should be designed to be independently supported whenever possible to reduce the interdependence of different trades;*

- *Establish good relationship with subcontractors and suppliers. Advise them of the problem immediately to win their understanding and cooperation.*

They commented that this approach was very useful and effective. They normally do not have many chances to get together and discuss about the problems on site. It would benefit them as well as the company if they had chance like this to sit down and reflect on the events from their day-to-day work. This practice not only allowed them to discuss the immediate effects of the problem but also forced them to think deeper into the root causes of the problem and seek long-lasting solutions and prevent similar problems being repeated. This required them to face their individual and organisational constructs in a setting where effective improvement could be created.

From above, it is clear that the KEM approach not only allows people to identify the problems and the immediate solutions, i.e. to complete the single-loop learning, but also challenges their personal constructs and facilitates them to tackle the wider and deeper causes of the problem, i.e. to complete the double-loop learning. As a result, the individuals' and the organisational learning ability can be enhanced and they are better equipped to deal with the changing and complex world.

Besides this long-term benefit from the improvement in learning capability, organisations can also have some immediate benefits by avoiding the identified problems repeat, whose effect can be costed (Boyd and Xiao, 2006). Unlike other KM techniques, costing the benefits resulting from KEM is not only possible but also becomes an important aspect of it. The costs of operating this KEM approach itself are simply the time of the participants and this can be regarded as nominal as this is part of the normal operation of the project, either as part of the reporting of site managers or the monitoring of contract managers. Each of the consequential effects identified in the process can then be costed in terms of cost of labour, materials and machine and possible loss of profit.

The ultimate objective of this research is to make this KM practice operate without an external facilitator and be embedded in the organisation's routine operation, so that their performance and competitiveness could be improved continuously. A number of the companies involved in the research are developing self-operation of this KEM practice. One of the key success factors of this KEM practice is to incorporate it into people's daily routine. To achieve this, *operational debriefing* and *knowledge-event post project review* have been developed. The first involves doing the event collection and debriefing at the same meeting during the normal operation of a project, at site meetings or valuations. The latter involves each participant taking one or two events to the post project review meeting and as a group using the target diagram to identify and analyse the wider implications from the events.

Organisations need to face a lot of challenges to implement this KEM practice successfully. During the research, some participants commented that they were happy to talk to outsiders about their problems and get them 'off their chest', but they were reluctant to do so with their own managers. It is necessary that an organisational culture and environment should be created to promote openness and trust and encourage people to innovate and learn from mistakes, and share their experience and learning (Skyrme and Amidon, 1997). Lack of time is also mentioned frequently. This is mainly due to that fact KM has not been built into the organisational culture enough for people to actually take time to do it (McDermott and O'Dell, 2001), and KM is still regarded only as an activity desirable but not essential (Carrillo, 2004). There is also a need to share the lessons learned along the supply chain (not to mention the whole industry!) to improve the overall project and industry performance.

CONCLUSIONS

Traditionally, construction practice is concerned with: 'getting the job done', finding pragmatic solutions to problems and only addressing problems as they arise, which encourages practitioners to miss out the reflection and conceptualisation stages and so insufficiently learn from experience (Boyd and Wild, 1994). People regard KM as a panacea and expect it to provide a quick fix. KM can to some extent fulfil this task by identifying, capturing, filing, storing and accessing solutions against problems from a database, but this may not give real value as the solutions may come from ineffective constructs. In an industry seeking real change, these ineffective constructs need to change. Thus, more important than providing immediate solutions is for KM to improve individuals' and organisations' learning ability and prepare them to tackle the root causes of the problems and prevent the repeated mistakes. In order to improve our ability to learn and then handle problems better, our personal constructs need to be challenged and a double-loop learning needs to be completed. Our personal constructs can be validated, revised and replaced when they are tested by a course of events, and when we are encouraged to explore the context and our acts in the event in a manner which allows the emotion of this to be contained.

A new KM approach called Knowledge-Event Management (KEM) has been developed and tested to do this. It uses audio diary to collect events from day-to-day work, and debriefing technique to analyse the events, challenge people's existing constructs and transfer knowledge. In this paper, a real-life example was presented to demonstrate how this is achieved. The result shows that this KEM approach works on many levels of knowledge to be effective and to face the emotional consequences that changing personal constructs requires. It can not only help people to find immediate solutions for their problems, but also facilitate them to seek the root causes of the problems and ensure that individuals will be motivated and empowered to undertake their practice differently and that their organisations can best benefit from KM practice.

ACKNOWLEDGEMENT

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