



Knowledge management in development projects

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THE EFFECTIVE MANAGEMENT of knowledge is now recognised as a vehicle through which the construction industry can address its need for innovation and improved business performance. The failure to capture and transfer project knowledge, which is usually buried in unread reports and arcane filing systems, or lost because people move on, leads to the increased risk of 'reinventing the wheel', wasted activity, and impaired project performance. Knowledge is therefore considered vital in creating competitive advantage in the new economy. Much of the growth in many global firms has been credited to knowledge, as new technologies and innovations are applied to the market and workplace. Knowledge management is therefore increasingly seen as an integral part of an organization's competitive strategy as it facilitates continuous improvement through learning and innovation. This is now increasingly recognised by most sectors of industry, with many organisations appointing a Knowledge Manager or Business Improvement Manager, with responsibility for articulating and implementing the organisation's knowledge management strategy. This paper argues that knowledge management is equally important in development projects and advocates the application of knowledge management practices to these projects. It introduces the key phases in knowledge management (creation, storage, sharing, modification, etc.) and explores how these can be implemented in development projects. The application of knowledge management to development projects is expected to result in numerous benefits including the transfer of lessons learned from one project to another, improved transfer of knowledge between developed countries and developing countries, and better management of human resources. This paper starts with a review of key knowledge management concepts, and outlines some of the characteristics of development projects. It then discusses the potential for knowledge management in development projects and concludes with a summary of the practical benefits to be gained.

Knowledge management: key concepts

Knowledge Management (KM) refers to the developing body of methods, tools, techniques and values through which organisations can acquire, develop, measure, distribute and provide a return on their intellectual assets (Snowden, 1999). Project-based organisations operate in a dynamic business environment where it is becoming increasingly important to continuously improve performance. Knowledge is central to improving performance and knowledge management systems are vital for project moni-

toring to ensure that projects are delivered within a given timeframe, allocated budget and expected quality, required by increasingly demanding clients. Whilst plant, equipment & buildings (tangible physical capital) and investment remain essential for production, knowledge (intangible intellectual capital) is increasingly seen as a major source of competitive advantage. The importance of knowledge is well illustrated by the metaphor of a tree with fruits and roots (Edvinsson, 1997). The basic argument is that it is more important for long-term sustainability to focus on nurturing the roots rather than harvesting the fruits. If the roots are not nurtured properly, then it will only be a matter of time before the tree will collapse, resulting in a situation where there will be no more fruits to harvest. For long-term sustainability, organisations will therefore have to focus on nurturing their roots.

Types of knowledge

Closely associated with the knowledge concept are data and information, which are sometimes used interchangeably. However, there are clear distinctions between these concepts. **Data** are discrete facts about events usually in the form of un-interpreted materials whilst information is data interpreted in a given context. **Information** is therefore provided when data is analysed and structured. **Knowledge** provides an awareness and understanding of the meaning of information in a specific context. Information therefore becomes knowledge when it is contextualised by processing in the mind of an individual, and the knowledge becomes information again once it is de-contextualised by articulating or communicating it to others in the form of text, computer output, spoken or written words or other means.

There are different classifications of knowledge but the most common is the distinction between tacit and explicit knowledge. Tacit knowledge is that which is stored in people's heads. It is a product of education, experiences, insights and intuition (e.g. estimating, tendering, or craft skills) which can be technical (i.e. know-how of an expert) or cognitive (i.e. based on values, beliefs and perceptions). Tacit knowledge is personal and is therefore difficult to share. Explicit knowledge, on the other hand, is stored as written documents or procedures (e.g. performance specifications, design manuals on paper or in electronic format, engineering and production drawings). Materials testing guidelines, design sketches & images, manufacturing processes in computer systems are examples of explicit knowledge. As explicit knowledge is codified, it is reusable in a

consistent and repeatable manner and therefore easier to share. The management of knowledge involves the interaction of both tacit and explicit knowledge.

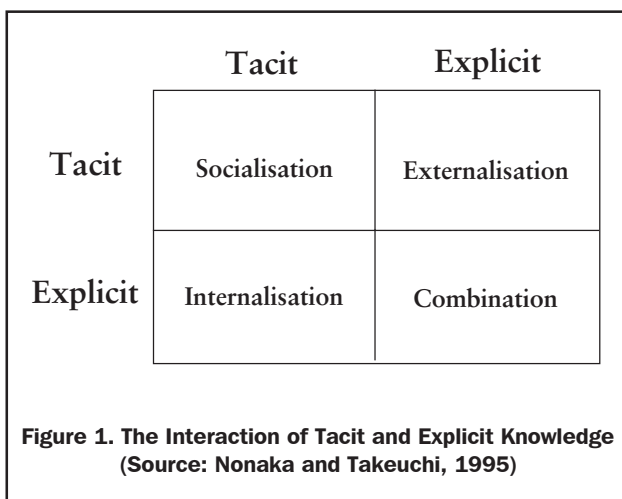
According to Nonaka and Takeuchi (1995), there are four distinct modes of interaction in the creation of organisational knowledge (see Figure 1).

Tacit to tacit knowledge transfer takes place through the process of socialisation. Apprentices often work with their masters to learn craftsmanship through socialisation by observation, imitation and practice, and not through formal instruction. Similarly, young engineers supplement their academic training with practical experience through mentoring by more experienced engineers. Externalisation is a process of articulating tacit knowledge to explicit. Internalisation takes place when tacit knowledge is created by the conversion or absorption of explicit knowledge. For example, when reading a book on architectural design theory, you create an internal mental model of your own design reflecting your clients' taste and style but underpinned by the theory. Combination is a process of systematizing concepts into knowledge systems. Project team members exchange and combine knowledge through project documents (design brief, engineering and production drawings, performance specifications, bills of materials or quantities), project meetings, telephone conversations and communications through computerised networks such as CAD systems, e-mails, intranets and extranets.

Before discussing knowledge management in development projects, it is useful to outline the main characteristics of these projects.

Development projects

In the context of this paper the term 'Development Projects' is used to describe projects intended to achieve improvement in infrastructure and services in developing countries. There are many kinds and forms of activities that have to be undertaken in the context of a development project; some examples are given opposite:



- Infrastructure sectoral projects such as the provision of infrastructure for basic services such as water, sanitation, health, education, and governance;
- Financial management and technical strengthening;
- Design and implementation for institutional capacity building projects;
- Project design, feasibility study, appraisal, review and evaluation.

The implication of these varied activities is that the information needed by different stakeholders and at different stages demands very effective and efficient knowledge management systems.

Development projects have various dimensions: physical, social, cultural and political involving communities, organisations and project teams. In addition, sustainability considerations have implications for further skills and capacity to deal with the technical, economic, financial, social, and environmental issues involved. All of these factors have an influence on how knowledge in development projects is generated, stored, transferred and managed.

The complexity increases further as the promoters of development projects vary significantly in terms of their organisational characteristics, which has an influence on how project procedures are developed and how information flows within and between organisations. The promoters for these projects include governments at various levels, bilateral and multilateral agencies (such as the African Development Bank, the World Bank, and UN agencies) and non-governmental organisations (NGOs). In terms of how these projects materialise, the institutional contexts can be classified as follows:

- *Municipalities*: these are usually subject to political control through elected councillors. Whilst many municipalities are inefficient and even paralyzed by poor management and lack of resources, they remain crucial to long-term implementation and maintenance of initiatives for neighbourhood-level improvements.
- *Specialist agencies*: these are set up to perform certain functions such as water supply, waste collection and disposal, regularization and development of low-income settlements and power supply. These agencies enjoy some autonomy, and are mostly involved with the construction of trunk and secondary infrastructure.
- *External agencies*: these are normally set up for a limited period to implement very large projects (e.g. urban development authorities). Potential problems arise through duplication of the efforts of municipalities and specialist agencies.

From the foregoing, it is evident that several organisations are often involved in each development project. Effective co-ordination of the input of the various participants necessitates a high level of communication.

Why manage knowledge in Development Projects?

A recent survey shows that a significant proportion of project organisations in the construction sector perceive KM as having the potential to provide benefits to their organisations (Robinson et al, 2001a). These benefits include reducing the loss of tacit knowledge as staff leave or retire, decreasing the cost of constantly re-inventing knowledge, and reducing the risk and expenses of repeating the same mistakes, increasing the value of knowledge, and to ensure survival in a changing project environment. This is equally true of development projects. An effective KM strategy can ensure that:

- project knowledge is captured, organized or stored properly so that it can be retrieved easily, as the speed at which knowledge is available can affect project decision making;
- project knowledge is shared and transferred to the relevant project team members at the right time, right place using the right medium so that project decisions can be made effectively;
- project knowledge is combined to create new knowledge to solve problems arising from unusual project situations (as often occurs in many developing countries), unusual needs of clients (or local NGOs), or the search for new answers to solve problems during project delivery;
- key project knowledge and lessons learnt are archived properly for future use.

The overall effect will be to facilitate learning and feed new knowledge into a project organisation to enhance project performance. A KM strategy can only be successfully implemented if a project organisation is sufficiently motivated. Davenport et al (1997) noted that the presence of motivation to create, share and use knowledge as an intangible asset is a critical success factor for virtually all KM initiatives. A recent survey of large project organisations in the construction sector identified a number of motivating factors (Robinson et al, 2001a). These factors, which are also applicable to development projects, include:

- the dissemination of best practice to key sets of project personnel;
- retention of the tacit knowledge of key personnel;
- continuous improvement.

Most project organisations recognise that considerable improvement can be achieved if 'best practice' knowledge within and outside the project environment is made readily available and utilised by project team members. It is also recognised that a significant proportion of the knowledge in project organisations is in the heads of key individuals, who tend to move from project to project, and/or from one organisation to another. In development projects, these movements may cut across continents and cultures. It is

therefore very important to manage the tacit knowledge held by members of development project teams.

Relevant knowledge management processes

There are several knowledge management processes that are relevant to development projects. Before exploring these, it is useful first to outline the variety of knowledge that may need to be managed in development projects. These include, amongst others:

- costing and project finance knowledge;
- planning knowledge;
- knowledge of the performance of local contractors;
- knowledge of quality standards;
- knowledge of the project's stakeholders
- knowledge of the socio-economic impacts of development projects;
- knowledge of sustainability issues.

In order to manage these diverse items of knowledge effectively, it is important that the most appropriate knowledge management processes are used. There are several classifications of KM processes. For the purposes of this paper, five distinct but not necessarily linear processes (Robinson et al, 2001b), will be used:

- The *discovery* and *capturing* stage is aimed at finding out where knowledge resides, whether in peoples' heads, processes or products. Examples include capturing tacit knowledge by bringing people together, discovering a database of products or 'experts' or codified knowledge about processes.
- Knowledge *organisation* and *storage* deals with the best way of storing knowledge so that retrieval can be done easily and quickly. This includes the form in which knowledge is stored, how to catalogue and index the knowledge and how the user will retrieve the knowledge.
- Knowledge *distribution* and *sharing* deals with getting the right knowledge, to the right person or part of the organisation or project team at the right time. It requires awareness of the relevant knowledge or best practice. Examples include using technology to distribute explicit knowledge or by connecting those who have tacit knowledge with those who need it.
- The knowledge *creation* and *leverage* stage involves combining knowledge in new ways to extend the overall knowledge base of the business to enhance competitive advantage and to exploit the new knowledge to optimise the return on intellectual assets. Examples of knowledge creation include setting up processes to routinely monitor knowledge for new insights, whilst knowledge leverage includes licensing or selling knowledge.
- The knowledge *archiving* and *retirement* stage deals with treatment of knowledge that has not been used or has already been used but not updated, or knowledge

that is no longer valid. This includes knowledge that is not of immediate use and relevance to an organisation but is placed in an archive to be retrieved as and when it becomes useful in the future. This stage is often ignored but it is crucial in development projects where foreign agencies may lack knowledge of old methods, materials or processes that are still in use in developing countries.

Knowledge transfer in Development Projects

Many knowledge management problems in development projects revolve around the transfer of knowledge from one person/group to another. Whilst this is explicit in so-called 'technology transfer' projects, it is implicit in all development projects. There are different facets of this: inter-project, intra-project and cross-sectoral knowledge transfer.

Inter-project knowledge transfer takes place across projects by sharing lessons learned in previous projects to develop new knowledge for improving performance on future projects. This is perhaps the most popular knowledge transfer mechanism in project organisations. Documents relating to previous projects in the form of drawings, cost estimates, performance specifications, work programme and progress charts, diaries and project reports are often kept or archived for future reference. In some cases, a summary of lessons learnt (whether good or bad practices) are also available following project closure. The scope for learning also depends on the type of project and is greater in standard projects relying on well-established answers at every stage of their execution. It will also cost significantly less than non-standard projects as the reuse of designs or plans, reduction in risks and uncertainty, and reduced rework will improve project performance.

Intra-project knowledge transfer takes place within a project by the creation and sharing of knowledge during the project life-cycle. It provides a direct opportunity to influence an on-going project, as lessons learnt in earlier phases can be applied to subsequent phases of the project. However, such benefits are not always fully realised, as time is always a major constraint during the execution of a development project.

Cross-sectoral knowledge transfer takes place across industry sectors. There is considerable scope for this on development projects as project teams often interact with a variety of disciplines (engineers, planners, economists, bankers, aid workers, etc.) in the course of a project. For example, good management practices and processes that can be shared. So can local knowledge relating the specific geographical area within which the project is taking place.

Discussion and conclusions

This paper has sought to highlight the important role that knowledge management can play in development projects. It must be emphasised, however, that there are several

issues that need to be addressed in the adoption of knowledge management in development projects. These include, amongst other things, accurate record keeping, adoption of a transparent information and communications management culture, and a proactive approach to logging lessons learned.

As highlighted in the earlier parts of the paper, there are many benefits that can be realised from the adoption of KM in development projects. In particular, there is the potential for more effective knowledge transfer and capacity building. Considerable improvements in the overall delivery process for development projects can also result, as KM can:

- support mechanisms to increase transparency and accountability;
- improve the design and implementation processes in a project;
- help develop standards and formats for supervision, monitoring and evaluation of development projects sensitive to community-related procurement and disbursement.

Clearly, it is important that all parties involved in development projects explore ways of improving their performance through knowledge management.

References

- Davenport, T.H., De Long, D.W. and Beers, M.C. (1997), *Building Successful Knowledge Management Projects*, Centre for Business Innovation, Ernst & Young, Working Paper, January.
- Edvinsson, L. (1997), *Developing Intellectual Capital at Skandia*, Long Range Planning, Vol. 30, NO. 3 pp 366-373.
- Nonaka, K., and Takeuchi, H. (1995), *The Knowledge Creating Company: How Japanese Companies Create the dynamics of innovation*, Oxford University Press, New York
- Robinson, H.S., Carrillo, P.M, Anumba, C.J and Al-Ghassani A.M. (2001a), Perception and Barriers in Implementing Knowledge Management Strategies in Large Construction Organisations, *Proceedings of the RICS COBRA Conference*, Glasgow, United Kingdom, 3-5th September, pp 451 - 460.
- Robinson, H.S., Carrillo, P.M, Anumba, C.J and Al-Ghassani A.M. (2001b) Knowledge Management: Towards an Integrated Strategy for Construction Project Organisations, *Proceedings of the Fourth European Project Management (PMI) Conference*, London, June 6-7, Paper published on CD.
- Snowden, D. 1999. Liberating Knowledge, in Reeves, J. (ed.), *Liberating Knowledge*, Caspian Publishing, London: 6-19.

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