

# Preface

Value-driven products and services today are delivered through complimentary competence sharing between different organisations. This is more of a commonality than an exception in industries such as construction, where the typical modus operandi is that of the virtual enterprise. Within such inter-enterprise collaborative environments, the management of the valuable experience and knowledge gained is crucial for success. Easy-to-use information and communications technology (ICT) systems that work across organisations are mandatory for not only ensuring data and information integrity, but the smooth passage and flow of knowledge. This is essential, as a predecessor to the task to be accomplished by one organisation is the result of an undertaking by another organisation. ICT solutions to support the same are still in a relatively infant stage from the perspective of actual take-up and use in the industry. What's more, we are still coming to grips with what "knowledge management" can and cannot do for us.

## Background

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To the outside world, the media is meticulous in highlighting through reports of disasters and failings on large and small construction projects alike of a problem-plagued industry. People are reminded again and again of a highly inefficient, poorly managed industry. Success stories, rarely, if at all, make the headlines. Yet at the same time, we are a profitable industry that employs a very large workforce. If we were not successful, or profitable, we would be out of business.

The construction industry has long been characterised as a project-based business that delivers one-of-a-kind products (such as a building). No two buildings are alike, though they may appear similar from the outside. One only needs to look back at the construction of buildings such as the Petronas Twin Towers in Kuala Lumpur, Malaysia to understand this reality. Similar in look and feel, yes; in construction methods, more or so, yes; in problems faced, no. In most construction projects, it is no longer one

skilled “master builder” who builds the building for us, but a set of organisations working together in parallel through sharing of complementary competencies to provide “value to the customer.”

In the words of Albert Einstein, “The only source of knowledge is experience.” This has been one of the earlier guiding principles of the construction industry. Skills were passed on from master to student, from one generation to the next; the construction industry of yester years was a pool of skilled craftsmen, artists in their own right. The birth of industrialisation, large-scale projects, and a large mind shift to profitability has over the years changed the very nature of the way the construction industry operates today. In the past, management focus was on the transfer of skills to maintain a set of skilled craftsmen; today the focus is on shortening construction times, minimising costs, and effectively utilising resources. As projects grew larger over time, emphasis was put on IT solutions to help manage them. These solutions were never really intended to support and maintain the traditional process of transferring skills.

There is a growing concern in the construction industry today that new recruits prefer to sit in front of a computer to “control” projects and “surf” for information, rather than spend some time on a construction site to master the skills of the trade. With a depleting skilled force (based on discussions with several lead contractors, estimates range from 40% to up to 70% of the skilled workforce retiring within the next 15-20 years), the urge to capture their experience and skills cannot be over-emphasised. Complex IT solutions were initially seen as the solution; opinions are now however divided over the issue. While terms such as “knowledge” and “knowledge management” were in the past seen by many in the construction industry as hype and a means for management consultants to make more money, such attitudes are now changing. Knowledge, or as some call it, “experience” management may be the solution to counter balance the effect of the skilled craftsmen who will be retiring soon.

## **Knowledge Management**

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The construction industry has generally been reluctant to pick up on new management paradigms. Many see these as complex “buzz words” or “re-packaging” of well-known principles that offer little added business value. The same has been the case for knowledge management. This can be attributed to one main reason. We are generally told of the “how” behind new management paradigms. Many in the construction industry insist on first knowing the “what” and “why” before approaching the question of “how.” However, when presented in a form that is understandable to the industry, there is a sudden brewing of enthusiasm and a willingness to see what can be achieved with knowledge management.

During a recent discussion with the managing director of a building contractor on the subject of intellectual capital, the managing director immediately dismissed the word as being yet another management “buzzword.” According to him, words such as these did not have any effect on the bottom line, the balance sheet. When told that by this reasoning, if his mind were to be replaced by that of a “horse,” there too would be no difference on the bottom line. There was a very long silent pause. He snapped his

fingers and said, "...now I know what you mean. I have suddenly realised how valuable the experience and insight of my employees really are. So is this what knowledge management is about, managing this experience and insight? What can I do to ensure that I can maximise on 'intellect sharing' in my company?" Towards the end of the very long and interesting discussion, the managing director suddenly asked, "In financial management, we talk of ROI as return on investment. So in knowledge management, do we see ROI as return on 'intellect' or return on 'intelligence'?"

Most researchers like to discern two main types of knowledge, explicit and tacit. A well-accepted definition of explicit knowledge is: knowledge that can be expressed in words and easily communicated and shared in the form of hard data, scientific formulae, codified procedures, or universal principles (Nonaka & Takeuchi, 1995). It is this form of knowledge that may be programmed in the form of IF, THEN, AND, OR rules. Tacit knowledge on the other hand, though, is difficult to grasp from a "programming" perspective. It is accepted by most as being highly personal and difficult to formalise. Subjective insights, intuitions, and hunches form the basis of this form of knowledge (Nonaka & Takeuchi, 1995). Within the construction industry, this form of knowledge is seen as the most important one, one that is difficult to write down on paper, and one that is typically transferred from peer to peer through face-to-face interaction (Kazi, Hannus, & Chareonngam, 1999). It pertains to not only sharing the intuition or hunch, but also sharing the reasoning ("ba") behind that intuition or hunch. The Japanese word "ba" (Nonaka, Toyama, & Konno, 2001) is used by many in the construction industry today to describe this experience and intuition.

There is general agreement that in the simplest of terms, knowledge management is that body of knowledge that deals with the management of both personal and organisational knowledge (Nonaka & Takeuchi, 1995; APQC, 1996; Davenport & De Long, 1997; Skyrme, 1997; Davenport & Prusak, 1998). Around this general understanding, different processes and mechanisms have been introduced to serve as frameworks or guidelines into how knowledge can be managed. There is no golden rule or method. Each organisation is unique, both in terms of its business processes and its culture. Of these, it is the latter that is usually the most influential element in designing an effective knowledge management strategy and follow-up plan for implementation. As an example, Kazi, Puttonen, Sulkusalmi, Välikangas, and Hannus (2001) used a combination of approaches. First of all, the framework developed by APQC (1996) showing a combination of processes and process enablers was translated to a set of "questions." For processes, questions were asked as to how knowledge is identified, collected, organised, shared, adapted to existing products and processes, used, and new knowledge is created from existing knowledge. In terms of enablers, questions were asked as to how technology supports the processes; the influence organisational culture has on the implementation, how knowledge is measured and what impact it has, and finally, how the strategy and leadership of an organisation supports knowledge creation and sharing. These were then mapped on to a "palm tree," used as a visual metaphor to illustrate how scattered knowledge "seeds" evolved into knowledge "coconuts." This was just one example used in the case of a company providing engineering, procurement, and construction services to the energy sector. You will find several such examples within the chapters of this book.

Once an organisation has appreciated the need for knowledge management by understanding what it is, what it can do for the organisation, and mainly why it is needed,

some basic “how” questions emerge: How can I capture and then share knowledge? How can I represent knowledge? How can I convert my tacit into explicit and vice-versa? Knowledge capture and sharing in a form that is later usable and shareable with many is often difficult. While a certain degree of explicit knowledge may be captured through human-to-computer interaction, the bulk of tacit knowledge is mainly captured (or more precisely shared) through human-to-human interaction. The important message being that, “if we know what we know,” then we can be a highly effective workforce (Sieloff, 1999). Murray (1999) identified conceptual indexing, conceptual mapping, hypertext (hypermedia), information modelling, and semantic networks as some means for knowledge representation. Social network analysis is another means being used to visually represent knowledge through links and interrelationships between individuals in a typical knowledge exchange chain (using who knows who, and who goes to whom for information on a specific topic). In terms of knowledge conversion, the most popular model in use today is the SECI model (Nonaka & Takeuchi, 1995; Skyrme, 1997; Nonaka et al., 2001). It advocates socialisation as a mechanism for tacit-tacit, externalisation for tacit-explicit, combination for explicit-tacit, and internalisation for explicit-tacit knowledge conversion/transfer.

## **Challenges and Emerging Solutions**

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Experience is the intellectual wealth of both individuals and organisations. There is a need to handle this experience (knowledge) properly so as not to reinvent the wheel on every new project, and not repeat past mistakes again and again (Stewart, 1997). This is ever more so important in project-based businesses. When people move from project to project and work in different teams (at times concurrently), valuable experience gained can be lost if not recorded or shared properly. This has in fact been one of the factors inhibiting progress in the construction industry. Success has many parents and failure is but an orphan. The construction industry is waking up to the fact that both, however, form integral parts of the intellectual capital of organisations and individuals. Means and mechanisms to capture and share this wealth are being urgently sought, as most of the skilled workforce (tacit knowledge base) is headed for retirement in the very near future.

We are always in pursuit of the right information at the right time. The reality is that we rarely find it. Either it is residing somewhere in an IT system, or worst of all was never really recorded. When a project ends, so do on countless occasions the valuable lessons and experiences gained. Today, many of us are overwhelmed with information and just do not have the time to share what we know. What little time we do have, we spend searching for that ever so important needle of information that is buried in our information haystack (document archive). This is no different from what many of us in the construction industry go through on a daily basis in mission-critical projects.

The Internet has been hailed by many as a free, open, information goldmine. Yet, we are overwhelmed with content, some useful, and most not, all scattered in different places. Proper organisation of these documents and information is but a first step. Each individual may have a different mindset when organising information. As an example, just

look at the data folders of different people in an organisation. Each individual has his/her own way of categorising and organising information. A key challenge is to “sort the wheat from the chaff, and then sieve out the real drops of wisdom.” This would mean not only providing the right information to the right person at the right time, but also ensuring the validity of the information, its source, relevant experts, and the provider of the information. On many occasions while the person who writes a document has one thing in mind, the reader grasps another. So it is always essential to be able to trace back to the source of the document or information to ensure its correct understanding and validity.

There is unfortunately no fixed recipe or tool for knowledge sharing. It all depends on the organisation and the people involved. Most successful organisations have adapted certain tools to their own needs. Foremost however, they have ensured that people mix and talk together. Without the willingness to acquire and share knowledge, even if the knowledge exists, few will know where it resides and even fewer will be able to use it.

People in the construction industry are very social people and proud of their experiences and achievements in problem solving. As you may know, each day on a construction site brings new problems that at times require on-the-spot solutions. People are proud to be a part of the process that solved the problem. They love to share this experience by narrating stories to peers, colleagues, and at times, to anyone who will listen. So a simple solution is to get people working on different construction sites together for a social event like a dinner and let them socialise. The main thing that connects them is their work, and that is what most will end up talking about and telling of what they did, and when. Once the evening is over, exchange names, phone numbers, and emails. Repeat this with the same people, but in different groups over a period of time. When these people encounter a problem, they will be able to recollect the stories they heard and will use this as a basis for either solving the problem, or getting in touch with the person who told them the story.

There are many interesting knowledge management tools on the market. Some are re-branded document management systems, while others focus on search functionality, and some support collaborative work in team environments. The construction industry in general is realising that a tool on its own is not enough. There is a need to instil a knowledge-sharing culture within the organisation that fosters social communication and interaction. Once an organisation can get its employees talking and sharing experiences face-to-face, it can later also encourage them to do more of this sharing using software tools.

There is no “*the* tool” for knowledge management, let alone one for the construction industry. Experience shows that most tools need to be built and customised to the needs and culture of an organisation. No two organisations are alike, so even if one uses the same tool in each, some customisation is needed. This of course is on top of the basic integration with the organisation’s other legacy systems.

The construction industry has long been dominated by a project-based delivery paradigm to deliver unique products and services. Though two adjacent buildings may look the same, each has a characteristic of its own when it comes to constructing it. Valuable experience is gained throughout the process. In fact each day brings new surprises and lessons. These, however, may be lost if they are not properly recorded and shared widely with peers. This sharing is possible through a harmonious blend of both social

and technical (supported by information communications technologies) interactions (Davenport, 1994). Construction organisations such as YIT Construction Ltd. in Finland for example, are trying to address this challenge by making both good and bad practices available to its employees and business partners during key construction process phases. At the same time, they are also identifying critical “intervention points” during these phases where “social processes” are purposely induced to allow for better tacit knowledge capture and sharing.

## **This Book and Its Contents**

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This book presents a portfolio of various concepts, methods, models, and tools supported by real-life case studies from various corners of the globe providing insights into the management of knowledge in the construction industry. Untangling the hype from the reality, practical means of implementing knowledge management in the construction industry through various mechanisms and tools are demonstrated. Case studies ranging from the implementation of decision support systems, external provision of knowledge management services, learning histories, innovation, human resources management, and so forth provide enriching practical experiences in knowledge management implementation in the construction industry.

This book is organised into 18 chapters. Each chapter lists a set of “Learning Objectives” that then are conveyed to the reader through the content of the chapter. At the end of each chapter, you will find a set of “Practical Tips and Lessons Learned,” summarising the key lessons the chapter had to offer. Each chapter furthermore provides a wealth of sources for further reference on knowledge management in general and knowledge management in the construction industry in particular. A brief description of each chapter follows.

In Chapter 1, de Kretser and Wilkinson present a case study from New Zealand focusing on the development of project-generated knowledge management systems, and the benefits that construction organisations can reap from such developments. They discuss how wasted, lost, and inefficient use of knowledge leads to inefficiencies and reworking of past problems. We learn in this chapter that it is the people that use and produce the knowledge that are in the best position to help develop project-generated knowledge management systems, with senior managers and company knowledge managers providing structure, facilitation, and support.

In Chapter 2, Dainty, Qin, and Carrillo present a case study on HRM strategies for promoting knowledge sharing within construction project organisations from the perspective of a large construction company based in Hong Kong. Focusing on the use of innovative solutions to encourage knowledge sharing within the company, they demonstrate a set of techniques based on a sophisticated combination of HRM approaches aimed at breaking down barriers to open communication and reciprocal knowledge exchange. We learn that while different approaches could facilitate knowledge sharing and management within a construction project environment, to be effective they must be underpinned by a supportive culture, effective communication structures, and appropriate HRM practices.

In Chapter 3, Smyth explores the external provision of knowledge management services for projects through a case study from the United Kingdom. He argues that while knowledge management is largely considered from the perspective of internal generation, the external provision will increase due to the diversity of problems and scarce resources that most construction companies today have. We learn that project managers and teams must be equipped in advance with sources of knowledge for problem solving both internally and externally from their firms, with external provision of knowledge management expected to increase in the coming years.

In Chapter 4, Pasher and Horsky take us through the experience of developing the world's first intellectual capital report for a construction company, Danya Cebus Ltd. from Israel. They point to learning, appreciating, and capitalising on the intellectual capital of firms, and guide us through a phase-by-phase approach on how to develop an intellectual capital report. Their experience demonstrates that through intellectual capital reports, shareholders are able to better understand and appreciate an organisation's hidden competences and values. We learn how to create a vision and core values, and communicate them to serve as a compass for creative energies.

In Chapter 5, Fong and Wong take us through a case study in Hong Kong on the capturing and reusing of building maintenance knowledge. Their study shows that owing to the unique nature of building maintenance, building surveyors need sufficient knowledge and experience to facilitate their decision-making process, and therefore proper capture and reuse of knowledge is required to reduce the risk of "reinventing the wheel." We learn that knowledge usually resides in the minds of the individuals, and it is through sharing and socialisation that this knowledge is elicited.

In Chapter 6, Peansupap and Walker share their experience on the community of practice concept in a case study of three major Australian contractors. Communities of practice are analysed and presented from the perspective of the individual, work groups, and the organisation. The authors demonstrate how communities of practice can be used as an efficient diffusion mechanism for information and communications technologies within and across companies. We learn that communities of practice already exist in organisations. They need to be tapped into as useful and powerful instruments for knowledge creation and sharing.

In Chapter 7, Jewell and Walker provide insights from a large UK construction organisation case study where communities of practice have been supported through use of a software tool and management approach that encourages their spread across the organisation. They provide valuable insights from several years' reflection upon the tool's use and application, and highlight both drivers and barriers to its deployment. We learn that dynamic profiling, for example, can be used as an effective means to enable people to be more effectively connected with each other through their expressed interests.

In Chapter 8, Orange, Onions, Burke, and Colledge present the results of an action research project on facilitating organisational learning within the construction industry. They describe the development of the COLA (Cross Organisational Learning Approach) process and its use. We learn from the experience of two major construction clients, a privatised utility company, a major leisure services provider, a large construction company, and two leading construction consultancy firms, that reflective practice benefits the organisation and, when seen as a social process, contributes to organisational learning.



In Chapter 9, Ng presents experiences from the use of knowledge management methods in the higher education and professional development of members of the construction industry. He sets a case for lifelong learning and continuing professional development as essential ingredients to ensuring that graduates and workers remain competent and maintain a competitive advantage. We learn that “learning to learn” is an essential skill for successful knowledge sharing in the construction industry.

In Chapter 10, Dikmen, Birgonul, and Ataoglu explore organisational learning ability as a performance driver in construction through a survey of 85 Turkish construction contractors. Through empirical evidence, they demonstrate that as organisational learning ability increases, firm performance also increases. We learn that the measurement of organisational learning ability within an organisation necessitates an evaluation of both its knowledge management abilities and the appropriateness of its culture.

In Chapter 11, Jefferies, Eng, and Zenke present a case study on the application of the “learning history” approach to organisational learning in the Tasmanian State Public Health Sector, Australia. The approach relies on the learning history of an organisation as a basis for evaluating the organisation’s methods of acquiring and managing knowledge, and thereafter its learning culture. We learn that a learning history tool adds value far beyond producing documentation, in that the process itself, particularly reflective interviews, it gives stakeholders the opportunity to discuss their experiences and therefore enables a form of knowledge capture.

In Chapter 12, Wild revisits early studies on socio-technical research in construction conducted by the Tavistock Institute of Human Relations in the early sixties. Using this as a reflective basis, he discusses the extent which the tacit order, instability, and diffuseness of construction may, practically, undermine knowledge management initiatives. A set of critical questions are presented, challenging the current discourse of knowledge management research in construction. We learn that the diffuseness of construction requires a significant tacit order, and that the solution to the problems of the construction industry may be simply to manage projects differently.

In Chapter 13, Walker, Maqsood, and Finegan introduce “the knowledge advantage” (K-Adv) approach that describes a model in which knowledge leadership provides the setting in which an organisation’s knowledge vision can be developed and activated. Through a set of examples, they demonstrate some strategic as well as practical tactical tools that companies can use to develop their competitive advantage. We learn that the challenge is for the construction industry to embrace its commitment to a style and form of leadership that not only empowers its knowledge workforce, but also positively supports and underpins them with appropriate infrastructure, the means to unleash innovation and creativity.

In Chapter 14, Whelton, Pennanen, and Ballard use a case study to explore the co-production of project needs and requirements by client-specialist groups. They describe the significance of project definition as a project delivery phase and outline a project definition model for knowledge creation. Through the case study, it is demonstrated that project definition is a complex adaptive process, and that knowledge about project purpose emerges from group collaboration. We learn that at times, organisational boundaries often limit the creative process. There is a need, therefore, to search both internally and externally for solutions to stakeholder needs.



In Chapter 15, Abdou, Radaideh, and Lewis provide an overview of decision support systems and their application in the construction industry. They present a set of examples from current research demonstrating the use of different types of decision support systems in the construction industry. We learn that decision support systems, while useful, are there to support decision makers, but not to replace them. Talents such as creativity, imagination, or intuition should not be ignored in the course of making a decision.

In Chapter 16, Tserng and Lin demonstrate the use of a knowledge management portal built on the basis of knowledge maps for activity-based knowledge management in construction. Various life cycle stages of knowledge management from knowledge acquisition, extraction, storage, sharing, and updating are demonstrated, followed by a description as to how these are used to construct a knowledge map. We learn that knowledge maps are an efficient visual tool for presentation of the availability and source location of knowledge within a construction project.

In Chapter 17, Chen, Kong, Li, and Xu present an integrative knowledge management system for environmental-conscious construction based on a comprehensive integration of environmental management techniques and tools in construction. An experimental case study is used to demonstrate its use and applicability for the construction sector. We learn of the need for better integration of environmental management tools to support better decision making in various construction phases.

In Chapter 18, O'Brien, Issa, Shen, and Xie present a vision for future project information technologies in the form of configurable environments. These configurable environments combine data integration capabilities with visualisation and analysis tools in a format customised to the needs of specific users and projects. The need for and technical aspects of the configurable environments approach is presented in the context of an illustrative case study of construction space management. We learn that as information technologies evolve, they will shift the balance of job tasks from information gathering to analysis. Firms should consider grooming younger employees for such changes.

This book is not a primer on knowledge management, nor is it a primer or introductory text on the construction industry. It is in fact a collection of global perspectives, practical experiences, and research in the area of knowledge management in the construction industry. While revisiting the advent of socio-technical thinking in the construction sector from the early sixties, it goes well beyond the current state of the art in exploring various visions for knowledge management in the construction industry. Encapsulated within are recent research undertakings supplemented with real-life cases and lessons learned from various corners of the globe.

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