

THE KNOWLEDGE ADVANTAGE (K-ADV) CONCEPT

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Research reported up here explores innovation diffusion and knowledge management literature providing a model of how organisations can enhance competitive advantage through a knowledge advantage (K-Adv). This conceptual model is explained in sufficient detail to indicate how an organisation may use it to benchmark its K-Adv maturity level. This model was based upon extensive review of the knowledge management literature and draws upon results from a parallel study on innovation diffusion. The model was tested using unstructured interviews with key personnel from a building construction contracting firm (annual turnover of AUD\$1 billion) and three Australian government departments responsible for building and infrastructure projects. The innovation diffusion study also included data from a global engineering consultancy. Both studies were completed in mid 2004. The concept model was accepted as being highly valuable for benchmarking by our collaborating industry partners, but they showed reluctance to commit commercialisation funding to develop a strategy for establishing how a benchmarking group might be established to undertake KM consulting work using this model and tools developed. The prevailing view was that currently, the Australian construction industry is poorly prepared for the required cultural change necessary for organisations to realise a competitive advantage based upon its knowledge management approach.

Keywords: Innovation Diffusion, Knowledge Management, Learning Organisations

INTRODUCTION

The aim of this paper is to report upon part of a major research project undertaken in knowledge management (KM) and innovation diffusion in the Australian Construction Industry. The broader study started with an ICT innovation diffusion research study involving 117 respondents from three large construction organisations and data was analysed and results were reported elsewhere (Peansupap *et al.* 2003b). This was then followed up with a further study of a major contractor who participated in the survey plus two other similarly large contractors to provide case studies of their diffusion of ICT innovation. Results from that part of the study has also been reported upon elsewhere (Peansupap *et al.* 2003a). It is important to provide the above preamble because it sets the context for this paper. We substantially drew upon the innovation diffusion literature and results from that work to frame our understanding of organisational culture issues that impact upon the way that knowledge is managed in the target organisations. We developed from extensive review of the KM literature, and the results of the innovation diffusion part of our research project, a model that describes how organisations may develop their knowledge assets and build what we refer to as their knowledge advantage (K-Adv).

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We define an organisation's knowledge advantage as its capacity to liberate latent creativity and innovation potential through effective management of knowledge both from within its organisational boundaries and its external environment. Our review of the literature suggests that this capacity provides organisations with both cost competitive advantage as well as a potential quality differentiation competitive advantage. We argue in this paper that this K-Adv is a key to effective innovation diffusion. We have sought expert opinion through a series of interviews with key senior construction personnel from one of the largest first tier construction contractors in Australia and three large government departments managing construction projects. While our findings cannot be considered conclusive, it provides an interesting framework to view how these organisations view the knowledge management process and this helps to develop a debate that is critical to the construction industry because the impact of knowledge management and diffusion of innovation is becoming more widely appreciated in the construction industry.

We structure our paper as follows. First we discuss the literature that links knowledge as being recognised as an important asset, the innovation diffusion process that helps new ideas take hold in a community, and the development of sustainable competitive advantage. We then describe the K-Adv model in broad terms and illustrate how it can be used to benchmark an organisation's preparedness to recognise and capitalise on its knowledge assets. This is followed by a brief discussion of the feedback we received from our industry panel of senior managers from the construction industry. We then discuss our analysis of their feedback and reactions and conclude with our recommendations for the future of this initiative.

THE LITERATURE

Gaining a knowledge-based competitive advantage is principally about adding value through working smarter and for the workforce to instinctively embrace both a quality and innovation culture. Porter (1990) argues that a firm has competitive advantage when it can produce the same good as its competitors at less cost or it can deliver a qualitatively differentiated product that is difficult or impossible to replicate. The cost advantage is simply doing the same thing smarter by being cheaper through reducing waste or using less expensive inputs. The second kind of advantage is to be able to provide a product or service that is perceived to be unique. Simply convincing people through brand image that a similar product/service is in fact quite different, may achieve this through differentiating the qualities or features. More often though, this is achieved by genuinely providing some extra value (often a service value-add) that is difficult to duplicate or improve upon. Competitive advantage is thus embedded in the concept of a value chain, proposed and widely explored by Porter—it is a useful way of looking at the process of delivering products and services from the value-adding perspective. Instead of looking at production as a process of combining functions as resource inputs it looks at each input in the chain as value-adding contributors. The crucial question for each input at each stage is "what value does this input create to the outcome?" This begs a further question "To what extent can waste be eliminated or minimised from the creation of the outcome?" The supply chain becomes a value chain and upstream suppliers provide value inputs that allows a given supply chain member to add value to these before passing on to the next stage of the process. Knowledge is a critical ingredient in realising value for each input in the chain. During the late 1980s, the management literature began to recognise the value of intangible deliverables as explicit performance outcomes (Eccles 1991; Sveiby 1997). Further, the accounting concept of 'goodwill' (that undefined asset representing the

residue of a firm's market value in excess of its capital and liquid assets) was explored to delineate a more fine-grained definition of the value of a firm's total tangible and intangible assets (Edvinson 1997; Sveiby 1997). This led to a re-examination of concepts of brand value, supply chain relationship value and both intellectual and human capital value as they relate to 'good will' and intangible assets.

The concept of multidimensional value led to a balanced scorecard (BSC) approach that attempts to measure organisational performance from four perspectives (Kaplan and Norton 1992, 1993, 1996). The financial perspective is directed at generally accepted measures of profit, market share etc performance. A second perspective, the customer perspective, is aimed at quality issues as perceived by the firm's customers. A third is the internal business process perspective that measures the efficiency and effectiveness of the firm. Finally, the innovation and learning perspective measures help answer the question "Can we improve and create wealth?" This latter perspective has been gaining increasing levels of attention in terms of how valuable is the firm's knowledge assets that permit it to compete with others in its market space.

This issue is also closely linked to the notion of core competencies, those things that a firm is especially good at that explains to a large part its success and drives its decision making for charting its strategic direction (Prahalad and Hamel 1990). The BSC allowed researchers such as Argyris and Schön (1978) to give their ideas a voice, and this resonated with those interested in business performance, because this knowledge dimension helps explain how organisations learn more effectively.

The literature on how firms develop an environment that encouraged learning to enhance firms' business sustainability also gained much prominence during the latter part of the 1990's with numerous classic texts appearing on what became known as knowledge management (KM) for example (Sveiby 1997; Hansen *et al.* 1998; Ruggles 1998; Davenport and Prusak 2000; Nonaka and Teece 2001). The value of tacit knowledge (that which is difficult to codify and make explicit) also became a focus of KM (Polanyi 1997). This led to work on the concept of knowledge networks and communities of practice that are particularly effective at generating, transferring and using knowledge (Lave and Wenger 1991; Wenger *et al.* 2002).

Also, during the latter decades of the 20th century, there was a growing and keen interest in understanding how innovations are diffused, fuelled by the seminal work of Rogers (1995) and Von Hippel (1990; 1999) and more popularly Dorothy Leonard-Barton (1995). Most of the underlying research studies related to the concept of 'sticky knowledge' or the way in which knowledge about innovations and the transfer of best practice is difficult to achieve because of various barriers to the ease of knowledge transfer, much of which is highly tacit (Von Hippel 1990; King 1999; Szulanski and Winter 2002; Szulanski 2003). These studies highlight the pivotal role of people in knowledge transfer. Nancy Dixon also developed a knowledge transfer typology that reinforced the importance of and processes of people sharing knowledge (Dixon 2000). Others such as Zack (1999) linked the management of knowledge with leadership and strategy and thence to competitive sustainable advantage.

While KM became accepted as a viable topic in organisational learning, and more generally innovation diffusion in organisations, it lacked a coherent and thoroughly validated application model that could be used for benchmarking. Parts have been well explained and investigated, but the broader picture remains un-validated—mainly because complex interrelationships of knowledge, innovation diffusion, strategy and organisational dynamics make proving cause-effect links difficult. Research work continues to develop and test models of KM, but with only a decade or so of sustained effort being reported upon, much more research work needs to be undertaken in this

area as it has relevance to innovation diffusion policy. Three principal supportive components (information communication technology (ICT), leadership, and organisational culture) provide a consistent framework for linking innovation and KM. While details vary of how knowledge thinkers view the way these components contribute to innovation, these three component themes remain broadly consistent.

THE KNOWLEDGE ADVANTAGE (K-ADV)

In the first part of the research study that we draw upon in this paper, eleven factors were extracted using SPSS factor analysis from data collected from 117 respondents and these were then analysed and grouped into four thematic and inter-related groups. These groups that were found to substantially (70+%) and reliably (with Chronbach's alpha values >0.6 to 0.9) explain what affected ICT diffusion in the surveyed organisations (Peansupap *et al.* 2003b). These groups were described as: management support through training and development and reward systems; individual motivation through benefits of the ICT application's use; technology functionality; and the workplace environment that supported the ICT application diffusion. The questionnaire that was used to frame the variables measured was drawn from the literature on innovation diffusion, change management, KM and organisational behaviour. The results provide a clearer picture of what aspects might drive ICT innovation and from this what might drive other aspects of KM—because what was principally being transferred in the ICT innovation diffusion process was knowledge about the applications, the environments that people were operating in, support systems and leadership factors that enabled or inhibited effective ICT diffusion. We realised that the strong link between ICT innovation diffusion (and perhaps many other forms of innovation diffusion) and knowledge management comprised three inter-related elements as illustrated in Figure 1 below.

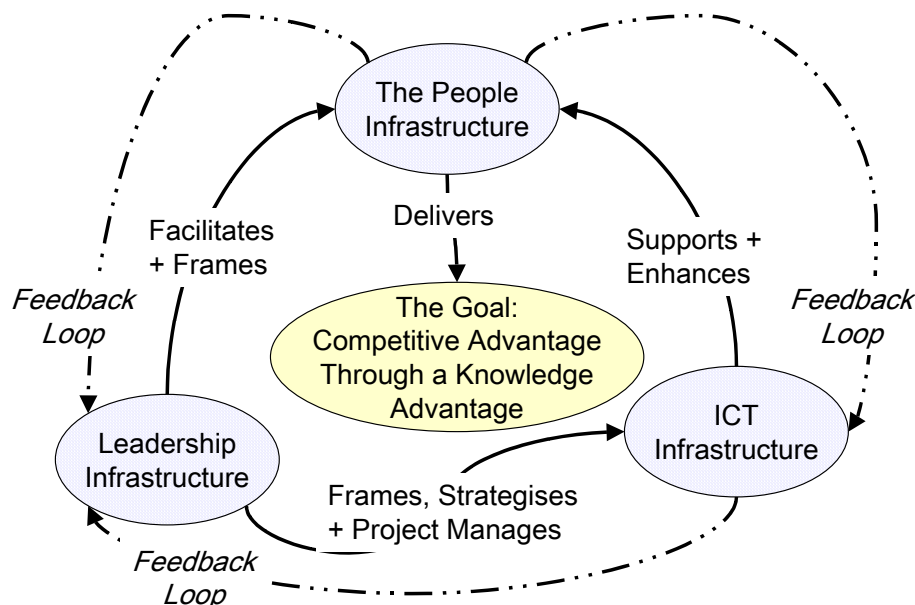


Figure 1 - The K-Adv Meta-Level Model

The goal of the organisation is competitive advantage through gaining a knowledge advantage. The leadership infrastructure driver envisages what could be achieved and what knowledge is available from a range of sources both within and outside the organisation. Knowledge is a human attribute, while knowledge has been argued to be embedded in systems, products and inanimate objects (Skyrme 1999), it is widely

recognised as being fundamentally interpretative—people use information plus their experience and others they jointly solve problems and/or work with to generate knowledge (Nonaka 1997; Sveiby 2000; Nonaka and Teece 2001; Nonaka *et al.* 2001). Thus the people infrastructure is the only entity that can deliver a K-Adv. This is supported by the leadership infrastructure that also nurtures and supports the creation of a complimentary ICT infrastructure. Commonly this comprises groupware systems, portals and interfaces to the organisations intranets, information systems, and problem solving tools and to the World Wide Web. There is also constant feedback.

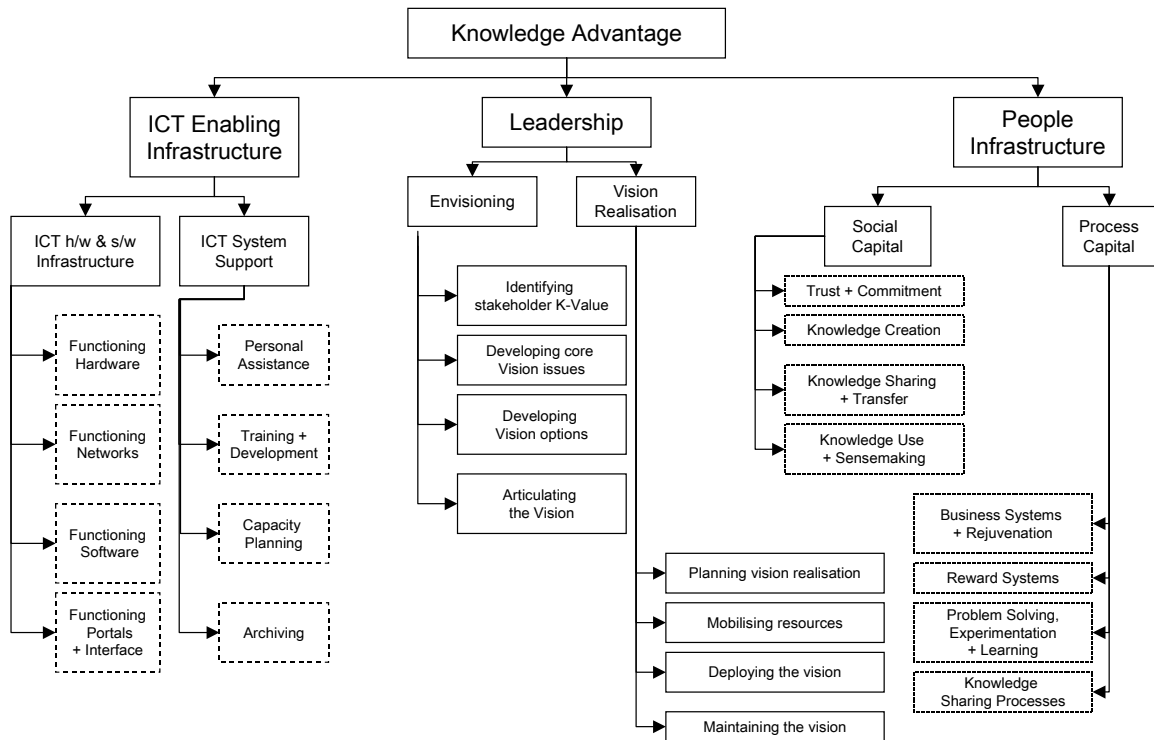


Figure 2 – The K-Adv Detailed Level Model

We analysed these three infrastructure elements further to develop a detailed breakdown structure model of each of the three infrastructures. The ICT enabling infrastructure for example comprises two elements: ICT hardware, software and interface portals; the second element links users with ICT system. Leadership is broken down into the envisioning process that identifies the stakeholders and develops a vision of how knowledge creation, transfer and use can be best managed and a second element that relates to the project management processes that realise the knowledge vision. The people infrastructure comprises two elements. The social capital element provides the environment in which knowledge is best managed. The organisation’s process capital element includes its business systems, reward systems, its approach to experimentation and problem solving that manages knowledge-in-action as well as the knowledge sharing processes.

As can be seen from Figure 2, that the detailed level model provides a coherent breakdown structure or framework with which to visualise the characteristics of an organisation’s K-Adv. The model is further defined in terms of unique attributes for each of the sub-elements illustrated in Figure 2. If we take the example of the People Infrastructure element and look more closely at the Process Capital sub-element and within that look at the Problem-solving, experimentation and learning attributes of that sub-element, we can see how the model can identify useful measurable attributes.

Table 1 - Problem Solving, Experimentation Learning and the K-Adv

Maturity	Performance Characteristic			
	Experiential Learning	Organisation Response to Failure	Organisation Linking R&D to T & D	Change Adaptation & Re-invention
How can process capital be improved, by ensuring that the organisation →	Stimulates people to learn through joint problem solving and testing ideas in developing or adapting ideas.	Minimises the –ve and accentuates the +ve impact of learning from mistakes	Supports and sustains learning through “blue sky”, applied and action research	Encourages and sustains an adaptive capacity to change k-approaches and business focus when necessary
Inactive AWARENESS	Adapting from others with uncoordinated <i>ad hoc</i> problem-solving “fixes”. Experimentation is seen as a cost.	Failure is punishable. Little tolerance for taking risky experimentation that might fail.	Little or no link between R&D activities and subsequent T&D. Focus on T&D is based upon past successes.	Fear of the unknown inhibits adoption of new ideas and adaptation of good ideas from others
Pre-active INITIATION	Takes a not invented here (NIH) mind set and only develops in-house solutions	Failure tolerated but rarely forgiven. Lessons learned are lost in cover-ups.	R&D and T&D are considered as cost-centres and so compete for resources.	Management understands the need for adaptation and takes ad hoc initiatives often viewed as fads
Active ADOPTION	Followers in taking existing systems from others and applying it with minimum thought of how to adapt it	Forensic examination of failures for lessons learned but non-standard format for reporting these.	R&D and T&D are coordinated and focus on organisational needs. R&D is mostly applied research.	Continual change, restructuring and renewal to cope (reactively) with need for innovation. Poorly strategised.
Pro-active ACCEPTANCE ADAPTATION +	Scans for good ideas and plans and prepares for their implementation and adaptation. Encourages piloting and trialling	Failures are valued as learning opportunities. Rigorous methods are used for reporting and categorising lessons for k-transfer.	R&D activities span the supply chain and T&D likewise. There is a strong focus on getting user T&D to help with feedback to R&D after design	People selected & promoted on the basis of their capacity to adapt and help re-invent the organisation.
Embedded ROUTINISATION + INFUSION	Co-develops with lead customers and supply chain partners through piloting. Continually tests and probes for new ideas.	Harvesting lessons learned from all projects. Identifying critical lessons learned as a k-creation activity and rewarded as such	R&D and T&D are linked through action learning with feedback from users to idea generators so that both groups jointly develop and learn during design	Aims for disruptive change. Uses iconoclasts to challenge and trigger organisational reinvention. Co-opts customers and supply chain in reinvention.

Table 1 provides an illustration of these attributes being the way that experiential learning is managed, the organisation’s response to failure, its linking of research and development to training and development, and its posture on change adaptation and re-invention of itself. These issues are central to an organisation’s ability to gain a K-Adv. Table 1 can be used to measure the organisation’s current and desired level of attainment by matching its best fit to the scenarios that populate the matrix. Each matrix element indicates a stage of maturity as indicated in the first column. In this way the K-Adv model can be used for benchmarking and when an ‘as-is’ versus a ‘where we would like to be’ rating is undertaken to determine gaps, this tool can be effectively used to assist strategic planning.

FEEDBACK ON THE (K-ADV) MODEL

The testing process comprised two interlinked phases. Phase 1 was designed to test the validity and merit of the overall K-Adv concept and its principal attributes and processes, and also reveal the maturity level of knowledge management undertaken by the tested organisations. We interviewed 17 key senior personnel in three large government departments managing construction projects using a summary of the K-Adv model as indicated in Figure 2 together with draft indications of the matrices. Phase 1 research was conducted with two major government-based client groups. A research instrument was designed that consisted of purposely-devised briefing documents and a short questionnaire to gather feedback comments. Several weeks after distribution and dissemination of the appropriate background documents, semi-structured interviews were conducted with 8 senior managers of these organisations. Interviewees were selected based on their perceived workplace association with one of the principal attributes of the K-Adv model. To examine and test the validity of the K-Adv model of *Leadership Infrastructure*, senior management with strategic planning and decision-making roles were selected and interviewed. People associated with the management of human resources were interviewed for the *People Infrastructure* element. People directly associated with organisational use and management of ICT systems were selected and interviewed for the *ICT Infrastructure* model element. The specific purpose of the interviews was to provide background explanation of the K-Adv and to examine and reveal the perceived validity of the system elements and maturity indexes such as that illustrated in Figure 2. Questions were also directed to gauge the level of maturity of the organisation's adoption of knowledge management and its interest in the potential use of the K-Adv model.

The interviews revealed different levels of knowledge management adoption by each organisation. One of the government organisations actively and systematically embraced knowledge management over the previous 3 years while the other organisation had not consciously undertaken any knowledge management related activities other than participating in the research. There was however recognition by both organisations of the need to systematically manage their knowledge. As a leader from the less mature adoption organisation stated: 'We know we should be doing something but we just don't know what it is'. Although the more mature organisation had embraced the concept of knowledge management, its activities were rudimentary, reflected refinement of information gathering and storage and encouraging simple organisational communities of practice. There was however no outcome-directed systematic, whole-of-organisation KM approach.

All interviewees validated the appropriateness of the elements and sub-elements of the K-Adv with the exception of the *Functioning Hardware* sub-element of the *ICT Infrastructure* element, which was perceived as being valid but less important as the *Functioning Software* and *Functioning Network* sub-elements. Respondents were particularly enthusiastic about the nature and content of the maturity indexes provide for each sub-element of the K-Adv model such as that illustrated in Table 1.

As a direct consequence of the Phase 1 testing outcomes, refinements were made to the K-Adv. A draft industry information guide was produced that reflected these refinements for development of a future comprehensive users K-Adv manual.

The draft industry guide was tested in Phase 2 with three personnel from the global engineering group and seven from a third government-based client organisation. All industry partners engaged in this study thus contributed feedback. The purpose was to reveal the appropriateness of the guide in terms of industry interest and descriptive comprehension and relevance. A brief 10-question instrument using a Likert-type 5

point scale was designed to deliver these insights and distributed to selected members of the organisations either with particular knowledge management credentials or responsibilities and senior strategic decision-making roles. Follow-up focus group semi-structured interviews were conducted to investigate and validate the outcomes of the questionnaire process.

Phase 2 revealed generally low comprehension and insights into knowledge management concepts, even amongst knowledge management specialists in the organisation. The general assessment was that, for an industry information guide, the document was too complex in its structure and description of the K-Adv knowledge management concepts. Comments such as ‘the primary introductory document should be much simpler/shorter in its pitch’ were typical. It was determined as a result to produce a user-friendlier introductory version of the industry booklet to allow a structured nurturing and development of knowledge management processes by the industry. Similar follow-up research was conducted through a two industry group seminars and information sessions, feedback from which indicated similar results to the Phase 1 and 2 research outcomes as detailed above.

DISCUSSION, ANALYSIS AND CONCLUSIONS

The general purpose of the validation exercise was for potential users of the K-Adv benchmarking instrument to provide proof-of concept feedback and validation of the K-Adv model so that the justification for a full scale K-Adv benchmarking audit and development tool could be implemented during 2004/5. Through this process, use of the K-Adv model and its maturity indexes could be enhanced into a developed benchmarking tool to be used both inter and intra-organisationally. This tool would challenge organisations to move beyond their value focus of time, quality and cost towards a broader scale of performance outcome measures centred around knowledge, lessons learned and an approach that fixes the system rather than fixes the immediate problem. It was anticipated that organisational learning could be thus engendered and that the K-Adv might provide a suitable vehicle not only for continuous improvement and business excellence, but also could trigger breakthrough invention by challenging the status quo. Results were encouraging in that there was general support for the K-Adv idea and perceived need for a measurement system of this kind but it was interesting that a simple version of this was consistently called for. Also, after several months and further follow-up meetings and phone conversations with senior managers in each of the organisations, each felt that their organisation was unready to undertake any further in-depth collaboration in developing and validating the sub-element matrixes (such as that in Table1). Reasons cited related to the expected level of effort required of staff to undertake the audit with the research team. We anticipate that there would be a similar level of effort required if the K-Adv model and benchmarking tool were in commercial operation.

Implications for the K-Adv model’s further development are as follows:

1. The model could be simply inappropriate and poorly designed. It was, however, developed on rigorous research and was consistent with the innovation diffusion research results so we tend to question this conclusion;
2. The model is too conceptually complex for the participating organisations. This would imply that the construction industry is far from ready to truly embrace a KM approach and this may explain stickiness of knowledge transfer related to innovation—the knowledge environment is still nascent;

3. The maturity level challenged those responding to our feedback request. This certainly could lay at the core of comments made to us, those we interviewed felt that they were less KM-mature than they felt their organisational leaders might prefer to admit to;
4. The K-Adv is a sound tool but perhaps ahead of its time. If this is true then the work developing it will be deployed at some future stage for the construction industry or it could be deployed in other industries and industry sectors where there is already a higher KM maturity evident. Isolated more advanced construction industry organisations may see the value in this tool.
5. While the K-Adv is a potential innovation and needs to be diffused like any other innovation, the model illustrated in Figures 1 and 2 may also hold a key to how to do this more effectively. It appears that we need to better focus the communication of the knowledge vision for the K-Adv.

We first described in this paper how the K-Adv concept has its roots and basis in the innovation diffusion and KM literature. We then used the literature to explain how an organisation's sustainable competitive advantage can be linked to the concept of a knowledge advantage. We then explained a model that we have developed (the K-Adv) and explained how it could be used by organisations to benchmark, and thus provide an audit, of their KM preparedness. We reported on feedback received and this indicates that the construction industry participants that we selected (although highly sophisticated in their use of ICT and some tools commonly used for KM) may not be ready for applying the K-Adv concept and benchmarking tools. We presented five implications of our work and we conclude that while the K-Adv concept has potential, it is as yet undeveloped to a stage that it can gain tangible acceptance even by sophisticated construction industry organisations.

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