Managing Project Knowledge

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ABSTRACT

This research aims to develop understanding of why project lessons are not more effectively learned from experience, particularly in large government sponsored information systems projects. A synthesis of the related literature assists in the development of a conceptual model which identifies key factors which can restrict or facilitate the management of project knowledge. A survey of senior project management professionals, together with 16 in-depth, semi structured interviews are used to refine and validate the model. Future areas of research are suggested. The contribution of this research aims to inform both academic and practitioner audiences.

KEYWORDS

Reflective practice; Collaboration within and between projects; Reflective practice; Value generation; Knowledge management; project management

The purpose of this paper is to develop a better understanding of managing project knowledge and particularly why lessons are not more effectively learnt from experience. The research is set in the context of UK government sponsored information systems (IS) projects, partly because of the mandated use of PRINCE2 as a project management methodology, and the integral part that lessons learned reporting plays in PRINCE2. For this reason, there is obviously a clear intention to more effectively learn from what has gone before, yet frequent and recurring complaints from the UK National Audit Office and the Committee for Public Accounts (CPA) suggest that this is not working ((C.P.A., 2005; C.P.A., 2007; C.P.A., 2009; C.P.A., 2011; C.P.A., 2014). In 2011 the CPA stated "Projects have been too big, too long, too ambitious and out of date by the time the ICT is implemented" (C.P.A., 2011: 3). In addition, more recently the C.P.A. commented,

> *The Department for Work & Pensions has spent £700 million on Universal Credit since the programme began in 2010. Very little progress has been achieved on the front line with fewer than 18,000 people claiming it by October 2014... (C.P.A., 2015)*

One potential solution to this ongoing issue may come from Petter & Randolph's (2009) argument that "valuable knowledge gained on IT projects is rarely captured and utilized". In practical terms it makes sense for organizations to effectively manage their knowledge in that there are clear benefits to

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organizational performance (Cummings & Bing-Sheng, 2006; Edmondson, 2008; Nonaka, 2007) . This can involve drawing in (or "grafting") new knowledge to the organization, for example through appropriate recruitment, consultancy or training (Huber, 1991) It can involve generating new knowledge from within the organization, or to add value through sharing, exchange or recombination of existing knowledge (Galunic & Rodan, 1998; Reich, Gemino, & Sauer, 2008). Finally, knowledge management can also involve the amelioration of knowledge loss through staff turnover or retirement, as well as through the use of consultants. In some cases it may be more effective to encourage "unlearning" of obsolete or misleading knowledge (Hedberg, 1981).

An important focus of this paper is on understanding the internal organizational knowledge management processes as they apply to projects. This process can be seen as a cycle involving: knowledge creation, storage, retrieval, and application, together with how knowledge is transferred and converted between these processes (Alavi & Leidner, 2001). However, consideration will be given to both the 'cognitive' approach to knowledge, i.e. that knowledge is objective and universal and a representation of a pre-established reality, together with the autopoietic view, that only data can be transferred (Koskinen, 2004), which is then interpreted before forming knowledge (the implication being that the same data can form different knowledge, depending on the receptiveness and pre-existing ability of the recipient).

The importance of this research is illustrated by the significant under-exploitation of the potential benefits of effective knowledge management. "The benefits of collecting, storing and providing access to experiential knowledge are particularly relevant for multi-unit organizations where *knowledge* acquired at one site can be beneficial to other sites"(Olivera, 2000).

With a failure rate of over 80% for knowledge management programmes (Storey & Barnett, 2000) there is obviously a problem of significant proportions in putting knowledge management into practice. The Chief Information Officer at the Department of Work and Pensions stated that only 30% of UK government sponsored projects succeed (Collins, 2007) and yet a fundamental part of the government mandated project management methodology (PRINCE2) is the formal creation and use of "lessons

learned reports". Surely we can more effectively improve project management through learning from past experiences, both good and bad?

> *"It is deeply depressing that after numerous highly critical PAC reports on IT projects in recent years, the same mistakes have occurred once again. We question the purpose of our hard work if Whitehall accepts all our recommendations but still cannot ensure a minimum standard of competence"* (CPA2009: 5)

The number, size and cost of government sponsored IS projects emphasises the importance of research into more effective methods of knowledge management in this area.

Literature Review

Key issues, and barriers to effective project knowledge management relating to the research objectives are synthesised below. At a basic level it is useful to categorize knowledge as either 'explicit', including language and documentation, and able to be expressed, documented or stored; or 'tacit' which of its nature is less tangible and includes personal experience and skills (Polanyi 1966), But despite Nonaka and Takeuchi's (1995) "spiral" model of knowledge creation portraying the conversion of knowledge from 'explicit' to 'tacit' and vice versa, in practice tacit knowledge (because of it intangibility) is often difficult to convert either to explicit knowledge, or to new tacit knowledge. Another categorization which can be seen as useful variously defines knowledge as 'declarative' knowledge (facts), procedural knowledge (know-how), or conditional knowledge (know-when), i.e. under what circumstances knowledge applies (Paris, Lipson, & Wixson, 1984). Earl (2001) argues that "knowledge management not only can be defined in different ways, but that there is considerable choice in both what to do and how to do it". He goes on to say that many find theoretical models too abstract, or too limiting in that they don't tell a firm wishing to implement a knowledge management programme "what to do next Monday". On the other hand, Davenport and Prusak (1998) argue that knowledge management "…is not rocket science …It's good sense and managerial basics". A suggested way forward is to draw from the literature the barriers to

knowledge management and examine their relevance through consultation with experienced project managers. Table 1. below synthesises key barriers in order to develop a conceptual framework.

INSERT TABLE 1 HERE

Part of the problem of understanding, is that in terms of adding organizational value, knowledge is often part of a series of related processes (Nonaka & Takeuchi, 1995; Ruey-Lin, 2008). Figure 1 (below) illustrates the main stages in the knowledge management process.

INSERT FIGURE 1. HERE.

Figure 1. The knowledge management process (adapted from Alavi and Leidner (2001)).

Of itself learning does not guarantee benefit. Indeed, it is useful to note that learning may not be intended or conscious. In addition, people can incorrectly learn, and learn that which is incorrect, and new findings can overturn old 'truths' (Huber, 1991). So the initial stage of identification of knowledge that is current, valuable and transferable is important. On an individual basis Kolb (1976) argues that we learn through a cycle including stages of concrete experience and an ability to reflect and conceptualise from that experience in order to develop better ways of doing things. However, without reflection this learning may not happen consciously, and for this reason this stage of the model is labelled "knowledge in action" to encompass that which we come to know in our (work-) life through our daily organizational tasks and events (Nonaka, von Krogh, & Voelpel, 2006). However, awareness of the existence of knowledge that is potentially useful to the organization is an essential part of this process, as without this, the process will progress no further. Identification of knowledge is not always straightforward however, as Huber comments, "organizations often do not know what they know" (Huber, 1991: 100) and in the case of projects or programmes "proprietary and political concerns tend to inhibit dissemination of any but positive findings" (Huber, 1991: 92). Further arguments suggest that a combination of cost and benefit associated with the situation creates a form of inertia threshold which needs to be exceeded before search for alternative knowledge is initiated (Borgatti & Cross, 2003). It is therefore suggested that in order to

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trigger the process to move from the first stage to the second, it is necessary to have a proactive procedure in place to seek and identify knowledge that has potential use for the organization.

The second stage of the knowledge management process is that of knowledge capture and storage. This stage is important for any effective organizational knowledge management system and in broader terms is sometimes referred to as organizational memory ((Huber, 1991) It can include knowledge stored in written form, electronic databases, expert systems or in the tacit knowledge acquired by individuals (Alavi & Leidner, 2001). The most significant difficulty at this stage is the need to convert knowledge into a form suitable for storage, or, if it resides within one or more individuals, the matching of knowledge to its source within an appropriate directory.

While explicit knowledge is relatively easy to store in electronic or other physical form Nonaka (1994) suggests that there are four forms of knowledge creation through knowledge conversion, some easier than others to accomplish, and subsequently allow storage. But in effect the storage is still of the two forms, explicit or tacit knowledge. Alavi and Leidner (2001) suggest that while information technology does not have to be a part of knowledge management systems, nonetheless it can contribute usefully as an enabler in many ways, providing a single, central source of explicit knowledge as well as a directory to more tacit forms of knowledge. It also ameliorates the human tendency to forget, or lose track of knowledge.

However, as with the identification of useful organizational knowledge, sometimes knowledge capture can be problematic. Huber suggests that, "feedback of the results of organizational action is often distorted or suppressed" (Huber, 1991: 95) and Feldman adds, "in many organizations the evidence needed to learn from experience may be deliberately ignored (or hidden)" (Feldman, 1986: 284).

Stage three of the knowledge management process focuses on the ease of retrieval; in other words, access to necessary or useful knowledge. This can include advanced computer storage technology, sophisticated retrieval techniques and multi-media databases (Alavi & Leidner, 2001). It can also include corporate directories mapping areas of tacit knowledge or expertise that is difficult to convert or codify. The degree to which knowledge is perceived as accessible is a significant predictor of the use of knowledge sources

(O'Reilly, 1982). Accessibility includes the cost in terms of time and effort as well as having physical access to the knowledge. So, for example knowing that the knowledge exists, where it is located, and what time and effort is involved in extracting it, all increase the likelihood of use.

The degree of "tacitness" (Galunic & Rodan, 1998) is a significant barrier to effective knowledge management as generally the higher the "tacitness" the more difficult it is to codify or transform into explicit knowledge (Winter, 1987). McCall et al. (2008: 78) suggest that Knowledge Management Systems (KMS) "focus on bringing together the explicit knowledge that exists in organizations, the "know-what" that is easily shared ... such as basic definitional information, procedures for performing tasks, and previous problem resolution examples". More complex tacit knowledge is added to the Knowledge Management System as it matures, although often using different methods of storage, or access (e.g. 'signposting' experts who may be available for coaching, mentoring or workshops as a more effective method of knowledge transfer). This form of access to tacit knowledge brings with it the attendant need for appropriate reward systems, including allowing time, or space for the knowledge owners to transfer their knowledge through what Nonaka (1994) refers to as socialization.

Stage 4. in Figure 1. refers to the absorption of the knowledge in order that it may then be reused (and potentially create new knowledge through adaptation to differing contexts) in "knowledge-in-action". Others describe this stage of the process as internalization (Cummings & Bing-Sheng, 2006), "application" (Alavi & Leidner, 2001), or the ability to convert and use others' knowledge and experience in a local context (Huber, 1991). If absorption is viewed from a learning perspective Bloom's taxonomy of learning objectives can be usefully employed in this context (Bloom, 1956). They describe advancing maturity of learning, developing from basic memory of factual information, through comprehension; the ability to apply the knowledge in different contexts; analytical ability; the ability to synthesise and finally critique that which is learnt. Especially for tacit or complex knowledge, organizations are likely to value the higher order of learning described by Bloom. However, in terms of transferring knowledge it is more difficult to achieve these higher levels. Szulanski and Cappetta (2003) highlight a temporal issue, in that

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early use of new knowledge may well be ineffective (Galbraith, 1990), only improving over time, and with possible external assistance. Argyris and Schon (1974) argue that learning is enacted through the detection and correction of error. If the error correction fits with our view of the world what they call "single loop learning" occurs. This is made more complex if the error contradicts our underlying beliefs and view of the world, and the correction required is to those beliefs, what Argyris and Schon call "double loop learning". This view is extended further by Yanow (2009) who argues that what she calls 'passionate humility' is an important requirement in knowledge transfer, in that people must accept that they could be wrong, or mistaken, or deficient in their knowledge before they will seek or embrace others' knowledge. Yanow argues that in professional (including administrative) practice there is a predominant "language of certainty", that is, a conviction that one is self evidently right, through common sense, logic and rational thought. What she believes is required is a move to more reflective practice through a "language of inquiry", challenging one's own perspective, and adopting a more empathetic, or "emotionally intelligent" perspective (Goleman, 1998).

Barriers to Effective Knowledge Management

Despite a significant depth of knowledge management literature, and the closely related area of organizational learning adding to that depth, there is still a weakness in the practical application of the existing theory, in terms of implementing an effective knowledge management process. The concept of knowledge management is often oversimplified, with reference made to the use of knowledge management systems as if their implementation is sufficient for effective use. However, some of the factors already discussed have given a flavour for the degree of difficulty and complexity in getting such programmes to work. More explicitly, some of the main barriers to effective knowledge management implementation are summarized below under five main headings:

1 **Innate knowledge attributes**.

The early dichotomy of explicit or tacit knowledge (Polanyi, 1966) has given way to more of a continuum, and "degrees of tacitness" (Cummings & Bing-Sheng, 2006; Galunic & Rodan, 1998)

including how much the knowledge is contextualised, and the degree to which the knowledge is dispersed, or concentrated in one person. The "tacitness" or "causal ambiguity" of knowledge is a well recognized barrier to its transfer (Polanyi, 1966; Zander & Kogut, 1995). In addition, Carlile (2004) identified three boundaries that limited the transfer of knowledge: 1.Syntactic boundaries require only knowledge transfer on the expectation that all parties understand the knowledge transferred; 2. Semantic boundaries also require translation of the knowledge, as it may not be universally understood; 3. Pragmatic boundaries require knowledge transformation, in that the new users may have different interests or objectives and the knowledge needs to be matched to its new context. This is important in that, depending on the degree of complexity of the knowledge in question and the receptiveness of the transferee, there needs to be a match between 'donor' and receiver in terms of language used, the ability and experience of the receiver, and the generalisability or transferability of the knowledge to a new setting (e.g. a different culture) (Szulanski & Cappetta, 2003).

2   Limitations of the knowledge source.

The credibility of the knowledge, or its source, or the motivation or capability of the source to share knowledge (Cummings & Bing-Sheng, 2006) can impede the identification, storage or transfer of knowledge (Huber, 1991; Walton, 1975). Morris & Oldroyd (2009) describe an increase in interest and absorption though better profiling of the contributors and giving users the ability to value or rate the contributions. Szulanski & Cappetta (2003) identify the barrier of when the source is not perceived as trustworthy, and Alavi & Leidner (2001) also question the perceived credibility of knowledge where the source is not known. Ultimately, however it is likely that there needs to be some voluntary act to share knowledge from the 'donor', and for tacit knowledge in particular this is likely to involve some social interaction (Reid, Baloh, & Desouza, 2010). This, and other difficulties in knowledge transfer are sometimes referred to as knowledge "stickiness" (Szulanski & Cappetta, 2003)

3   Knowledge receiver limitations.

There are similar limitations but from the knowledge receiver perspective, including the motivation and capacity to learn (Cummings & Bing-Sheng, 2006). The concept of absorptive capacity (Cohen & Levinthal, 1990) views knowledge at both the organizational and the individual level and argues that absorptive capacity is influenced by the existing knowledge base.

> *a recipient that lacks absorptive capacity will be less likely to recognise the value of new knowledge, less likely to recreate that knowledge, and less likely to apply it successfully* (Szulanski & Cappetta, 2003: 524).

Some organizational cultures encourage competition which can work against co-operation and the motivation to share knowledge. Also organizational politics, structure and leadership can impede communication and thence knowledge transfer (Antal, Lenhardt, & Rosenbrock, 2001).

These identified barriers lead to the following conceptual model, reflecting the key factors influencing the management of project knowledge.

INSERT FIGURE 2. HERE.

Figure 2. Model of factors influencing the effective management of project knowledge

Methodology

The research question driving this research is: how can UK Government sponsored projects develop an effective method of managing project knowledge? How can they move from knowledge identification, through knowledge transfer and conversion processes to knowledge storage, retrieval, and ultimately to knowledge absorption, utilisation and potentially adaptation, and thus, when appropriate create new knowledge?

A review and synthesis of the related literature led to the development of an adapted version of Alavi & Leidner's (2001) model illustrating the knowledge management cycle (Figure 1 above). Identification of key barriers or impediments to this process allowed the development of a conceptual model to aid understanding and to guide the next stage of this research.

The factors identified in the literature review, and in the conceptual model were used as the basis of a short web based survey as a preliminary assessment of their appropriateness and credibility. Purposive, convenience sampling was used, firstly through professional body websites such as the Chartered Institute for IT special interest group for project management, and the Association for Project Management. 25 responses were received and the analysis is shown below. Although the number of responses is low, the purpose of the survey is not to provide any statistical generalization, merely as exploratory research to guide further work in this area. Also, the purposive nature of the sampling reflected the importance of gaining senior, and experienced project managers as respondents. For example there was an average project management experience of 15 years, and an average previous project budget of £52 million (excluding one respondent whose budget was over £400 million). A summary of responses to key questions included in the questionnaire are shown in Appendix 1.

Using an abductive research approach, 16 in depth semi-structured interviews with experienced project and programme managers in the UK public sector were used to refine the conceptual model further, explore any unusual or unexpected responses in the survey, and establish the importance of the research and the difficulties currently faced. Respondents were chosen using purposive homogenous sampling and include project managers and consultants with significant experience of multiple large government sponsored projects. Interview questions focused around the key themes identified in the conceptual model and the barriers to implementation of an effective knowledge management process, and including the 'lessons learned' process within PRINCE2.

Preliminary Results

The survey showed respondents unanimously felt that there were useful lessons to be learned from previous projects, supporting the importance of effectively managing project knowledge. 52% felt that public sector projects attempted to learn from past mistakes and successes. However, only 20% of respondents felt that the lessons learned process was effective, and only 20% believed that the lessons learned reports were collated, analysed or summarised for more strategic analysis.

The respondents were asked "if the process for learning from previous project mistakes and successes was NOT effective, this was because…?", and their responses are illustrated below in Figure 3.

INSERT FIGURE 3. HERE.

Figure 3. Perception of the reasons for an ineffective project knowledge learning process

Early analysis of the survey and interviews suggests that: there is at best, a limited application of the principles of 'lessons learned' reporting as an integral part of the PRINCE2 project management methodology; but more importantly there are significant barriers to effective knowledge management in the context of government sponsored IS projects.

Conclusions

There is almost unanimous agreement that there are lessons of value to both experienced and inexperienced project staff and stakeholders that are gained throughout the project process. One limitation of the PRINCE2 approach appears to be, that the lessons learned reporting is a classic attempt to identify, store and make available, tacit knowledge, but paradoxically using what might be called a traditional explicit 'knowledge management system'. In addition this is often seen either as an administrative 'chore' to be completed with the minimum effort; or it may be delegated to one person who may, or may not actively explore the learning achieved from multiple perspectives.

This research has highlighted the complexities and difficulty in implementing the knowledge management process. In specific relation to the management of project knowledge, an often overlooked issue is the transient nature of projects, especially large, complex or multi-stage projects. Projects, or project management may be outsourced; project teams may be assembled and retain a coherent identity, or may loosely coalesce around a defined organizational unit; yet again they may be drafted into, and released from, the project team for varying amounts of time depending on their technical, commercial or managerial contribution. This creates difficulties in who can learn what, from whom, when. And this means that managing project knowledge is perhaps more complex than other forms of organizational learning, perhaps requiring a view of projects where "learning and knowledge are paramount"(Reich et

al., 2008). Barriers to managing project knowledge have been linked to the knowledge management process through the conceptual model which aims to improve understanding of this area.

Why do we not learn from project failures? "We rarely try" argue Abdel-Hamid and Madnick (1990), reinforcing Feldman's claim (above) that people tend to hide mistakes. They propose that learning from successful projects is no less problematical, in that there is no desire to look for problems unless someone is dissatisfied. This echoes earlier comments (above) by Borgatti and Cross (2003). In the first instance there appears to be a positive motivational force to cover up mistakes, and a lack of motivational force to learn from success even at the first stage of identification of knowledge.

However, retrospectively identifying either good practice to be embraced, errors to be avoided, or solutions to known problems is insufficient as a means of changing the way that an organization manages its 'knowledge in action', or how it applies or develops knowledge in practice. It can be argued that for very specialized, complex or high value knowledge (such as is often found in project management) transfer of knowledge on a smaller scale, using rich communication media including one to one communication, coaching or mentoring, may be an effective, and indeed cost effective solution. It may be that lessons learned reports may be better used in a much more limited context in terms of knowledge complexity. The literature described earlier in this paper suggests that the form of knowledge management process that is appropriate will vary depending on the level of complexity of the knowledge being transferred. Therefore simple forms of "knowledge" or "lessons" are easier to transfer through conversion into explicit knowledge (for example, lessons learned reports) than more complex synthesized or integrated knowledge (Grant, 1996).

Future Research

Much of the analysis of the interviews still remains to be completed in this research. However important issues and inconsistencies of practice have been identified. This suggests benefit from future research which should test the identified influences on managing project knowledge and attempt to focus on 'high value knowledge, and appropriate methods of managing such knowledge.

Authors	Contribution	Conceptual Framework Elements
Alavi and Leidner (2001)	Knowledge cycle: knowledge creation, storage/ retrieval, transfer, application	Context
Galunic & Rodin (1998) Winter (1987) Zander & Kogut (1995)	Degree of 'tacitness' Causal ambiguity	Degree of knowledge complexity
Huber (1991) Feldman (1986)	Knowledge distortion or suppression Proprietary or political inhibitors to dissemination	Knowledge donor's willingness to share
Borgatti & Cross (2003) Yanow (2009) Carlile (20040	Cost/ benefit in search for knowledge Willingness to learn Pragmatic boundaries	Knowledge recipient's willingness to learn
O'Reilly (1982) Bloom (1956) Carlile (2004) Szulanski & Cappetta (2003)	Ability to access knowledge Ability to learn Syntactic boundaries; pragmatic boundaries Knowledge 'stickiness'	Knowledge recipient's ability to learn
Carlile (2004) Szulanski & Cappetta (2003) Antal et al., (2001) Morris & Oldroyd (2009)	Semantic boundaries Organizational politics, structure and leadership	Knowledge donor's ability to create understanding or transfer knowledge

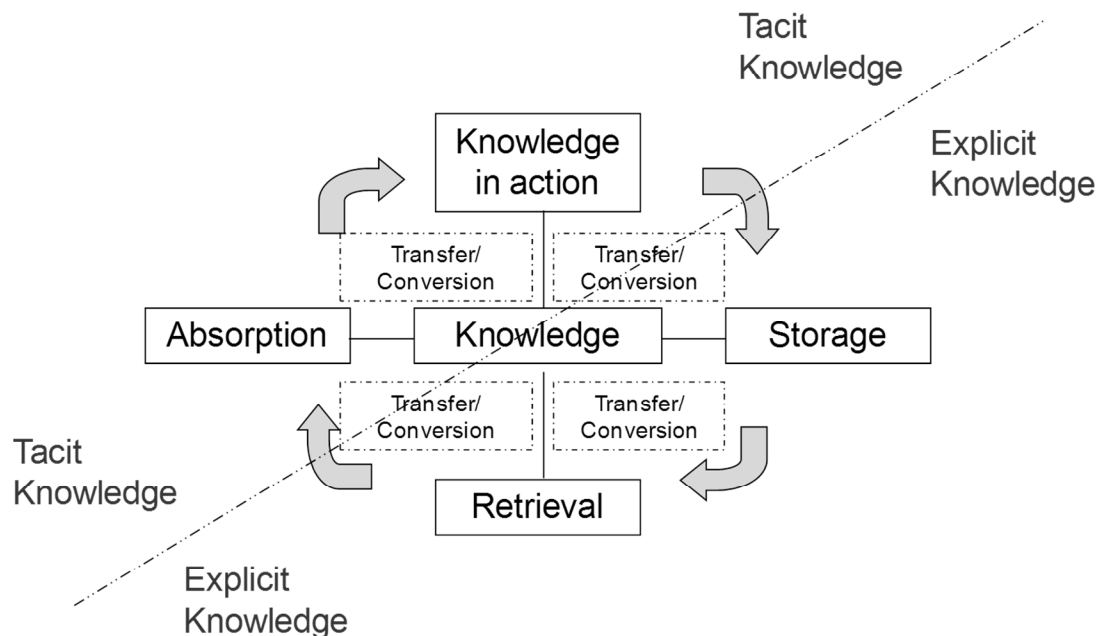**Table 1.   Literature supporting conceptual framework of barriers to knowledge management**

Figure 1. The knowledge management process (adapted from Alavi & Leidner (2001)
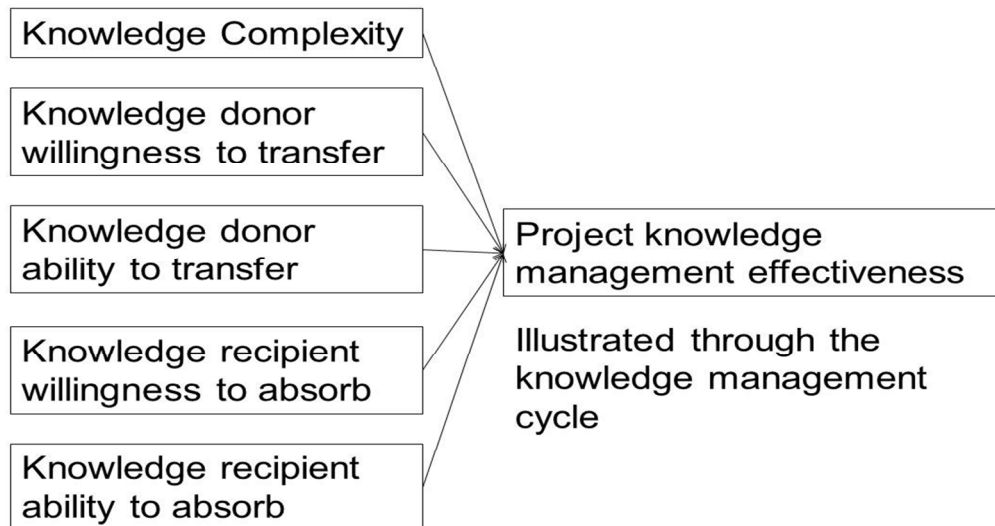
Conceptual Model

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Knowledge Complexity

Knowledge donor
willingness to transfer

Knowledge donor
ability to transfer                    Project knowledge
                                       management effectiveness

Knowledge recipient                    Illustrated through the
willingness to absorb                  knowledge management
                                       cycle

Knowledge recipient
ability to absorb
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Figure 2. Model of factors influencing the effective management of project knowledge
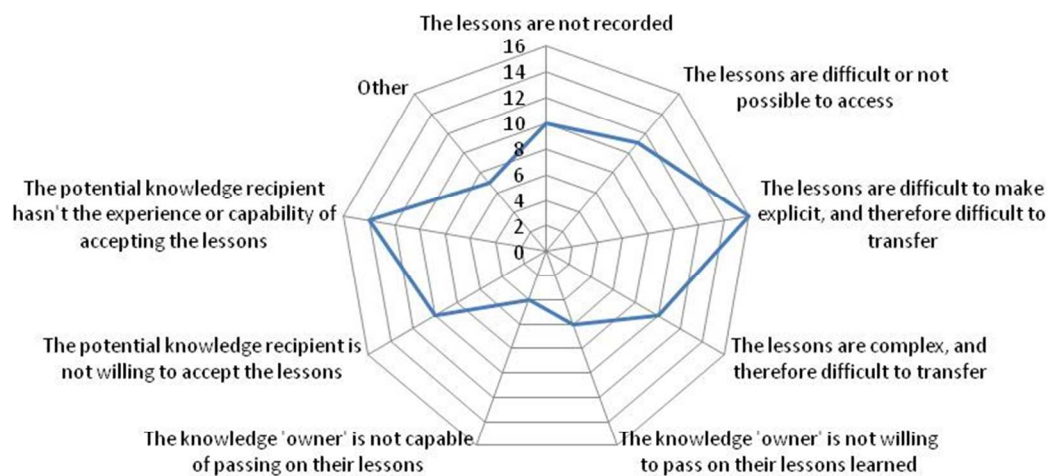

Figure 3. Perception of the reasons for an ineffective project knowledge learning process

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Knowledge and the speed of the transfer and imitation of organizational
capabilities. Organizational Science, 6(1), 76.

Appendix 1.   Summary of Responses to Key Questions from On-line Survey

Question	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree
In your experience there are useful lessons to learn from previous projects	18	7	0	0	0
In your experience public sector projects attempt to learn from previous project mistakes and successes	3	10	2	9	1
Lessons Learned reports are easy to retrieve	1	8	4	10	2
I feel that the lessons learned process is effective	5	0	6	11	3
The actual process for learning from previous project mistakes and successes in this organisation is effective	3	0	4	16	2
	Yes		No		Don't Know
Are lessons learned reports, or any other knowledge recording methods collated, analysed or summarised for more strategic trend analysis	5		13		7

Question	No.
If the process for learning from previous project mistakes and successes in this organization is NOT effective, this is because	
The lessons are not recorded	**10**
The lessons are difficult or not possible to access	**11**
The lessons are difficult to make explicit, and therefore difficult to transfer	**16**
The lessons are complex, and therefore difficult to transfer	**10**
The knowledge 'owner' is not willing to pass on their lessons learned	**6**
The knowledge 'owner' is not capable of passing on their lessons	**4**
The potential knowledge recipient is not willing to accept the lessons	**10**
The potential knowledge recipient hasn't the experience or capability of accepting the lessons	**14**
Other	**7**