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Carmel Joe

Pak Yoong

Brian Harmer

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Joe, Carmel, Victoria University of Wellington, Rutherford House, 23 Lambton Quay, Wellington 6140, New Zealand, carmel.joe@vuw.ac.nz

Yoong, Pak, Victoria University of Wellington, Rutherford House, 23 Lambton Quay, Wellington 6140, New Zealand, pak.yoong@vuw.ac.nz corresponding author

Harmer, Brian, Victoria University of Wellington, Rutherford House, 23 Lambton Quay, Wellington 6140, New Zealand, brian.harmer@vuw.ac.nz

Abstract

All too often, valuable knowledge is lost from organisations when experts leave — both the experts and their expertise represent valuable assets (Huber, 1999). When older experts leave the workforce, they take with them significant experience and critical knowledge essential to the smooth management of organisations (Hylko, 2005). Employers, however, are often unaware of who possesses expertise, or the nature of that expertise. The loss will be accentuated as members of the post-World War II baby boom cohort retire.

Approaches to recover or recreate knowledge after it is lost are not sustainable in terms of prudent knowledge management. Organisations need to develop a deeper understanding of where expertise resides and how it is retained. This paper, presenting a limited set of results from a larger study, addresses the knowledge retention processes of an individual expert providing technical advice on a New Zealand construction industry helpline, in a leading scientific research organisation. Within the organisation, a single expert who possessed much personally-held undocumented knowledge was identified. Through detailed observations and peer interviews, the researchers learned much about the elements of his expertise, problem-solving processes and knowledge retention behaviour.

Keywords: older experts, knowledge retention, knowledge loss, technical helpline.

1 Introduction

A phenomenon evident in New Zealand is the growing proportion of the workforce that is made up of older workers, reflecting the situation elsewhere in the developed western world. Many of these older workers are part of the post-World War II baby boom generation, born between 1945 and 1963. The oldest members of this cohort are approaching retirement, or are likely to reduce their working hours within the next decade. The New Zealand Department of Labour predicts that 25% of the workforce will be over 55 years of age by 2020 (New Zealand Department of Labour, 2009). The subsequent generation, however, is only about 75% of the size of New Zealand's baby boom cohort and the labour force rate of growth is predicted to slow after 2016.

All too often, the extent of organisations' actions to retain older workers' knowledge extends no further than an exit interview (Liebowitz, 2010; Patton, 2006), or attempts to recapture knowledge after they have left (Becerra-Fernandez & Sabherwal, 2005). Within the baby boom and preceding generation, there are some experts with valuable knowledge and experience that will be lost if organisations do not act to retain such assets. Thus, employers must adopt a sustainable approach to preserve knowledge, and address the threat of losing institutional knowledge in particular.

Knowledge retention begins with an awareness of the expertise of the older worker. This paper reviews literature on older experts, describes how an older expert was observed in the delivery of a vital service to the construction industry, and presents a discussion of the findings, in particular an integrated view of the business process and the expert's process for retaining knowledge.

2 Literature review

Organisations face issues such as the loss of knowledge, skills and personnel, for which they may not yet have effective approaches for addressing (Ham, 2009). Despite growing awareness of the ageing workforce, many employers lack policies or any sense of urgency (McPherson, 2008; Strack, Baier, & Fahlander, 2008). Where organisations regard knowledge as a valuable resource, the generation and transfer of knowledge is recognised as a significant organisational capability and a source of long-term competitive advantage. (Alavi & Leidner, 2001; Leonard & Swap, 2005). For the purposes of this paper, and as supported in the literature, older workers are defined as being over 55 years of age (New Zealand Department of Labour, 2009; McPherson, 2008).

2.1 Older experts' knowledge

Older experts can be resilient and adaptable workers, with much life experience to complement their expertise (Equal Employment Opportunities Trust, 2008). Older experts tend to have well-developed communication skills, knowledge, good work ethics and creativity (Equal Employment Opportunities Trust, 2008). When older experts leave the workforce, they can tend to leave skills gaps, taking with them significant experience and critical knowledge essential to the smooth management of organisations, affecting a range of industries (Hylko, 2006).

In addressing knowledge retention challenges, organisations are concerned with "how best to capture and leverage knowledge to create value as well as preserve the institutional knowledge base" (Liebowitz, 2010, p. 87). "Knowledge is fuzzy and closely linked to the people who hold it. Its categories and meanings change frequently…knowledge resists engineering" (Davenport, De Long, & Beers, 1998, p. 51). The literature on expertise does not provide precise definitions of the terms expert and expertise, hence definitions are implied from studies of experts, who have a role in creating, holding and disseminating knowledge (Huber, 1999).

A number of factors can be taken into account in distinguishing an expert. Scarcity of the knowledge resource is an important factor. If co-workers recognise an older individual as being the only expert in an important subject area, their expertise needs to be captured and available to others (Didierjean & Gobet, 2008). Experts handling rare but critical events, such as hurricanes and extensive power outages, are candidates for knowledge transfer (Hylko, 2005). Experts are able to learn from the past

and having a powerful recall of episodic memories (Didierjean & Gobet, 2008; Ericsson & Kintsch, 1995). The US Electrical Power Research Institute (EPRI)'s Strategic Human Performance Program analysed the types of valuable expertise to be captured from older experts, by defining the organisational risks of knowledge loss. Retaining and sharing such knowledge before experts leave organisations will prevent the necessity of re-inventing it after it has been lost.

The knowledge held by experts is different from that of novices, because of its "underlying schema, goal-orientation, practical focus, categorical chunking, cognitive complexity, automaticity of expert problem solving, and finally, the episodic nature of expert memory" (LaFrance, 1989, p. 6). The discipline of psychology regards expertise as a personal characteristic, existing at an individual level, and as a relative characteristic. An expert exists only in relation to a lay person: a client, co-worker or manager who needs and seeks their expertise (Huber, 1999). Expertise can be defined as the ability to perform with excellence in a specific area, involving intellectual and cognitive effort over a sustained period of time (Ericsson & Ward, 2007; Huber, 1999). An expert demonstrates higher levels of efficiency than a lay person, performing tasks with greater accuracy and effectiveness.

2.2 Sustainable knowledge

The concept of sustainability may be described as the ability for us to meet our needs without compromising the ability of future generations to meet their needs (Melville, 2010). Sustainability may be understood intuitively, and be difficult to describe in operational terms, but there are opportunities for technology management practices to address aspects of sustainability more directly (Brent & Pretorius, 2008; Melville, 2010). If organisations are able to use and manage ICT effectively to retain the knowledge of older experts, this enables them to maintain knowledge bases from which other colleagues can recall knowledge, rather than creating it from a zero base. Although knowledge seekers may not be reusing knowledge in the same way, since knowledge is situated and relational, they are able to recall and apply it to new and varied situations, combining, adapting and adding to existing knowledge (Bennet & Bennet, 2008). Knowledge becomes more sustainable as it goes through such cycles of reuse over time. This enables organisations to increase knowledge capacity, and enables experts to develop more robust and sustainable knowledge, allowing them to solve problems in a broader range of environments that may also be dynamic.

In reviewing how information and communication technology (ICT) is used to capture and provide access to the expertise of the older expert, we recognise the crucial role of ICT in facilitating a sustainable approach to knowledge retention. The importance of ICT lies with "its cross-functional view of the entire organisation and ability to understand, change, and reinvent business processes to better support sustainable practices" (Watson, Boudreau, & Chen, 2010, p. 23). Therefore, knowledge retention processes, supported by the use of ICT, provide positive benefits in terms of reducing the loss of an individual's unique expertise, as well as enhancing organisational knowledge stocks. For the purposes of this paper, we adopt a generalised definition of sustainable knowledge. In the context of knowledge management, we adapt Melville's (2010) concept such that the term *sustainable knowledge* refers to the goals and actions of strengthening the capability to meet an organisation's information and knowledge needs, enabling future employees to leverage such retained knowledge.

2.3 Subject matter expertise

Older experts hold types of knowledge, skills and insight that are in demand and of value to others. Experts are a powerful source of value creation within organisations and have "deep, specialised knowledge of a subject, who are tested, trained, especially by experience" (Huber, 1999). However, they may be difficult to identify, as there is a complex distribution of expertise throughout the modern organisation, and experts may not necessarily be labelled as such. Experts rely heavily on their skills and knowledge, rather than on capital assets, and are creative and proficient at solving unusual problems (Hylko, 2005). Kleimann (1996; cited in Huber 1999) distinguishes different types of expert knowledge. First, experts may have specialised and sought-after knowledge in a narrow field. Second, their knowledge can be rare and from an overview perspective, with proficiency in an

extensive subject area and the ability to form a synopsis of the entire field. Third, an expert operates at the edges of specialist subject areas, and thus has a breadth of general knowledge.

Studies with a practical basis recognise expertise as being tacit in nature, consisting of capabilities, knowledge and skills unique to individuals or a specific team, that may represent up to 80% of business critical knowledge, and be outside the scope of job documentation (EPRI, 2006; Lesser, 2006). Experts possess knowledge of longstanding, complex systems whose failure leads to negative economic, operational, safety consequences (Hylko, 2005; IBM Business Consulting Services, 2005).

Experts have an important role in organisations, where the knowledge base can be complex and distributed throughout the entity. The role of the expert includes making specialised knowledge available to executives for their decision-making processes, and being a conduit for making knowledge available to non-experts.

2.4 The tacit dimensions of expertise

Older experts' experience, intuition and their contextual awareness and knowledge of social networks is often tacit (Hylko, 2005; Jackson & Webster, 2007). The demands of an increasingly knowledge-based economy, coupled with high staff turnover, mean that organisations need to understand the expertise they possess and act urgently to retain it so they are better equipped to compete successfully in a more demanding environment (Becerra-Fernandez & Sabherwal, 2005).

The valuable knowledge and skills that experts possess include understanding mission-critical methods and procedures and the organisation's key tools, equipment and artefacts. Experts have knowledge and perceptions of key relationships with customers, suppliers and partners, and serve as connectors within the organisation, for facilitating the exchange of critical information. Sternberg (2003) perceives tacit knowledge to be part of practical intelligence, "the ability to solve everyday problems by utilising knowledge gained from experience in order to purposefully adapt to, shape and select environments" (p. 388).

The tacit nature of some expertise has implications for knowledge retention, as it is not readily retained but may be shared. Organisations need to capture undocumented business critical knowledge from older workers — various studies describe processes for achieving this (Hylko, 2005; IBM Business Consulting Services, 2005). Organisations therefore need to distinguish between the types of knowledge that can be captured and documented, and the tacit knowledge experts possess.

The theoretical necessity of studying knowledge retention arises from the loss of experts from organisations. Based on the literature review, there appears to be a gap in research in the area of knowledge loss when older experts depart organisations.

3 Methodology and data collection

The case research method was used in this study of the older expert. This was part of a larger, interpretive study, involving qualitative methods for explaining what happens in organisational contexts, in this case an industry technical helpline that had not previously been studied and for which there was little documentation. First, an interpretive perspective was adopted, as the study involved observing behaviour. Second, the study included observing how knowledge was retained from an older expert — focusing on his behaviour and processes. None of these aspects could be viewed in isolation from the characteristics of his setting within the organisation, industry and political situation. Third, we believed that a better understanding of the actors and the organisation would build a greater sense of ownership of the study findings (Cunningham, 2008).

The case research method is relevant for studying a contemporary setting, where researchers do not need control of study subjects, and where there is no established theoretical base (Benbasat, Goldstein, & Mead, 1987; Yin, 1989). Case research method is also useful for understanding a phenomenon, in this instance a person and process. It can also be used for producing detailed descriptions, developing possible explanations, and for evaluating the phenomenon (Leedy, 1997).

The use of direct observation and interviewing to gather data make the case research method suitable for organisational studies, especially when "how" or "why" questions are posed (Yin, 1989).

Before studying the older expert, we had already completed an initial step of interviewing a cross-section of managers and senior scientists, and analysing data to discover the organisation's concepts of valuable knowledge. These fall outside the scope of this paper. This analysis, however, provided a more holistic view the organisation as a system, enabled management to identify an older expert for study, and provided a context for our detailed observations and data collection. Next, the observations of the older expert were carried out as a diagnostic activity. The objective was to observe the expert in action, to discover his problem-solving processes, categorise the main types of telephone calls he handled, and to learn how he used ICT to support these processes to record and share knowledge.

Several methods of data collection were used. First, the previous analysis of valuable knowledge provided some clues from the expert's colleagues as to his areas of expertise. Second, as the expert's sole charge position indicated a heavy reliance on personal knowledge, much data was gathered while observing him over a period of several weeks. We directly observed the actions, approaches, processes and principles he applied in problem-solving. His interaction with callers yielded much data on the depth and breadth of his knowledge. Third, we also had access to a searchable store of the digital recordings of calls. This meant we could analyse particular types of calls, such as complex or unusual ones, or those demonstrating an aspect of his skill set.

The observations, which were the first source of data, focused on the steps involved in answering telephone inquiries and on the retention of knowledge, using ICT in the helpline business process. ICT included the customer relationship management system, databases, and intranet and internet web sites. The subject of the observations was the technical adviser who operated the helpline. At times he liaised with other experts to deliver advice and solve problems — we observed their interactions and noted how their roles and responsibilities interfaced. The researcher role was as an observer, without participation in the study (Bogdan & Biklen, 1992).

The second source of data was from two series of interviews with scientific and technical staff who provided some of the expertise to answer complex inquiries, and with a selection of industry callers who were regular users of the helpline. Data from these interviews were valuable for triangulating the results of the study. The third source of data was documents — organisational records such as diagrams, plans, discussion papers, presentations and electronic mail messages. Finally, digital call recordings and the researcher's observations were analysed.

4 Findings and discussion

The helpline is both a business process and a service that answers queries and provides information enabling callers to make decisions or locate relevant agencies (Cowan & Haslam, 2008; Resnick, Ugaz, Burford, & Carrigan, 2008). Typical users of the advisory service are construction industry practitioners, and members of the public to a lesser extent. The service delivers valuable and authoritative practical advice to the industry. It is a short inquiry service that it is not documented in much detail, and was operated largely by an older expert.

An expert's vast knowledge base and the ability to access it may be significant factors in the nature of expertise. However, it is unclear whether an expert would retain his knowledge to make it sustainable for future use, once the immediate problem is solved. Both the organisation and its customers regard him as unique, due to the specific combination of skills and temperament, which are important attributes for providing information to different types of callers (Ransom, et al., 2006). An industry peer noted that "a lot of contact he has with lay people is when they're in a highly stressed situation, like our customers are when they're going through a claim process. They've usually got a very technical problem they're trying to resolve, that they don't understand … a lot of what they hear, they don't like, so it's important when you've got a person like (the technical adviser) who can put himself in the homeowner's shoes, … getting a good understanding of where they stand."

In analysing over 200 records of calls and 50 transcripts as well as the researcher's journal, we were able initially to classify distinct call actions and a high level resolution process for all the calls. At the

highest level, the activities of the helpline involve listening to requests or problems and either providing suggestions and solutions, or directing the inquirer to an appropriate party if the query falls outside the adviser's knowledge domain. This high level process, together with some typical detailed actions that occur at each step, is depicted in Figure 1.

The high level process involves problem diagnosis and resolution. First, the adviser determines whether the inquiry falls within the scope of the service, then asks "discovery questions" (Ransom, et al., 2006, p. 15) to understand the issues. Good listening skills are critical from the beginning of the call, in order to determine the nature of the problem (Emmison & Danby, 2007). Second, he decides what resources he needs to solve the problem — references exist as paper or electronic documents, and he can ask technical experts for help. Third, he formulates the advice and there are a variety of responses depending on the type of inquiry. The adviser may give assistance in the form of information (e.g. documents and verbal advice), explanations, directions or referral to another person or organisation. The final steps are to close the call after checking that the caller understands what to do next, update the knowledge base with relevant new information, and create a record of the call.

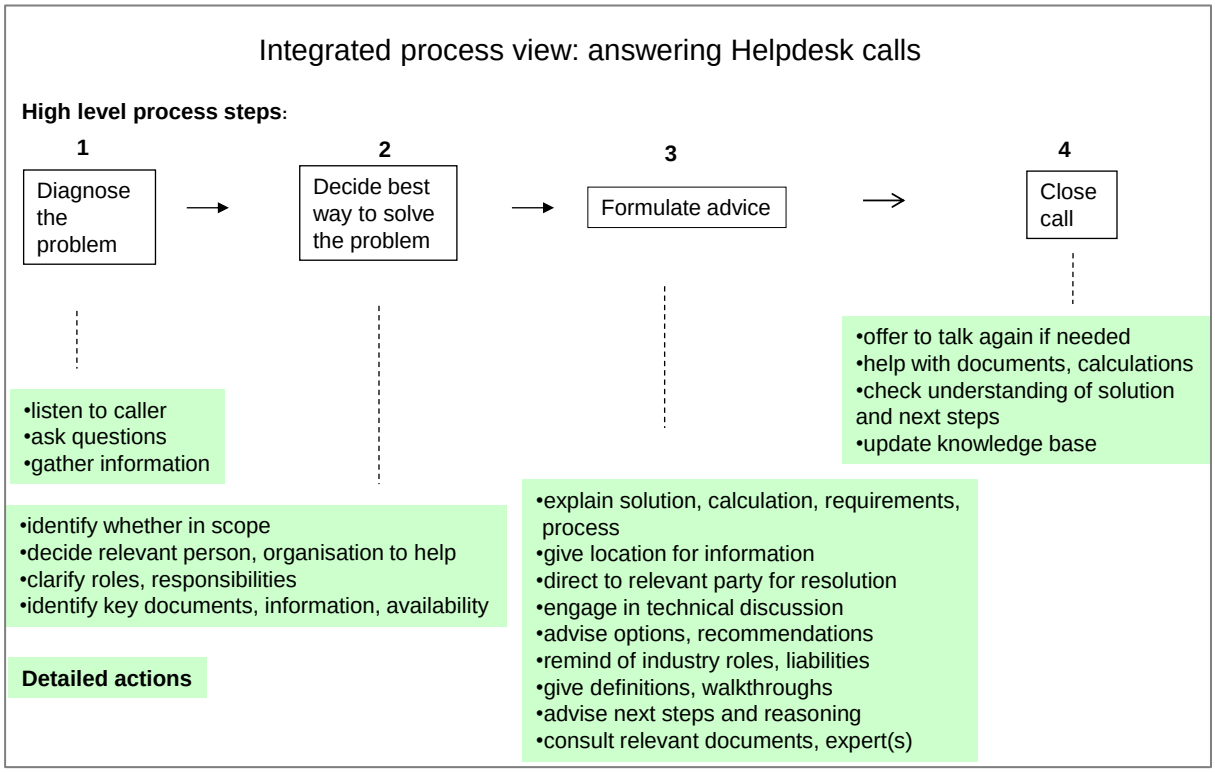

Figure 1 : High level helpline process

4.1 Lower level helpline actions

The helpline process steps depend upon the type of problem or query received. For example, similar steps were found as described at KPN Telecom's security and integrity helpdesk (Kaptein, 2002). The first step, *intake*, involves discussion, understanding the problem and explaining how to resolve it. The second step of *registration* involves recording call details in the system. In the third step of *referral*, the right officer to act upon the request is identified (Cowan & Haslam, 2008). In the final step, *follow-up*, the helpdesk operator subsequently telephones the caller to confirm that he or she has made contact with the appropriate officer.

The helpline calls we studied were resolved via six types of actions, as shown in Table 1.

	Action	Process steps identified
1	Seeking and using formal documentation	• listen, question, understand nature of the problem • decide best way to solve the problem • form clear answer; explain solution, calculation • explain how to locate authoritative documents • offer further help if required and close the call
2	Managing scope and signposting	• listen to caller to understand problem • decide correct person / organisation to assist • direct caller to appropriate party for resolution
3	Providing detailed technical and practical assistance	• decide caller's background, level of knowledge • discuss technical questions and options • reiterate industry roles and responsibilities • direct caller to relevant information
4	Providing technical assistance with documents and requirements	• set scope for providing facts and advice • identify relevant documents, relationships • provide technical information, definitions, processes • provide signposting any subsequent advice
5	Advising on compliance, responsibility and reliability	• listen, gather information, understand the parties • pinpoint source(s) of the problem • clarify roles, responsibilities and liabilities • advise actions and explain reasoning
6	Remedying pre-existing faults and failures	• listen and question the caller, diagnose problem • diagnose the fault / failure, identify likely causes • consult Code / Standard for action, consult experts • advise actions for remedying the fault or failure

Table 1: Lower level helpline actions and process steps

Detailed call analysis logic diagrams were constructed for each action, as shown in Figure 2.

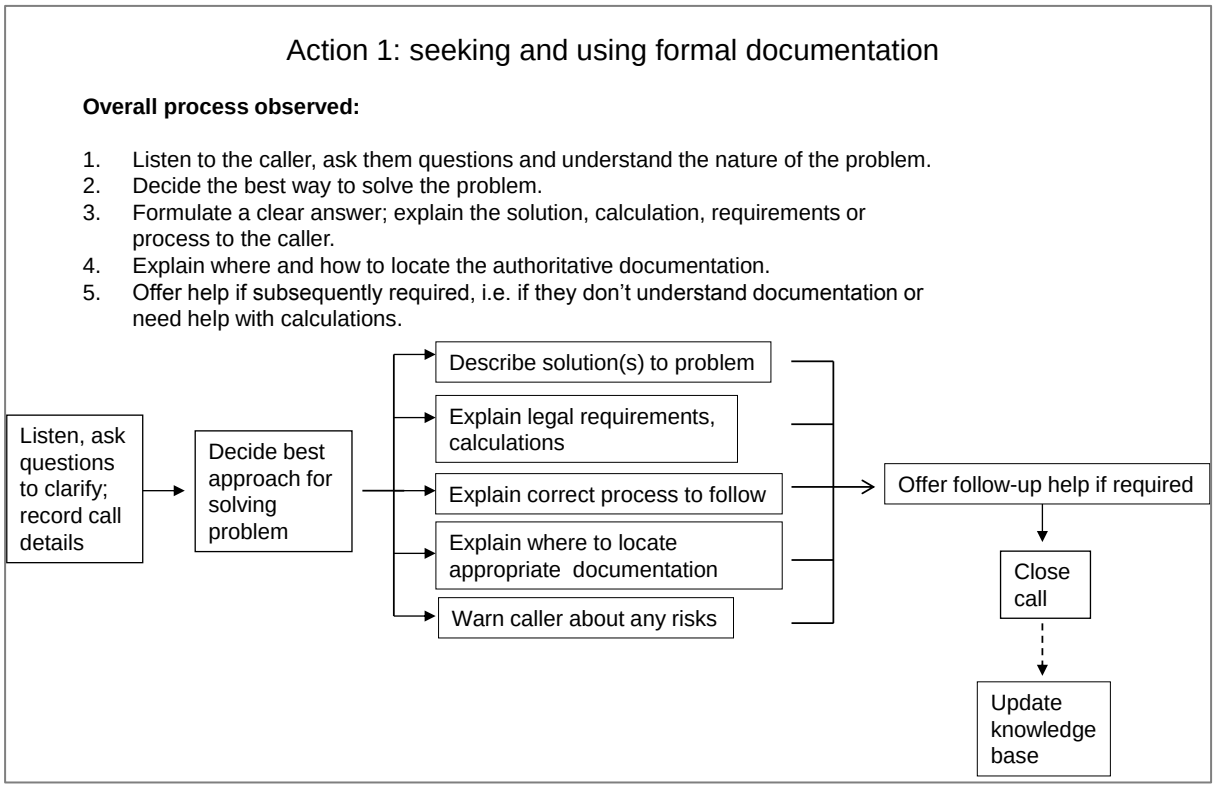

Figure 2: Call analysis logic diagram: seeking and using formal documentation

4.2 Retaining knowledge using ICT

We describe the role of ICT in the helpline function in retaining knowledge, by taking several examples identified while observing the technical adviser. Each example is an instance of creating sustainable knowledge. We found a typical pattern where the adviser is using ICT, first, to access existing stored knowledge; second, to refresh or extend existing knowledge; and third, to capture and retain new knowledge gleaned from the external environment through interactions with callers. Each example of knowledge retention in Table 2 shows how knowledge is retained, e.g. for dissemination or input to consultative processes with other experts.

Description and purpose of knowledge retention	Role of technical adviser	Use of ICT in retaining knowledge
Example 1: Stop ends to window head flashings Capturing new, innovative knowledge on construction method for weather proof window cavity	**Knowledge creator** in the sense that he identified knowledge that was new to the organisation	• drawings provided by caller are retained in a repository • call record created • future intention to publish article electronically
Example 2: Ensuring compliance of architectural roof design Retaining knowledge about a current technique as input to a revision of a building standard	**Knowledge facilitator** in ensuring that knowledge was provided for use in an important industry process	• drawings retained in repository for standards-related information • subsequent inclusion in revised standard • details of caller noted in call record for future liaison
Example 2: Capturing / publishing H1 (insulation) knowledge Integrating and widely disseminating new knowledge about requirements and compliance in relation to a newly implemented section of the Building Code	**Knowledge disseminator** in making new knowledge widely available. Facilitator of business process improvement, so callers can be informed before using the helpline	• supporting information on H1, including calculations, formalised and published, web site url publicised • subsequently, web pages updated • provision of calculation software on web site
Example 3: Formalising new knowledge on insulation Retaining new knowledge in a replicable format so members of the public can make informed decisions on insulation product types	**Knowledge co-ordinator** in liaising with technical staff to formulate document to ensure consistency of advice	• checklist is drafted, formalised and reviewed before being retained in the helpline repository • refer to checklist in future calls
Example 5: Call planning Use software innovatively to organise a call, ensure caller gets full information and capture specific advice given	**Knowledge co-ordinator** in organising knowledge to make the call process more efficient	• call management system updated with call details • add topics for discussion during call • use call record including topics to complete call
Example 6: Linking digital recordings to call record Group related information so that it is easily retrieved in future, and enable knowledge sharing with experts	**Knowledge facilitator** and **disseminator** in providing useable knowledge to others	• implement hardware and software for digital recording • open call record and link recording • nclude flag on call summary screen to show related digital recording

Table 2: Examples of using ICT for knowledge retention on the helpline

We identified that, in the course of retaining knowledge, the technical adviser undertook many activities that represent the creation of sustainable knowledge. Some examples include using ICT to capture new knowledge from external sources, co-ordinating the creation of knowledge artefacts for electronic publication, integrating newly developed knowledge in a useable format to use on the helpline, developing and recording more efficient ways of working, and grouping related electronic sources. In summary, the technical adviser addressed his usual role of operating the helpline, but also acted upon opportunities to create sustainable knowledge. In so doing, he adopted a number of roles, which we identified as knowledge creator, facilitator, co-ordinator and disseminator.

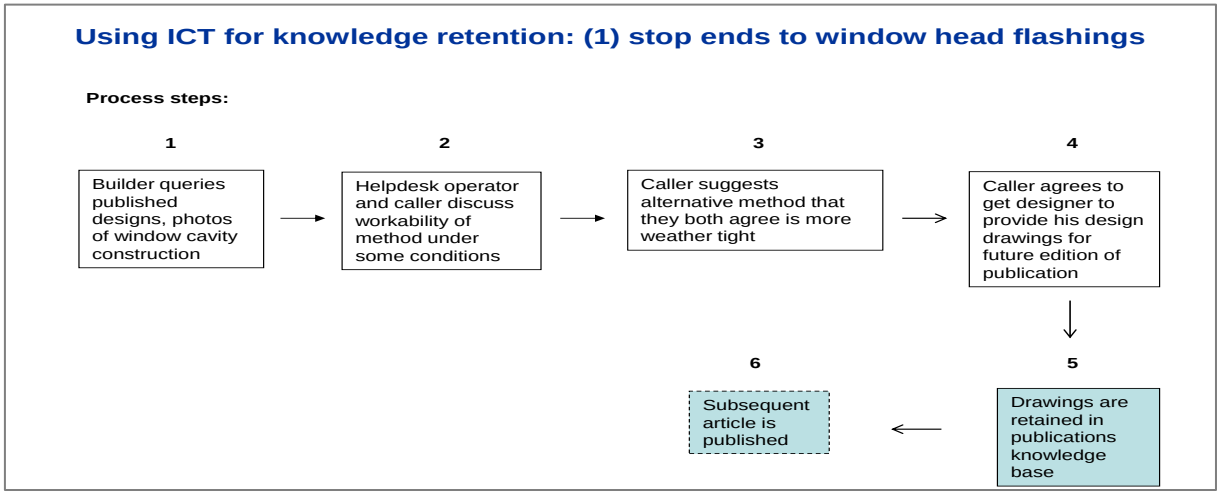

Figure 3: Capturing and sharing new knowledge

The knowledge retention process was mapped for each example. The first example, Figure 3, shows how ICT was used in knowledge construction. In the whole knowledge retention process, each step contributes to the dissemination of new knowledge. Step 1 triggers the retention opportunity, then during steps 2 and 3, the technical adviser realises the call content is of interest beyond the immediate discussion. Step 4 involves the technical adviser acquiring new knowledge, which is then temporarily stored at step 5. Finally a new knowledge artefact is created and disseminated at step 6.

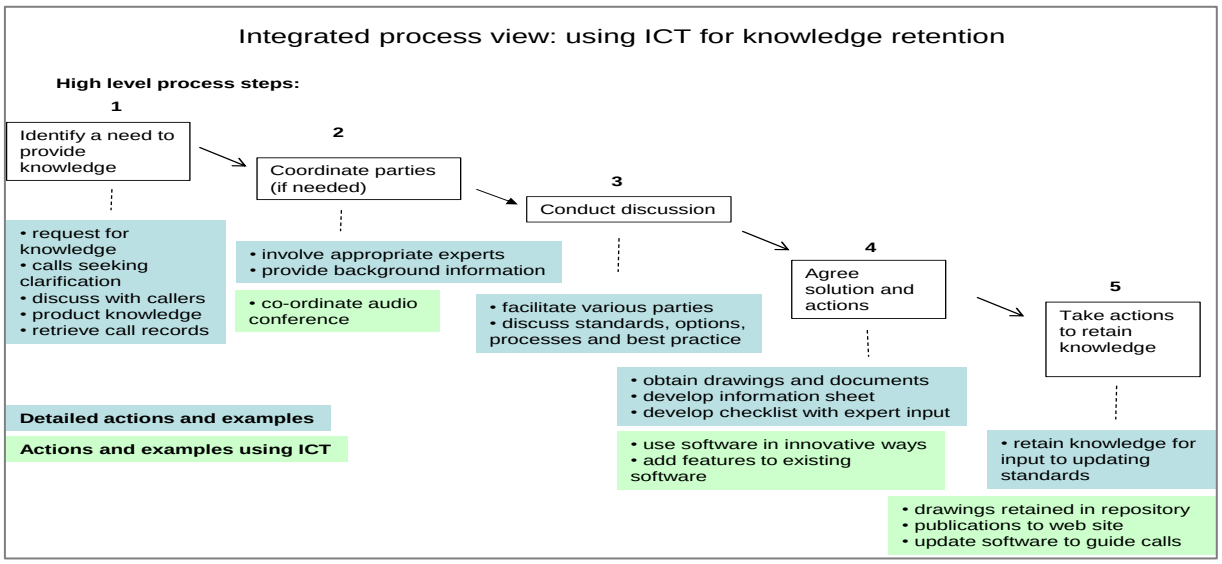

Figure 4: Integrated process view: using ICT for knowledge retention

The six examples may be summarised to a high level knowledge retention process, shown in Figure 4.

First, the adviser identifies a need to provide knowledge. His experience enables him to quickly decide how to provide knowledge, e.g. provide information, clarify details, or discuss a specific topic or type of product. These actions often involve the use of ICT. Second, he may need to co-ordinate other experts to assemble the information he needs. Generally, the third step involves discussing the problem and sharing knowledge. Fourth, he advises on a solution to the problem and agreement on actions each party will take, both to solve the problem and to retain knowledge. Fifth, after the call is closed, the adviser acts to retain the relevant knowledge from the call.

5 Conclusion

5.1 Limitations and applicability of the study

A limitation of the study is that it involved a single expert. As the data are unique to that individual and setting, the findings are therefore not transferable — studying another expert will yield a different set of data. A second limitation is that the findings are not likely to be applicable to younger experts, as the components of their expertise are probably different. It was not in the scope of the study to compare older experts with younger ones, or to compare ICT use by older with younger people.

The study makes three contributions to research and practice. First, it uncovers some of the elements of expertise that are evident in older experts, indicating that expertise includes experience, life skills and unique, personally held knowledge. Second, we revealed how an older expert used ICT to retain knowledge that can be described as sustainable knowledge. Third, there is relatively little literature on helpline processes or knowledge retention in a helpline context. This study also sets the scene and yields rich data for further investigations of different experts or groups of older experts, such as within a profession, whose knowledge is at risk of being lost.

5.2 Conclusion

The study's findings uncovered the expert's expertise, important when an employee with rare knowledge holds a sole position (Didierjean & Gobet, 2008). Different types of expertise emerged, including subject matter expertise in topics such as building techniques and materials, insulation, remedying existing faults, issues with new products, construction contract roles and responsibilities, and dispute resolution processes. We also found that the adviser had a substantial stock of organisational knowledge, and knowledge of business systems and processes, although such knowledge may not be visible to callers. Similarly, the adviser's knowledge of governance, structures and responsibilities at an industry level was valuable in accessing information and directing inquiries to relevant agencies. His proficiency with regulatory instruments like the building code, and with compliance requirements, was another dimension of subject matter expertise.

The analysis of a reasonably large call sample, including transcribed calls, revealed the expert's high level processes for both call resolution and knowledge retention to create sustainable knowledge. Close observations of the expert in action indicated a consistent problem-solving approach across a large number of interactions with callers, and a commitment to retaining knowledge, especially in unusual cases. This meant that knowledge was available to future helpline staff, colleagues and knowledge seekers in the industry. The availability of such knowledge means it can be accessed, reused, refined, developed further and distributed, making it sustainable.

The study also yielded detailed knowledge about the process of delivering the helpline service, in terms of how knowledge was shared, and how collaboration occurred when the adviser needed to locate technical and scientific knowledge. His extensive professional and social networks spanned the construction industry, and interactions with his industry peers revealed significant respect for his expertise. His roles in capturing, creating, facilitating, co-ordinating and disseminating knowledge for re-use through the use of ICT involved a wide range of people within and outside his organisation. His

knowledge retention actions were observed in the context of individual calls; however, he adopted a sustainable approach with standardisation and therefore consistency of knowledge, avoiding rework.

From our analysis and observations, we learned that the expert did actually document knowledge for retention in the course of delivering the helpline service. He also created new knowledge artefacts by collaborating with technical and scientific experts for their input, and co-ordinating drafting. This alleviates concerns about the loss of his expertise and his successor's need to recreate lost knowledge. Observing the expert in action, interviewing technical and scientific colleagues and users of the service, and analysing call transcripts led to a deeper understanding of the knowledge this expert possessed, including his extensive networks, how he shared his expertise with knowledge seekers, and how he ensured that his knowledge was retained in appropriate forms for re-use.

This study therefore demonstrates how knowledge retention is an ICT-enabled, sustainable business practice that develops robust knowledge, reduces knowledge re-invention, and promotes efficient use of organisational resources. Benefits accrue at an individual level in that the unique expertise of the expert is recognised, captured and may be accessed by his colleagues, while the organisation benefits in terms of enhancing its knowledge asset. Furthermore, through retention, sustainable knowledge is created that can be reused, refined and applied to new situations.

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