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# A GENERIC PROCESS FOR INDIVIDUAL KNOWLEDGE REUSE: POTENTIAL PROBLEMS AND SOLUTIONS

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## Abstract

*Organizations struggle to capture, retain, and disseminate knowledge for both creation and reuse. With knowledge creation, organizations develop new knowledge for creating new products or stimulating creativity to leapfrog the competition. Through knowledge reuse, organizations repeat past successes and learn from past mistakes. We have multiple frameworks for knowledge creation and reuse within information systems, management science, and other literature. However, we do not have a comprehensive understanding of how individuals reuse knowledge and the problems that can impede knowledge reuse. This research synthesizes the literature on knowledge reuse to develop a generic process to explain how individuals reuse knowledge. We examine each step of the generic process and identify problems that may occur as well as search the literature for potential solutions. We conclude by offering suggestions for future research.*

**Keywords:** knowledge reuse, knowledge reuse problems, knowledge reuse solutions, literature review

## Introduction

Organizations struggle to capture, retain, and disseminate knowledge for both knowledge creation (i.e., exploration of new ideas using current knowledge) and reuse (i.e., exploitation of existing knowledge) (March 1991). Organizations value knowledge creation to create new products or stimulate creativity to leapfrog the competition. Knowledge reuse is important because it can be a source of continuous learning (Szulanski 1996), organizational capabilities (Grant 1996), or competitive advantage (Carlile and Reberich 2003). While both knowledge creation and knowledge reuse provide value to organizations, the literature tends to focus on knowledge creation rather than on knowledge reuse (Markus 2001).

We have multiple frameworks for knowledge creation and reuse at the individual, group, or organizational levels within the literature (Alavi and Leidner 2001). However, we do not have a comprehensive understanding of how individuals reuse knowledge and the problems that can impede their knowledge reuse. Within the organization, individuals decide whether to reuse existing knowledge to solve problems and make decisions. Once we fully understand how individuals reuse knowledge, the problems they encounter in reusing knowledge, and potential solutions to these problems, organizations can develop better strategies to promote knowledge reuse among their employees.

The purpose of this research is to synthesize the literature on knowledge reuse to develop a generic process for individual knowledge reuse. Each step of this process can suffer from problems that inhibit an individual from reusing knowledge to make a decision or solve a problem. We identify these problems within the process and search the literature to discover potential solutions to these problems. Based on this examination of the literature, we outline some potential future research directions for knowledge reuse.

## Our Current Understanding of Knowledge Reuse

There are many knowledge reuse frameworks within the literature. Some researchers have developed frameworks for knowledge reuse for the purposes of innovation (e.g., Majchrzak et al. 2004), while others have frameworks for knowledge reuse for replication (e.g., Szulanski 1996). Others have created high level knowledge reuse processes (e.g., Markus 2001) or knowledge transformation models (e.g., Carlile and Reberich 2003). We also have a variety of best practices and helpful insights on the practical implications and challenges of knowledge management (e.g., Davenport and Prusak 2000; Dixon 2000). Some of the current research tends to concentrate on the knowledge reuse process within and among groups (Majchrzak et al. 2004), while other research emphasizes the

individual within the process (Markus 2001). We have multiple methods and approaches for knowledge reuse; however, the organization does not always obtain the intended results (Markus 2001; Newell 2004).

To assist organizations in their encouragement of individuals to reuse knowledge, we believe it is necessary to develop a comprehensive framework that integrates the multiple frameworks on knowledge reuse to describe how individuals reuse knowledge. Furthermore, while nearly every article on knowledge reuse discusses problems associated with knowledge reuse, few actually attempt to specify where in the knowledge reuse process the problem occurs. Knowing when the process of knowledge reuse can break down can provide insights into the gravity of each problem and lead to potential solutions for organizations or individuals to promote knowledge reuse.

### A Generic Process for Individual Knowledge Reuse, Its Problems and Solutions

In this initial work to integrate the literature, we focus on knowledge reuse in an individual context because even within a group setting, it is the individuals within the group that may seek out and share knowledge and insight to be reused. In addition, there are many contexts where knowledge reuse is solely an individual effort to seek, find, and apply knowledge. For example, a novice software project manager may struggle with managing the expectations of the user base and may search for best practices. A consultant may refer to the organization’s methodology to ensure necessary procedures are being followed. An IS manager struggling to retain employees may seek out others for advice. These are only three of many examples of the individual knowledge reuse within an organization.

We developed the process for individual knowledge reuse (Figure 1) by integrating literature on knowledge reuse, anecdotal evidence, personal experience, and insights from prior research projects.

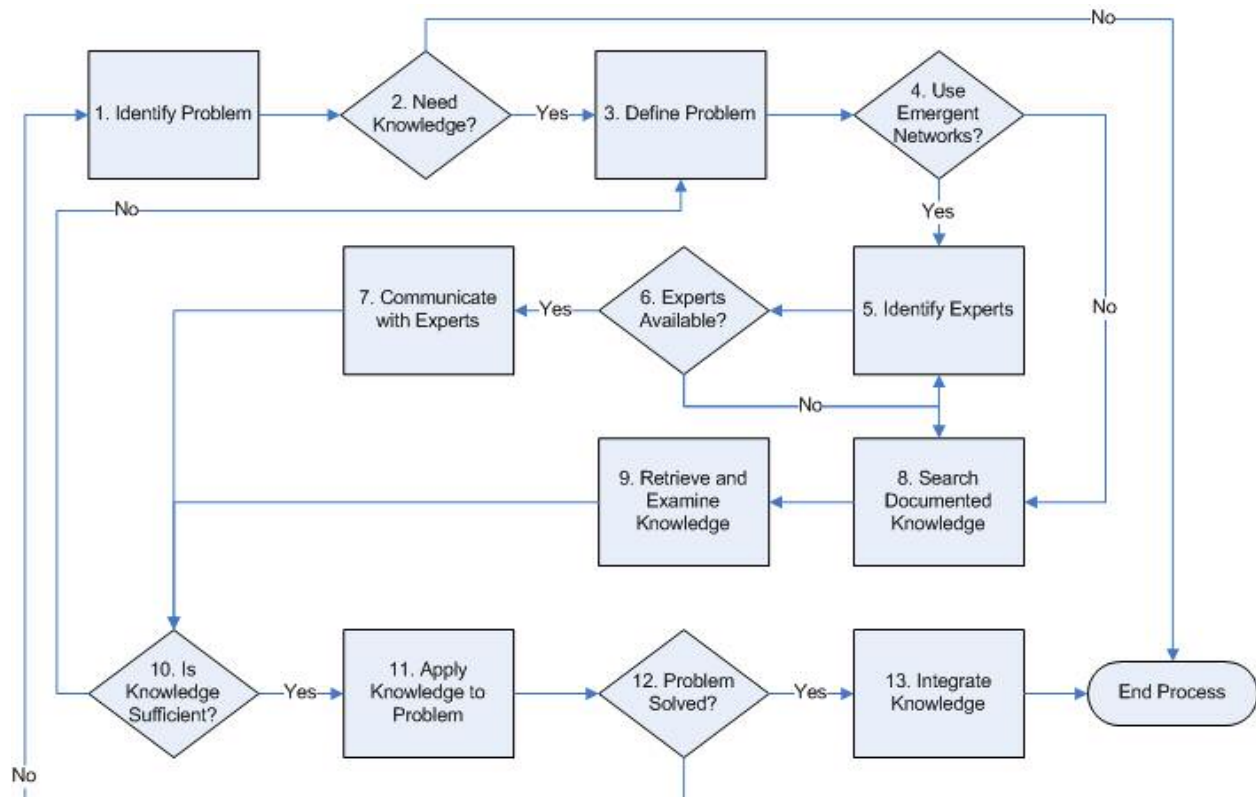


Figure 1: Individual Knowledge Reuse Process

There are numerous problems that can occur as an individual reuses knowledge, which could result in: 1) frustration with knowledge reuse, 2) inadequate application of knowledge to the problem, or 3) total abandonment of

knowledge reuse for current and future problems. Each of these results can lead to an environment in which individuals choose *not* to reuse the knowledge captured within the organization. Organizations may spend time, money, and other resources developing technology, content, and social networks to facilitate knowledge reuse by their employees; however, when knowledge reuse is inhibited, the individuals are unable to learn from the organization's past.

This section gives a brief description of each step of the process, some of the problems that may occur during each step of the process, as well as potential solutions to these issues. For decision steps, the choices made are motivated by individual preferences and organizational influence. Here, we outline the facets of the individual's disposition as well as incentives to act. In the confines of a conference paper, we cannot be all-inclusive, but we seek to highlight critical issues for each step of the process.

### ***Step 1: Identify Problem***

A problem, or need for knowledge, is identified (Szulanski 1996) and the individual initiates the knowledge reuse process.

#### **Problems**

Knowledge transfer does not begin until a problem is discovered (Szulanski 1996). Without this perceived need for knowledge, an individual has little reason to seek out knowledge (Newell 2004).

#### **Solutions**

One approach is the use of a third-party, such as a manager or auditor, to help an individual identify potential problems. Organizations could also employ technology as an intermediary in the knowledge search process. For example, knowledge is usually "pulled" when a need for knowledge arises (Newell 2004). As an alternative, technology could "push" relevant knowledge to an individual to help alert an individual to specific problems related to their job function using intelligent agents or other technologies. This may trigger the individual to realize that they may be experiencing a problem.

### ***Step 2: DECISION – Is Knowledge Needed?***

The individual decides whether to search for knowledge. The process can terminate at this time or the knowledge reuse process continues (Majchrzak et al. 2004).

#### **Individual Disposition**

An individual may choose not to search for knowledge for several reasons. First, an individual may not place much value in knowledge from other sources (i.e., the "not invented here" syndrome). Organizational culture may affect the perceived value of knowledge by individuals. If senior managers or experts place little value on others' knowledge, this social norm will affect other employees (Davenport and Prusak 2000), encouraging individuals to rely only on their own creativity and experience. For those with limited experience, this choice could be quite costly. A second barrier is a lack of knowledge about available knowledge, or rather a failure to know what knowledge is available for reuse. If the individual perceives that the problem identified is too unique, the individual may not seek knowledge because s/he believes there is nothing out there to help them with the situation. This problem can also occur if the individual perceives the problem to be too common. S/he may perceive that the solution should be "common sense," and may believe knowledge of something so elementary would be ridiculous to ask a colleague or find in a repository.

#### **Incentives to Act**

The organization should strive to create a knowledge sharing culture. Even if a few people in the organization see the value of knowledge reuse, their excitement and increase in performance can be contagious. "If people begin sharing ideas about issues they see as really important, the sharing itself creates a learning culture" (Dixon 2000). It is also important that individuals feel safe within the organization to ask questions and seek out knowledge, regardless if the problem may sound trivial or elementary. At this point, meta-knowledge (or knowledge about knowledge) becomes critical for the individual to determine if the type of knowledge needed is even available for reuse (Majchrzak et al. 2004).

### ***Step 3: Define Problem***

After deciding to search for knowledge, the individual becomes a knowledge-seeker. The knowledge-seeker defines the problem and the resulting search question to find applicable knowledge (Majchrzak et al. 2004; Markus 2001).

#### **Problems**

The key problem in this step is an improperly defined problem. The knowledge-seeker may identify a symptom rather than a cause of the problem. Recent past experiences may anchor the definition of the problem, which can also affect the development of the correct problem. The danger of this error is that the knowledge-seeker may find and apply the wrong knowledge to the problem, leading to a poor result.

#### **Solutions**

It is suggested that experts have the ability to better define search questions than novices (Kolodner 1983; Markus 2001), yet novices need the knowledge more so than experts. If this is the case, then training becomes critical. Novices have a more difficult time than experts in determining what questions to ask and what information is necessary to solve a problem (Kolodner 1983). Through mentoring, apprenticeship, and better training, novices have the opportunity to learn how to think and make decisions like experts (Canon-Bowers and Bell 1997).

### ***Step 4: DECISION – Use Emergent Networks?***

The knowledge-seeker chooses where to search for knowledge (Markus 2001). S/he may select to examine documented knowledge that resides in books, knowledge repositories, the Internet, or other sources (proceeding to step 8), collaborate with others to discover emergent knowledge using communities of practice, informal relationships, or other social networks (continuing to step 5), or pursue both strategies.

#### **Individual Disposition**

In some domains, such as software project management, knowledge-seekers first turn to emergent networks regardless of the quality of such networks (Newell 2004). Knowledge-seekers may choose documented networks as a last resort or if they have few social contacts within the organization. A knowledge-seeker may gravitate automatically toward one approach not because it is the most appropriate method to obtain knowledge, but rather due to their familiarity or past experience with a particular network. Furthermore, organizational incentives may also dictate the type of knowledge search that is performed by the individual.

#### **Incentives to Act**

Meta-knowledge, as in step 2, becomes critical in addressing the problem faced in this step of the process (Majchrzak et al. 2004). The individual needs an understanding of the potential sources of knowledge, the quality of knowledge from each source, and the type of knowledge available to select the best network for a given problem.

### ***Step 5: Emergent Path – Identify Experts***

If the knowledge-seeker pursues an emerging knowledge strategy, an expert or someone perceived to have the required knowledge is identified (Markus 2001).

#### **Problems**

It is sometimes difficult to identify an expert in a given area. Davenport and Prusak (2000) state that people only seek localized knowledge. People tend to avoid approaching complete strangers to ask for advice. If this is true, then the knowledge-seeker will not go to great means to find the expert in a given subject matter; the individual will seek only the “expert” within his/her social network. If the knowledge-seeker has a large and comprehensive social network, then a local search of experts will most likely yield the same results as a more extensive search; however, for those with small social groups and few contacts, the local “expert” may not have the expertise necessary to help the knowledge-seeker with their problem. An additional problem that compounds the problems with this step is that an individual may select an expert based on convenience, rather than the quality of the expertise.

#### **Solutions**

One approach to enable knowledge-seekers to identify others with specialized knowledge is to create a knowledge map (or personalized knowledge management system) within the organization. A knowledge map identifies individuals and their expertise (Davenport and Prusak 2000). The map can be stored on a corporate intranet for access by all knowledge-seekers. Knowledge maps are useful in helping people identify local experts to reuse knowledge that is difficult to articulate (Hansen et al. 1999). Another approach to help individuals feel more comfortable speaking with unknown “experts” in a domain is to create an opportunity for people within the organization to get to know one another, making approaching an expert for knowledge less daunting.

***Step 6: Emergent Path – DECISION – Experts Available?***

The knowledge-seeker determines if the identified expert is available. If not, the knowledge-seeker may identify a new expert (step 5) or may search documented knowledge (step 8).

**Individual Disposition**

The knowledge-seeker may find that the expert is not available to share their expertise because they are too busy. If the person is well-known for his/her expertise, the expert is most likely solicited by many knowledge-seekers for help. Time is a scarce resource, and even though the expert may want to offer assistance, it may be difficult for them to find the time (Davenport and Prusak 2000).

**Incentives to Act**

If an expert is identified but is unavailable to share his/her knowledge, the knowledge reuse process is either halted or continues with documented networks of knowledge reuse (i.e. knowledge repositories). One way to ensure that a balance can be achieved between both documented and emergent networks of knowledge reuse is to restructure job responsibilities of experts. Some organizations, such as the U.S. Army, have modified the job responsibilities of key personnel to include helping others via knowledge sharing (Dixon 2000). This gives experts the time to communicate and share their knowledge to those needing it in other parts of the organization.

***Step 7: Emergent Path – Communicate with Experts***

The knowledge-seeker communicates with the expert face-to-face or via telephone, email, chat, or another communication medium to obtain the required knowledge (Majchrzak et al. 2004).

**Problems**

The key problem that occurs at this stage is that the expert may have a difficult time articulating their knowledge. The knowledge-seeker may realize that the expert has the necessary knowledge to address the problem; however, experts have difficulty expressing knowledge. Experts have tacit knowledge, which is difficult to articulate (Nonaka 1994), and verbalization of this knowledge can be quite challenging.

**Solutions**

If the expert is available, but cannot articulate the knowledge, the expert needs help to convey the necessary knowledge. Experts can receive training on how to articulate their personal experience. Another tool to help experts share their knowledge is to encourage storytelling. Experts can tell stories of prior experiences to communicate rich tacit knowledge and context to others (Davenport and Prusak 2000; Denning 2000). By sharing a story based on prior experience, the knowledge-seeker can obtain the context of the problem as well as probe for the rationale within the story. Shared or common knowledge also enables communication between the expert and knowledge-seeker (Carlile and Reberich 2003; Grant 1996). This can be developed through training, methods, documents, or other methods (Carlile and Reberich 2003) to allow for higher levels of knowledge to be communicated between the expert and knowledge seeker (Grant 1996).

***Step 8: Documented Path – Search Documented Library***

The knowledge-seeker searches a knowledge repository, the Internet, documents, or any other written sources of information either within the organization or outside of the organization. Here, the individual determines the source(s) of knowledge to be reused.

### **Problems**

In this step, the individual may have no idea where to start searching for knowledge; therefore, the knowledge-seeker may choose a source not for the value it may provide, but on convenience. A knowledge-seeker may find a poor source and choose to rely on that knowledge for reuse, thus inhibiting solving the problem appropriately.

### **Solutions**

As with earlier steps, meta-knowledge can mitigate this problem (Majchrzak et al. 2004). Organizations could provide a list of potential sources for knowledge, such as knowledge repositories, websites, books, or other documented sources. Providing a list of quality sources for knowledge could be helpful in providing guidance to the knowledge-seeker in the documented search path.

### ***Step 9: Documented Path – Retrieve and Examine Knowledge***

Retrieval is the identification of knowledge that is likely to address the problem. In this step, the knowledge-seeker retrieves and examines knowledge to determine if it is appropriate for the context (Carlile and Rebentisch 2003).

### **Problems**

First, there may not be any knowledge related to the search question in the library. If this is the case, the knowledge-seeker may need to redefine the search question and try again. If the new search question does not retrieve any results, the knowledge-seeker may then rely on emergent networks, create his/her own solution to the problem, or ignore the problem. The second problem that can occur is that the repository retrieves too much knowledge during the search. While the lack of knowledge is a problem, the presence of too many options is a problem as well. Because time is scarce (Davenport and Prusak 2000), the knowledge-seeker may only look at a small sample of the knowledge entries retrieved or may simply give up on the knowledge search altogether.

### **Solutions**

One option to improve knowledge searches is to alter the retrieval process. Often, documented knowledge repositories use search engine tools that leverage key words or text-based searches to retrieve knowledge entries based on the search question. Other retrieval options could leverage artificial intelligence techniques, such as case-based reasoning. Case-based reasoning finds related knowledge by looking for repository entries (called cases) that are similar to the current problem (Aamodt and Plaza 1994). The case based reasoning process is simple in that a user presents a problem and similar cases or stories are retrieved. When possible, the case is adapted or reused for the current situation. If a new solution must be created, the resulting case is retained for future use (Jonassen and Hernandez-Serrano 2002). Case-based reasoning is often used for customer service knowledge repositories (Davenport and Prusak 2000), medical advice, and case law searches for the judiciary system.

The second approach, better indexing and retrieval of knowledge, could make the act of searching for knowledge more efficient. If the knowledge search is more efficient, then search questions can be refined until the knowledge-seeker obtains the correct knowledge. One way to enhance knowledge retrieval is through the use of ontologies and intelligent agents (O'Leary 1998). Ontologies provide a machine-readable taxonomy of the knowledge stored within a computerized knowledge repository used to index the knowledge. Intelligent agents search through the index to find knowledge most related to the search question.

### ***Step 10: DECISION – Is Knowledge Sufficient?***

Regardless if the knowledge-seeker obtained emergent or documented knowledge, s/he determines if the knowledge is applicable and if it is sufficient (Carlile and Rebentisch 2003; Majchrzak et al. 2004). If more knowledge is needed, the seeker returns to an earlier step (e.g., step 3) in the process.

### **Individual Disposition**

First, the knowledge-seeker may not find the needed knowledge due to breakdowns in earlier paths, such as an improper identification of experts (in the emergent path) or a poor search and retrieval of knowledge (in the documented path). A second problem that occurs, if knowledge was found, is a distrust of the knowledge obtained (Davenport and Prusak 2000). A third barrier to obtaining knowledge is the comprehension of the knowledge. If the knowledge-seeker has difficulty understanding the knowledge, it will not be reused.

### **Incentives to Act**

By addressing problems earlier in the individual knowledge reuse process, it is likely that the knowledge-seeker will find sufficient knowledge. To confront the barrier of distrust, two potential solutions could be implemented. One is to create opportunities for face-to-face interaction between the knowledge-contributors and knowledge-seekers to establish rapport among knowledge-seekers and knowledge-contributors (Davenport and Prusak 2000; Dixon 2000). Research in virtual teams has shown us that face-to-face interaction can dramatically affect the degree of trust among individuals. Another solution is to formally validate the knowledge. Knowledge intermediaries can perform this validation when packaging knowledge for reuse in documented networks. This ensures that the knowledge within the repository meets a certain threshold for quality, which can establish trust (Jonassen and Hernandez-Serrano 2002). To circumvent the third barrier to obtaining knowledge, which is failure to understand the knowledge communicated, shared knowledge is necessary among the knowledge-contributors and knowledge-seekers. A certain amount of shared knowledge, such as terminology, is necessary for knowledge reuse (Dixon 2000). This can be achieved via training, mentoring, or apprenticeship.

### ***Step 11: Apply Knowledge***

If adequate knowledge is obtained, the next step is to apply the knowledge to the problem (Markus 2001; Szulanski 1996).

### **Problems**

Two barriers can inhibit the application of knowledge. The first is the inability to adapt the knowledge, which may have been derived in a different context to the context of the current problem. Experts tend to better structure problems and have the ability to solve problems using less information than novices (Kolodner 1983). The differences in problem-solving approaches between experts and novices may impact the ability to adapt knowledge from different contexts to the current situation. A second barrier to applying knowledge is human forgetfulness (Markus 2001). The knowledge-seeker may forget some of the details of the knowledge when applying it to a problem. Another form of forgetfulness occurs when the knowledge-seeker is caught up in the crisis of the problem and reacts without applying the knowledge obtained.

### **Solutions**

Unfortunately, human memories are prone to forgetfulness; however, sharing knowledge through narratives can facilitate remembering and understanding (Davenport and Prusak 2000; Denning 2000). For knowledge-seekers that struggle to adapt knowledge from a different context to the current situation, their ability to adapt knowledge can improve with additional practice and experience. Knowledge intermediaries can package knowledge using different methods to improve the application of knowledge for reuse. For knowledge applied as verbatim, one should share knowledge based on abstractions, rules of thumb, and general best practices. Knowledge-seekers can apply this high level knowledge across contexts. For those interested in synthesizing the current knowledge with other forms of knowledge or using existing knowledge to create new knowledge, rich context is necessary to draw insights and ideas across situations and experiences.

### ***Step 12: DECISION –Problem Solved?***

After the knowledge-seeker applies the knowledge to the problem, s/he determines if the knowledge was helpful in addressing the problem. If the knowledge does not fully address the problem, the individual will return to an earlier step (such as step 1) to consider gathering additional knowledge for reuse (Szulanski 1996).

### **Individual Disposition**

If the knowledge-seeker goes to lengths to obtain knowledge only to find the problem was not solved, the individual may choose to abandon knowledge reuse and use creativity to address the problem. The individual may lose trust in the expert knowledge available (in either the emergent or documented networks), thus preventing future knowledge reuse (Davenport and Prusak 2000). The knowledge-seeker may choose to ignore the problem rather than looking for additional knowledge.



### **Incentives to Act**

The problems at this decision point can usually be attributed to a breakdown in the definition of the problem (i.e., Step 3), identification of experts (i.e., Step 5), and/or search for knowledge (i.e., Step 8). Addressing problems that occur at these earlier steps may help in ensuring that good knowledge that is applicable and relevant are used to solve the problem. If the problem is highly novel, existing knowledge becomes less useful (Carlile and Reberntsch 2003). For highly innovative problems, it could be more harmful to reuse knowledge rather than to try to leverage knowledge to innovate and create new insights (Carlile and Reberntsch 2003; Hargadon and Sutton 1997). Therefore, it is important to identify the boundaries of knowledge to ensure that the right knowledge is applied to the current situation.

### **Step 13: Integrate Knowledge**

The knowledge may become part of the knowledge-seeker's core routine and gets integrated into his/her work practices (Szulanski 1996), which may eventually be shared with others via documented or emergent methods (Grant 1996). This enables others to reuse the knowledge to continue the process.

### **Problems**

People are usually more than willing to share what they know (Dixon 2000); however, if integration is to occur via documentation, this can be difficult to achieve due to the pressures of time. Another barrier to integrating knowledge is that the individual may believe their knowledge is "common sense" and not worthy of contributing. Often, it is this "common sense" knowledge that is tacit and useful to others.

### **Solutions**

To better integrate and disseminate knowledge, organizations should alter job and reward structures to create opportunities to share knowledge within both documented and emergent paths. Another solution to the barriers inherent in knowledge sharing is to alter how people can contribute knowledge. People see formal knowledge sharing as time consuming and tedious, but tend to embrace emergent knowledge sharing when telling stories around the water-cooler. Simply re-thinking how knowledge reuse occurs may help an organization to create more formalized methods to ensure knowledge is integrated into methods and routines (Grant 1996).

## **Limitations, Future Research, & Contributions**

This research is a starting point for those interested in individual knowledge reuse. We chose to focus on the individual knowledge reuse process, not because this is the only level of knowledge reuse (Spender 1996) but to narrow the scope of this project and shorten the literature review. We encourage researchers to examine the literature and understanding of knowledge reuse in a collaborative environment to apply the current process and to identify problems and solutions with knowledge reuse and creation in other contexts beyond the individual.

The individual knowledge reuse shown in Figure 1 is a rather simplified view of looking at knowledge reuse. Some of the steps may actually be iterative (i.e., Steps 8-9 (Majchrzak et al. 2004)), while some steps may be completely overlooked by some. We chose to model the knowledge reuse process in a simple way to synthesize the literature on knowledge reuse. It also provided an easy to follow process to identify potential problems and solutions. Furthermore, we base this process of knowledge reuse not on a single theory, but on a combination of theories, best practice, anecdotal evidence, and research. This model has not been empirically tested or validated, but certainly could be in future research. Given the limitations on length for a conference paper, we also acknowledge that many other problems and solutions could be identified for each of the steps. We chose to simply highlight a few problems and ideas to stimulate more research in knowledge reuse.

In addition, many of the solutions for knowledge reuse are difficult to actually implement in practice. We pose these options as solutions not because they are all encompassing and easy to implement, but because of the potential they have to solve the problems. We want to stimulate creativity and research to examine *how* organizations can reduce specific barriers to knowledge reuse.

There are a multitude of problems that may arise during attempts to reuse knowledge which include, but are not limited to identifying the wrong problem, improperly defining the problem, and an inability to adapt knowledge to

solve the problem. Problems occurring early, such as identifying the wrong problem to solve, may be carried throughout the entire knowledge reuse process where errors and frustration compound. This can lead to an error where the right knowledge is applied to the wrong problem. Other problems may arise later in the search process, such as the knowledge-seeker is unable to apply the knowledge to the problem, creating a problem where the wrong knowledge is applied to the right problem. Both of these errors can lead to failure and frustration associated with knowledge reuse.

Because of the seriousness of the problems that can occur in knowledge reuse, it is critical that as a research community, we find solutions to help organizations and individual knowledge-seekers overcome these obstacles. In this paper, we identify steps to address the challenges associated with individual knowledge reuse. By addressing these problems, we can help organizations improve their ability to reuse knowledge. By synthesizing the research on knowledge reuse and outlining the specific steps needed to reuse knowledge, we provide a simple, easy-to-use process/framework for both academics and practitioners to identify problems and discover solutions for knowledge reuse.

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