University of Groningen

Understanding and Supporting Software Architectural Decisions

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Chapter 2

Architectural Knowledge Management in Practice

Published as: Tofan, D., Galster, M., and Avgeriou, P., Improving Architectural knowledge management in Public Sector Organizations – an Interview Study. In *Proceedings of the 25th International Conference on Software Engineering and Knowledge Engineering*, 2013.

To understand how architectural knowledge is managed in practice, we started by searching for and reading existing literature on architectural knowledge management. We noticed that the literature focuses on architectural knowledge management in organizations in the private sector (e.g. commercial software vendors), but there is a research gap on architectural knowledge management practices in public sector organizations (e.g. municipalities). Therefore, we conducted a study of architectural knowledge management practices in the public and private sectors, to apply lessons from the private sector to the public sector. Specifically, we conducted an interview study with four public and four private sector organizations. We identified challenges for architectural knowledge management in the public sector. Then, we derived solutions from the private sector to the challenges in the public sector. The main challenges in the public sector are vaporization of architectural knowledge, insufficient knowledge sharing, and organizational cultures that do not encourage architectural knowledge management. Solutions to these challenges include community building, improving tool support, quality control, and management support. The results confirm the importance of the overall problems addressed in this thesis: reducing architectural knowledge vaporization in practice.

2.1 Introduction

By searching for and reading existing literature on architectural knowledge management, we noticed that most work on managing architectural knowledge has been conducted in the context of private sector organizations (e.g. commercial software vendors or companies that develop products that rely heavily on software) (Babar et al., 2009). However, there is a research gap: architectural knowledge management in public sector organizations has not been studied. Addressing this gap is important because public sector organizations, given their sizes, budgets, and impact on everyday life, represent a significant part of the state of practice. Ignoring public sector organizations means an incomplete view of the state of practice.

Organizations in the private sector are not owned or operated by a government. Typical private sector organizations are corporations, regardless of their size. In contrast to private sector organizations, public sector organizations are owned and operated by some government. Typical public sector organizations are municipalities or government agencies.

Recent work on service-oriented architectures in e-government (Galster et al., 2013) suggests that architectural knowledge management in the public sector needs improvement. For example, immature architectural knowledge management leads to constraints on designing specialized reference architectures for municipalities (Galster et al., 2013). Additionally, similar to the private sector, e-government projects in public sector organizations are under pressure to reduce costs. As shown for the private sector, architectural knowledge management helps reduce costs (Babar et al., 2009). However, we could not find literature on architectural knowledge management in the public sector. Therefore, the goal of this chapter is to understand architectural knowledge management in practice, and to provide solutions for improving architectural knowledge management, especially in the public sector. Towards this goal, we formulate the following research question**: What are potential solutions to the challenges for managing architectural knowledge?**

To answer this research question, we conducted an interview study in public and private sector organizations. We were interested to find out practical architectural knowledge management challenges and solutions. Then, we can use architectural knowledge management solutions from the private sector to

address similar challenges in the public sector. Proposing solutions for improving knowledge management practices in the public sector by using practices from the private sector has already been applied successfully (Bate and Robert, 2002; McAdam and Reid, 2000).

The main contribution of this chapter is an increased understanding of the state of practice, in particular on architectural knowledge management in practice, using insights from the private and public sector organizations. Researchers and practitioners can use the results of this chapter to propose improvements to architectural knowledge management practices. Understanding the state of practice also encouraged us to focus in this thesis on a significant practical challenge: reducing architectural knowledge vaporization.

2.2 Related Work

This chapter is related to three research areas: knowledge management in software engineering, architectural knowledge management, and knowledge management in the public sector. We discuss related work from each area.

Dingsøyr and Conradi (Dingsøyr and Conradi, 2002) analyzed eight case studies of knowledge management in software engineering. All cases reported benefits due to knowledge management, such as time savings. However, results from a systematic literature review on knowledge management in software engineering indicate that most existing work consists of informal lessons learnt from applying knowledge management, instead of scientific studies (Bjørnson and Dingsøyr, 2008). In contrast, we conducted an interview study to answer our research question in a scientific manner.

Various architectural knowledge management challenges and solutions have been investigated in private sector organizations. For example, the challenge of architectural knowledge vaporization can be addressed by documenting design decisions (Jansen and Bosch, 2005). Furthermore, the challenge of sharing architectural knowledge can be addressed by considering communication, planning issues, and quality of captured knowledge (Avgeriou et al., 2007; Babar et al., 2009) when implementing architectural knowledge management strategies. Finally, a delicate balance must exist between sharing architectural knowledge through documentation and social interactions

(Avgeriou et al., 2007) to ensure that knowledge is made explicit, without causing much burden on architects.

The idea of getting inspiration from the private sector for improvements in the public sector has been used before. Bate and Robert (Bate and Robert, 2002) describe how knowledge management concepts and practices from the private sector can improve health care organizations in the UK public sector. Another study compares public and private sector perceptions and the use of knowledge management (McAdam and Reid, 2000). In both types of organizations, improved quality and efficiency were the main benefits of knowledge management.

Overall, many reports exist on architectural knowledge management in the private sector (e.g. (Avgeriou et al., 2007; Babar et al., 2009)), as well as on general knowledge management in the public sector (e.g. (Bate and Robert, 2002; McAdam and Reid, 2000)). However, we could not find any work on architectural knowledge management in the public sector.

2.3 Research Method

To answer the research question in Section 2.1, we conducted an interview study in public and private sector organizations, using semi-structured interviews. Such interviews belong to qualitative research, which aims at investigating and understanding phenomena within their real life context (Seaman, 2008). Challenges and solutions for architectural knowledge management are linked tightly to their context. Also, we needed flexibility during the interviews, so that we could ask new questions, to further probe for architectural knowledge management challenges and solutions.

Similar to (Svensson et al., 2012), we decided to conduct extended, semi-structured interviews. Using quantitative surveys was less optimal, because of the lack of reports on architectural knowledge management practices in public sector organizations, which inhibits the development of relevant questionnaires. Additionally, in a survey, participants might have different interpretations of the questions. Therefore, we decided to conduct semi-structured interviews, which enabled us to present our topics of interest, and discuss them directly with the participants. Furthermore, semi-structured interviews are useful as preliminary work for an in-depth case study (Seaman,

2008). However, semi-structured interviews require significant effort to prepare a discussion plan, recruit participants, and conduct the interview sessions. Overall, semi-structured interviews suited best our research goal, given the lack of previous work on architectural knowledge management in the public sector.

2.3.1 Data Collection and Analysis Procedures

To conduct the interviews, we selected organizations from the private and public sectors which had enterprise or software architects. We contacted diverse organizations from our collaboration network. For the interviews, we used recommendations from (Hove and Anda, 2005) to ensure that the interviewer has the needed skills, and to facilitate good interaction between interviewer and interviewees. Such recommendations include for example to encourage interviewees to participate in open discussions. In each organization, we interviewed one or two persons, depending on their availability. In total, we interviewed eleven persons.

The face-to-face interviews lasted typically one hour. The interviews took place between January 2010 and July 2012. We made audio records for the interviews, with the permission of the interviewed persons. We used a discussion plan with open-ended questions structured around three areas: strategy (e.g. '*what are the objectives of the architectural knowledge management strategy?*'), processes (e.g. '*what are the processes for sharing architectural knowledge?*'), and tools (e.g. '*what tools are used for architectural knowledge management?*'). We derived these areas from architectural knowledge management literature (Avgeriou et al., 2007; Babar et al., 2009).

To analyze the interviews, we transcribed the audio recordings. Next, two researchers performed content analysis, by assigning individually codes to sentences, phrases or paragraphs (Seaman, 2008). Each code corresponded to either a challenge or solution for managing architectural knowledge. Different codes could be assigned to the same piece of content. Afterwards, researchers discussed their differences, and they agreed on a common interpretation. In case of disagreements, we consulted a third researcher. Data analysis also included a mapping of challenges to solutions by identifying which challenges were addressed by which solutions.

2.3.2 Organizations

The organizations that took part in this study are listed in Table 2.1. Only the software architect in PS1 had about five years of practical experience. All the other participants had at least ten years of practical experience. The private sector organizations are international corporations. The public sector organizations are part of Dutch government. For confidentiality reasons, we provide limited details on the organizations, and we assign aliases to them.

Table 2.1. Summary of participating organizations.

ID	Sector	Domain	Number of employees	Interview with
Gov1	Public	Municipality	~1.000	Enterprise architect Knowledge management consultant
Gov2	Public	Municipality	~100	Enterprise architect
Gov3	Public	Agency	~1.300	Software architect Software architect
Gov4	Public	Ministry	~30.000	Enterprise architect
PS1	Private	Software provider	~600	Knowledge management director Software architect
PS2	Private	IT consultancy	~40.000	Enterprise architect
PS3	Private	Engineering	>100.000	Enterprise architect
PS4	Private	IT consultancy	>100.000	Software architect

2.3.3 Validity Threats

We discuss validity threats using the recommendations from (Wohlin et al., 2000), in line with a report that uses the same methodology conducted by (Svensson et al., 2012).

Construct validity refers to the relation between the observations and the theory behind the research (Easterbrook et al., 2008). We interviewed many

practitioners to avoid mono-operation bias (Wohlin et al., 2000). We avoided evaluation apprehension (Wohlin et al., 2000) by using the recommendations from (Hove and Anda, 2005) to create a comfortable and nonjudgmental atmosphere for the interviews, and ensuring their confidentiality.

Conclusion validity refers to obtaining the same study results, if other researchers replicate the study (Easterbrook et al., 2008). To increase conclusion validity, we involved more researchers in the data analysis, who reached high positive agreement when interpreting the data.

External validity refers to the strength of generalizability claims of the study results (Easterbrook et al., 2008). To increase external validity and to reduce validity threats, we conducted interviews at a variety of organizations in the public and private sectors. Besides architects, we also interviewed knowledge management consultants, who could offer insights on how architectural knowledge is managed.

Internal validity refers to the existence of confounding variables and other bias sources (Kitchenham and Pfleeger, 2008). Internal validity threats are not applicable to this study, because we do not try to establish any causal relationships.

2.4 Challenges

We identified three common challenges for the public and the private sector, as well as a challenge only for the private sector. Additionally, we link these challenges to results from knowledge management literature. We summarize these challenges in Table 2.2. Afterwards, we present details on all challenges, their consequences, and concrete examples from the public and private sectors.

Table 2.2. Challenges in public and private sector organizations.

Challenge	Public sector	Private sector
Architectural knowledge vaporization	Gov1, Gov2, Gov3, Gov4	PS1, PS2, PS3, PS4
Low architectural knowledge sharing	Gov1, Gov2	PS1, PS2, PS3, PS4
Organizational culture	Gov1, Gov2, Gov3	PS1, PS2, PS4
Low integration	-	PS1

2.4.1 Challenges in the public sector

Architectural Knowledge Vaporization: This challenge refers to the loss of architectural knowledge in an organization (Jansen and Bosch, 2005). We learnt that architectural knowledge vaporization contributes to increased vendor lock-in because the less in-house architectural knowledge remains in public sector organizations, the more they depend on software vendors for technology decisions (e.g. extending existing software depends on one vendor).

Also, architectural knowledge vaporization makes it more difficult to modify the architecture without involving vendors. For example, migrating existing systems to a service-oriented architecture depends on the willingness of the vendors. Having more in-house architectural knowledge enables organizations to make better decisions about software solutions that meet their core needs, and to decrease vendor lock-in. Overall, architectural knowledge vaporization reduces flexibility for public sector organizations and increases maintenance costs.

Architectural knowledge vaporization is a challenge across all public sector organizations that we studied. In Gov3, little architectural knowledge was captured on a regular basis. Architects had no formalized way to capture their knowledge. A wiki was used in the past, but only for a brief period, so the content became quickly outdated. Consequences of architectural knowledge vaporization were that similar problems were solved in different ways. Thus, new people who joined a team needed to re-discover solutions, instead of reusing a proven solution. Instead of reusing captured knowledge, much

informal communication of knowledge needed to take place. Architects often needed to explain the same solution to more developers, instead of documenting a solution and sharing the documentation.

Similar to the other organizations, little architectural knowledge was captured in Gov4. The architects working for Gov4 were employed through external companies, and were not asked to document their knowledge, although they were willing to do it. Moreover, little architectural knowledge existed inside Gov4 to facilitate knowledge sharing through direct interactions. Therefore, when the external architects stopped working for Gov4, their knowledge vaporized from Gov4, because there was no mechanism for preserving it.

Low Architectural Knowledge Sharing: This challenge refers to insufficient sharing of architectural knowledge, inside and across organizations (Babar et al., 2009). We learnt that low architectural knowledge sharing existed across Gov1 and Gov2. An architect from Gov1 compared his current position with his previous job in the private sector, where co-workers were much more open to knowledge sharing, resulting in higher efficiency, by helping each other.

At Gov3, architects worked in small, isolated groups, without sharing much knowledge across groups. Also, architects could allocate parts of their time to increase their knowledge, but not for sharing it with others. In Gov4, the same tendency for isolation between groups existed, with little knowledge sharing between them. Moreover, in Gov4 most architects were from external companies, and very few knowledgeable people existed in Gov4, so architects could not share their knowledge with them. Overall, low architectural knowledge sharing caused inefficiencies.

Lack of Supportive Organizational Culture: Culture contains norms about who controls what knowledge, and who can share or hoard it (Long and Fahey, 2000). For example, a cultural norm is accepting knowledge hoarding as a source of job security or power (Long and Fahey, 2000). An architect from Gov1 stated: '*Nearby municipalities are very small compared to us, maybe they fear we are going to take over things from them. That's the kind of feeling, which is very old*.' Such fears encouraged knowledge hoarding and reduced knowledge sharing.

An architect at Gov3 considered that organizational culture played a role in a previous failed attempt to use a wiki for knowledge sharing between architects

and developers. However, there were no accepted norms in Gov3 to capture and share knowledge, so the wiki content became gradually outdated, and was abandoned. Overall, we noticed that the lack of a supportive organizational culture increases knowledge vaporization and leads to reduced knowledge sharing, within and across organizations.

2.4.2 Challenges in the private sector

The challenges in the private sector match the ones from the public sector and include one extra challenge, namely low integration of architectural knowledge management with organizational goals.

Architectural Knowledge Vaporization: We found this challenge in all the private sector organizations. Architects mentioned several factors that contribute to this challenge.

First, due to lack of time, less knowledge can be documented (PS1, PS2, and PS3).

Second, documentation becomes irrelevant a few years after writing it, so the return for spending much time documenting is unclear (PS1, PS2, and PS4). The architect at PS2 summarized his view on documenting architectural knowledge: '*We typically document when either the client asks for it or we discover that we need it. I'm not really interested in this documentation, unless I discover that the speed by which I can address a problem depends on the documentation*.'

Third, the differences in educational background between software architects and maintainers increased the documentations costs. The architect at PS2 described this as follows: '*I have a designer, who has knowledge, puts it into a document, and pass it to someone who does maintenance, and who reads that information, generates knowledge from it, and these two do not match. Why not? Well, this one has architectural schooling for eight years and this one is good at programming routers. The points of view are so different, that these simply do not match, even if the documentation is the same*.'

Forth, existing research results on capturing architectural design decisions are not fully adopted in industry (PS1, PS2, and PS3). Overall, similar to public organizations, architectural knowledge vaporization lead to increased maintenance costs.

Low Architectural Knowledge Sharing: This challenge exists in all the private sector organizations. From the interviews at PS1, we learnt that a factor contributing to this challenge was sharing knowledge by e-mails, because senders determined receivers of its content. This created an obstacle for other persons that might be interested in the knowledge captured by e-mail.

For example, let us assume the rationale for an architectural decision is in an e-mail thread among a few architects. If a developer working on the code is interested in the rationale for that decision, then he would need to find out that the e-mail thread exists, and then ask one of the architects to forward it to him. Reducing overhead from these steps may facilitate architectural knowledge sharing.

Lack of Supportive Organizational Culture: We identified this challenge in the interviews at PS1, PS2, and PS4. Several factors contributed to this challenge.

First, architects and developers needed to be convinced to deliver not only source code, but also their knowledge. For example, at PS2, architects were not interested in transferring knowledge, because they do not consider it an interesting activity.

Second, trust was an important factor in organizational culture, as put by the interview at PS1: '*It's not about software. It's not about wiki content, it's about people getting trust and solving problems*.'

Low Integration with Organizational Goals: This challenge refers to the integration of knowledge management efforts with the goals of the organization (Rubenstein-Montano et al., 2001). From the interviews at PS1, we learnt that if such integration is low, then architectural knowledge management efforts carry the risk of adding too little value to the organization. Specifically, the challenge is to provide value from architectural knowledge management efforts throughout the lifecycle of projects for customers, i.e. from sales, to architecting, development, and during maintenance. Architectural knowledge management efforts need to show benefits, such as time savings for architects and other stakeholders.

Although the integration challenge did not emerge from the interviews in the public sector organizations, we considers this challenge is also relevant to public sector organizations, because such integration is a critical element of

knowledge management, regardless of the type of organization (Rubenstein-Montano et al., 2001). Due to their different nature, the organizational goals in the public sector differ from the goals in the private sector. However, in both types of organizations, architectural knowledge management efforts must serve organizational goals.

2.5 Solutions

We describe six solutions to the challenges in Section 2.4, elicited from the interviews in the private sector organizations: community building, tool support, training, resources allocation, quality control, and management support. Next, we present details about each solution.

Community Building: This solution was described in all private sector organizations. PS1 built its community, based on three elements: people, tools, and processes. People include architects, developers, testers, partners, and customers, who joined the community voluntarily and gradually. The main tool is a commercial wiki. Processes are managed through PS1's own business process management tool. For example, architects follow predefined processes for capturing knowledge regularly in the company wiki. If an architect leaves, the impact is reduced, because the other people in the organization can still use the architect's previous regular contributions to the wiki.

PS2 supports the creation of various communities of practice, in which architects can share knowledge with people in other positions or fellow architects. Moreover, collocating architects with other project groups improves architectural knowledge sharing across projects. Architects who work in other groups '*get the feeling on what that really means and how that works*.' Overall, getting perspectives from other groups helps architects deliver better documentation as architects became aware of the documentation needs of other groups.

Architects in PS3 share their knowledge through communities of practice, on architectural or other technical topics (such as Java or .Net), or business related topics. For these communities, the company organizes regular events to help networking, and promote knowledge sharing. Recognized experts are invited to share their insights at such events. The architect at PS3 stressed the idea that although tools help, they are less important than networks of people.

Tool Support: This solution receives much attention in all private sector organizations. At PS1, tool support shifted from a sender-dominant paradigm (e-mail) to a receiver-dominant paradigm (subscription). This means that notification about content and the actual content are separated. For example, instead of architects emailing content, they put architectural content in the wiki, and then send an e-mail notification with the wiki link. If a person considers that the content is interesting for her work, then the person can subscribe to the topic, and receive future notifications about it, without the constraint of receiving content through e-mail.

Moreover, at PS1 knowledge capturing is based on a wiki, to avoid using different tools (e.g. forums, wikis, or document management systems). Having content in multiple locations creates obstacles for end users in accessing and sharing it. Therefore, all content must be delivered in the wiki. For example, if architects produce artifacts with other tools (e.g. PowerPoint slides), then the artifacts need to be attached to a wiki page.

At PS2 and PS3, various tools (e.g. SharePoint, wikis, internal blogs, and a third party collaborative software system) are used for capturing and sharing architectural knowledge. Additionally, social networking tools (e.g. Skype, Twitter, and Yammer) are widely used in PS2, PS3, and PS4, enabling knowledge exchanges across offices around the world.

Training: PS2 develops training materials for maintenance persons, to facilitate the transfer of architectural knowledge. In PS3, to increase peoples' architectural knowledge, architectural training take place as part-time assignments, which may take six to nine months. Although demanding, such trainings are necessary to ensure similar levels of architectural knowledge throughout PS3. In addition, PS4 has central training facilities in which architects from various offices can meet in person during trainings, which leads to stronger connections through the social networking tools.

At PS3, in addition to trainings, there are company-wide events with software architecture experts. Architects can attend such events to expand their knowledge, or share their knowledge with each other.

Resources allocation: This solution refers to planning and allocating resources for architectural knowledge management activities. At PS1 and PS3, 10% of architects' time is allocated for knowledge management activities. At

PS2, transferring architectural knowledge to maintenance people is considered a project by itself. As part of the project, architects need to consider what knowledge is needed for maintenance, and plan for its transfer. Architects may join temporarily the maintenance team to facilitate the transfer.

Quality Control: This solution refers to measures for increasing the quality of captured knowledge. At PS1, various metrics are collected for the wiki pages, such as number of visitors, profile of visitors, time spent on a page, or next visited pages. Such metrics indicate issues with content. If the content in the wiki is useful and up to date, then visitors perceive value in accessing the wiki.

At PS3, peer-review is used to evaluate the quality of captured architectural knowledge. For example, a group of architects involved in a healthcare project sent some design documents to another group of experienced architects for review. The experienced architects provided constructive feedback to increase documentation quality. On the other hand, the reviewers (experienced architects) improved their knowledge on the healthcare domain.

At PS4, a solution to increase quality is to separate domain-specific knowledge from department-specific knowledge in the wiki system used for capturing knowledge. The rationale was that domains and departments evolve at different speeds. For example, a department might disappear during a re-organization, but knowledge from that department about the architecture of a specific system might be needed across other departments. If no separation exists, then the captured knowledge about that specific system becomes difficult to update, because it is mixed with irrelevant knowledge about the disappeared department.

Management Support: Support from top management was essential for the knowledge management efforts at PS1, because architectural knowledge management is a long term effort. A person from PS1 summarized this in a metaphor: '*Grass doesn't grow by pulling it*.' PS1 needed two to three years to implement its new knowledge management practices. To sustain momentum for long-term knowledge management efforts, knowledge workers (including architects) needed to experience benefits from the new practices. This was mainly achieved by saving time through architectural knowledge reuse.

Top management influences organizational culture by encouraging initiatives, and having tolerance for mistakes. This was described as a success factor at

PS1: '*You'll only get fired if you didn't take initiative, not because you made a mistake. Otherwise I wouldn't be doing this. I wouldn't even be close to this kind of ideas [for knowledge management]*.'

At PS4, management supported knowledge management efforts by providing positive reinforcements to the top wiki contributors who shared their knowledge. The positive reinforcements were in the form of emails from the top management thanking contributors, and internal news articles praising their efforts. By receiving recognition for their efforts, the organizational culture became more supportive for knowledge management activities. In turn, people became comfortable to share their knowledge and help colleagues.

2.6 Discussion

A similar study in the UK public sector (i.e. national healthcare) (Bate and Robert, 2002) describes knowledge management as a core activity for organizational improvements. Unfortunately, knowledge management in UK public sector is much more immature, compared to private sector organizations (Bate and Robert, 2002). Therefore, the public sector can benefit from the lessons and experiences in the private sector (Bate and Robert, 2002).

In our study, we noticed a similar situation for the Dutch public sector. Although architectural knowledge management provides significant benefits, architectural knowledge management in the public sector is much less mature than architectural knowledge management in the private sector. For example, interviewees from the public sector mentioned previous failed attempts to use wikis for capturing and sharing knowledge. Therefore, we think that the experiences derived from the private sector will help improve architectural knowledge management practices in the Dutch public sector and elsewhere. Similar to (Bate and Robert, 2002; McAdam and Reid, 2000), we consider that solutions from the private sector help improve the situation in the public sector. Also, the improved quality and efficiency that the private sector derives from its architectural knowledge management efforts can motivate public sector organizations to pay more attention to architectural knowledge management.

We summarize the solutions from the private sector (detailed in Section 2.5) and map them to the challenges in the public sector (detailed in Section 2.4.1)

in Table 2.3. Each solution exists in two or more private sector organizations, and addresses one or more challenges. For example, community building addresses the architectural knowledge vaporization and sharing challenges. Also, tool support addresses architectural knowledge vaporization, sharing and organizational culture challenges.

Table 2.3. Summary of solutions and challenges.

Organizations	Solution	Challenges
PS1,PS2,PS3,PS4	Community building	vaporization, sharing
PS1,PS2,PS3,PS4	Tool support	vaporization, sharing, culture
PS2,PS3,PS4	Training	vaporization, sharing, integration
PS1,PS2,PS3	Resources allocation	vaporization, integration
PS1,PS3,PS4	Quality control	vaporization, sharing, integration
PS1,PS4	Management support	culture, integration, sharing

Dependencies among challenges have received little attention in architectural knowledge management literature on the private sector. We noticed dependencies between architectural knowledge sharing and architectural knowledge vaporization: sharing reduces the risk of vaporization. On the other hand, addressing vaporization by creating architecture documentation makes it possible to share architectural knowledge. Also, to address the lack of architectural knowledge sharing and vaporization we can use a common set of solutions: trainings, processes, tools and building communities. Another dependency is that organizational culture influences the willingness of architects to share and capture their knowledge. For example, architects might not share their knowledge because there is no positive reinforcement in their organization for sharing. On the other hand, management support influences organizational culture, by providing the positive reinforcement and long-term focus. Both are needed to foster an organizational culture, which encourages knowledge-related activities.

This study also contributes to existing literature on architectural knowledge management in practice. For example, various solutions have been proposed to address architectural knowledge vaporization and sharing (Babar et al., 2009; Jansen and Bosch, 2005). However, little work exists on the role of organizational culture and the integration of architectural knowledge

management efforts with organizational goals. Results from knowledge management literature (Long and Fahey, 2000; Rubenstein-Montano et al., 2001) and from this study encourage more research on these challenges that focuses on architectural knowledge.

2.7 Conclusions

In this chapter, we present our research results on the state of practice on architectural knowledge management. The research results are based on an interview study consisting of eleven interviews conducted over two years. We conducted the interviews in four public and four private sector organizations. This chapter contributes to the existing body of work on architectural knowledge management (e.g. (Avgeriou et al., 2007; Babar et al., 2009; Dingsøyr and van Vliet, 2009)) with lessons learnt from implementing architectural knowledge management in the private sector, and proposes these as solutions to the challenges in the public sector. Also, this study confirms that architectural knowledge vaporization is a major challenge.

To address architectural knowledge vaporization, we need to better understand how architectural decisions are made in practice. As discussed in Chapter 1, architectural decisions are an important part of architectural knowledge. Therefore, by understanding real-world architectural decisions, we can propose approaches that help avoid architectural knowledge vaporization. The next chapter presents a study on architectural decisions in practice.

Acknowledgment

We thank the study participants for their help.