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Improving Knowledge Sharing Between R&D and Technical Support Organizations

Helsinki Metropolia University of Applied Sciences

Master's Degree

Industrial Management

Master's Thesis

11 May 2015

Preface

The Industrial Management programme at Metropolia had proven to be more challenging and demanding than I originally anticipated. Nevertheless, the interesting class discussions and engaging assignments have made it more captivating for me from start to end. So, I would like to thank all the instructors and classmates for making the journey interesting and engaging.

The thesis writing process on its own had been a great opportunity to learn how to do practical business researches. I would like to thank my instructors Zinaida Grabovskaia (PhL) and Marjatta Huhta (DSc) for their continuous support and valuable input throughout the thesis writing process. I would also like to thank all the participants of the thesis from the case company for not only engaging in the study wholeheartedly but also spreading news of the result through your word-of-mouth.

Thank you all!

Asrat Teshome

Helsinki, May 11th 2015

Author Title	Asrat Teshome Improving Knowledge Sharing Between R&D and Technical Support Organizations
Number of Pages Date	74 pages + 2 appendices 11 May 2015
Degree	Master of Engineering
Degree Programme	Master's Degree Programme in Industrial Management
Instructors	Zinaida Grabovskaia, PhL, Senior Lecturer Marjatta Huhta, DSc (Tech), Principal Lecturer
<p>The objective of this study is to improve knowledge sharing between R&D and TAC (Technical Assistance Centre) organizations in the case company. The case company is a telecom vendor manufacturing transport equipment for building mobile cellular networks. TAC has the responsibility to deliver quality support to new product features R&D continually develops and releases to customers. This requires an effective knowledge sharing mechanism between R&D and TAC to transfer the knowledge necessary to support new feature from R&D to TAC. Hence, the focus of this study is on improving knowledge sharing in the context of new feature releases.</p> <p>The study uses action research as its research approach. The study utilizes three qualitative data collection and analysis stages. The primary source of the data used in the study is in-depth, semi-structured interviews with key stakeholders of the study selected from both R&D and TAC teams. The data collected from the key stakeholders was utilized, first, to analyse the current state on knowledge sharing between the two units, second, as input suggestions to develop the initial proposal, and finally, as feedback to the initial proposal and the pilot implementation to validate the proposed solution.</p> <p>The outcome of this study includes three prioritized recommendations for improving knowledge sharing between R&D and TAC – implementing Feature Pages, conducting Feature Knowledge Transfer sessions, and organizing Cross-Team Networking events. The proposal has been validated both through pilot implementation and the positive feedback and approval from the key stakeholders.</p> <p>Finally, the study has produced practical recommendations how to improve knowledge sharing between the two units. With detailed guidelines prepared for each practitioner, the proposed solution is ready-to-use for both the managers and team members.</p>	
Key words	Knowledge sharing, knowledge transfer, knowledge management, organizational learning.

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Acronyms

CSA	Current State Analysis
TAC	Technical Assistance Centre
Tier 1	First line of support organization facing customers
Tier 2	Second line of customer support
Tier 3	Third line of customer support
R&D	Research and Development.

1 Introduction

Providing high quality network infrastructure solution to telecom operators, the main customers of the case company, requires the capability to deliver not only quality products but also quality services up to the customer's stringent requirements and expectations. Quality and competent technical service is the key for building customers' confidence and establishing long term relationship with the customer.

Providing quality technical support requires highly knowledgeable, high performance technical support team. The support team needs to be equipped with up to date knowledge and information on the products and features the company offers to the customers. To ensure the support team is equipped with the latest knowledge required to support the features, it is essential to enable an effective knowledge sharing mechanism between the development team, R&D, and the technical support team, TAC.

Feature development in R&D happens months or even years before the feature is released. Throughout this development period, R&D accumulates significant amount of knowledge that is useful not only in developing the feature but also supporting the feature in the customer network. As such, enabling effective knowledge sharing between R&D and TAC is of paramount importance to ensure quality support service to the customers starting from the date the feature is released. To that end, this thesis investigates the current knowledge sharing practice in the case company and proposes improvements based on concrete suggestions from participants and in-depth literature review.

1.1 Case Company Background

The case company considered in this study is a telecom equipment vendor. It has its global headquarters in US and regional headquarters in Germany and Finland. It has more than 3,500 employees worldwide (more than 400 in Finland), operating in more than 70 countries.

The main customers of the company are telecom operators. Currently, it serves over 500 operators worldwide. The structure of technical support includes: local service teams close to the customer providing Tier 1 service, with support from global Tier2 and Tier3 teams. The global support teams (also called Technical Assistance Centers, TACs) are located close to the case company R&D centers in Finland, Germany, and US. The R&D teams in the different geographical location develop different products and the co-located TAC team also specializes in the same product category.

This study mainly focuses on the R&D and TAC teams in Espoo, Finland. TAC Finland has more than 30 technical support engineers and R&D Finland has more than 120 developers in 7 teams of 15 to 20 members. Each team focuses on specific sets of the product features.

1.2 Business Challenge

In the telecom industry, technology changes relatively fast and vendors need to have the ability to stay at the edge to remain competitive. In the case company, new features are continuously added to the products packaged as feature packs. The R&D engineers developing these features are specialized in the specific areas they are developing; while supporting these features is typically the responsibility of all members of the technical support group once deployed in the customer network.

The case company experience suggests that the number of customer case escalations from TAC to R&D is typically high after new feature releases. One of the main reasons for that is the lack of proper *knowledge sharing mechanism* that would enable the transfer of the knowledge necessary to support the new features from R&D (who develop the new features) to TAC (who will technically support customers with the new feature). Currently, knowledge transfer happens mainly through email exchanges between R&D designers and TAC engineers while resolving customer cases after the feature has already been deployed in customer networks. This way of knowledge sharing is highly ineffective considering the fact that new features are released frequently. The R&D engineer will be engaged in sharing the same information repeatedly to multiple TAC engineers at different times. Since only information relevant to the case in

hand will be discussed in the email exchanges, it is generally difficult for TAC engineers to acquire the whole picture of the features and its implementation details necessary to support the features competently, in a short period of time. This in turn affects the quality of the customer support and hence the customers' satisfaction in the service.

1.3 Research Question and Scope

Therefore, developing an improved way of sharing knowledge between R&D and TAC is essential to deliver quality customer support service at the time customers need it the most. Hence, the research question can be stated as:

“How to improve knowledge sharing between R&D and TAC for supporting new feature releases in the case company?”

This research questions can be approached by developing a tool that will help improve the current knowledge sharing practice between R&D and TAC in cases of new product features and their implementation. The scope of the study is limited to a team in R&D Finland responsible for one major feature set development and TAC Finland responsible for the support of the feature. The way the R&D team currently shares knowledge with TAC will be analyzed, areas of improvement will be identified, and a solution will be proposed and piloted.

The thesis is written in six sections. Section 1 introduces the study. Section 2 describes the research approach, methodology and design the study follows. Section 3 establishes the current state of the issue at hand in the case company through data collection and its analysis. Section 4 then builds the theoretical background for the study by examining existing literature and best practice. Utilizing the current state information and the theoretical background, Section 5 and 6 build a solution proposal and validate it through pilot implementation. Finally, Section 7 concludes the study with discussions on the findings of the study.

2 Method and Material

This section discusses the research method and data collection and analysis techniques used in this study.

2.1 Research Approach

Action research has been selected for the research approach since the purpose of this study is to improve the current knowledge sharing practice and the researcher also acts as a practitioner in the process. According to Coghlan and Brannick (2010), action research is a cyclic process of planning, taking action and evaluating undertaken by a concerned practitioner holding a dual role of being part of the organization and a researcher. Figure 1 below depicts the cyclic nature of action research according to Coghlan and Brannick (2010).

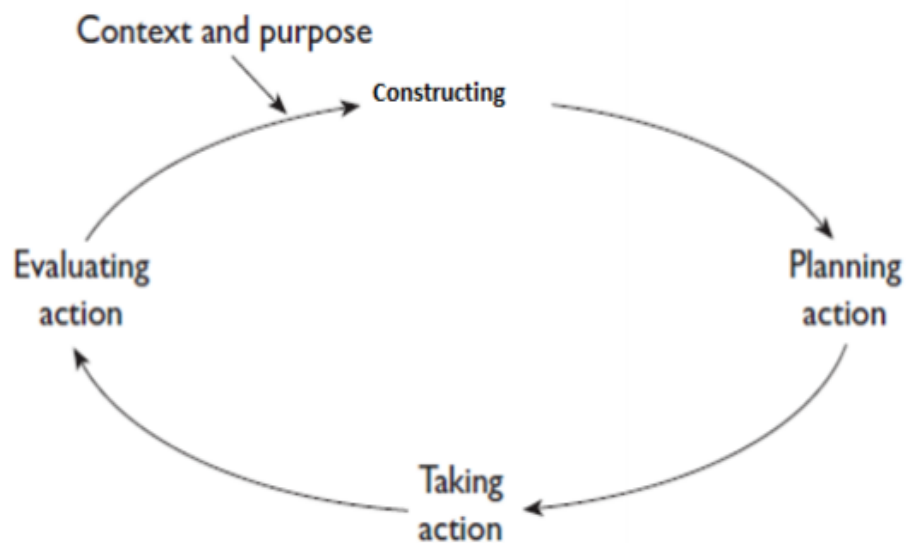


Figure 1: The Action research Cycle (Coghlan and Brannick 2010: 9)

As seen from Figure 1, action research begins with establishing *the context and purpose* of the study where the business problem and challenges are identified and recognized. Once this is done, the researcher goes through cycling processes of *constructing* (also often called diagnosing) the issue, *planning for actions* necessary to resolve the issue, *taking these actions* and then *evaluating* the results of the actions for further improvement.

The study utilizes qualitative research methodology. According to Ritchie and Lewis (2007), qualitative research methods are based on interpretive approaches that allow gaining insight into meanings people associate with phenomena (actions, decisions, beliefs, values, etc.).

2.2 Research Design

The research design for this study is based on the action research approach where a problem area is first identified and then followed by planning for action, taking action and refining the solution based on the result. The below diagram illustrates the design for the study.

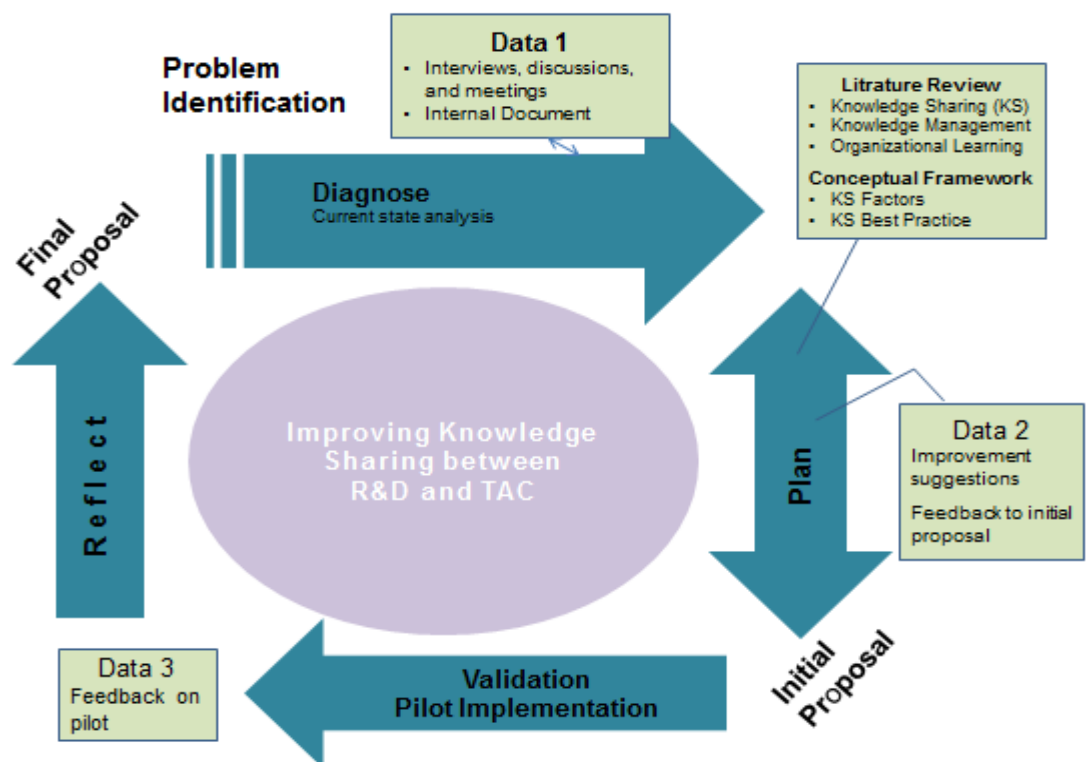


Figure 2: Research Design for this study.

The study begins with problem identification defining the business challenge, objective and desired outcome. This is followed by current state analysis based on interviews, observation, and review of internal documents. In parallel to the current state analysis, conceptual framework will be synthesized through available best practices and literature reviews. The conceptual framework and the

current state analysis will then be utilized to build the initial proposal for the solution, discussed and further developed together with the team. The initial proposal, after incorporating the feedback from selected participants will then be implemented in a pilot. The results of the pilot implementation will then be used to refine the solution and construct the final proposal.

2.3 Data Collection and Analysis

As depicted in the research design in Figure 2, this study involves three stages of data collection and analysis: first, Data 1 as part of the current state analysis; second, Data 2 seeking for improvement suggestions from the participants of the study; third, Data 3 for feedback on the pilot implementation of the initial proposal. The three rounds of data collections are described below.

Data collection 1

The first stage of data collection and analysis (Data 1) was conducted as part of the current state analysis. Various data sources were utilized for this end. First, in-depth semi-structured interviews with representatives from both R&D and TAC organizations; second, from observations on current processes and procedures; and third, from review of available internal documents. The table below provides the *interview* details with the key participants in Data collection 1.

Table 1. Details on the interviews and participants (Data 1).

	Date and Duration	Interviewee's position	Interviewee's Background	Documented
1	5 Mar 2015 60 min	Engineering Manager, R&D Finland	25 years of experience in the company in various positions. Currently managing one R&D team in Finland.	Audio recording and field notes
2	11 Mar 2015 70 min	Technical Service Manager, TAC Finland	15 years of experience in the company including operations and customer support. Currently managing Tier2 team in TAC Finland.	Audio recording and field notes
3	6 Mar 2015 40 min	Staff Engineer, R&D	10 years of experience in the company as developer and designer. Currently responsible for multiple features as chief designer.	Audio recording and field notes
4	7 Mar	Lead Engineer,	8 years of experience in the company. Currently re-	Audio recording and field

	2015 40 min	R&D	sponsible for multiple features as designer.	notes
5	7 Mar 2015 50 min	Lead Engineer, R&D	8 years of experience in the company. Currently responsible for multiple features as designer.	Audio recording and field notes
6	12 Mar 2015 70 min	Staff Technical Support Engineer, Tier2	12 years of experience in the company in various customer support responsibilities. Currently works as staff support engineer in Tier 2 team TAC Finland.	Audio recording and field notes
7	13 Mar 2015 60 min	Senior Technical Support Engineer, Tier2	7 years of experience in the company in various customer support responsibilities. Currently works as senior support engineer in Tier 2 team TAC Finland.	Audio recording and field notes
8	13 Mar 2015 50 min	Senior Technical Support Engineer, Tier2	5 years of experience in the company in various customer support responsibilities. Currently works as senior support engineer in Tier 2 team TAC Finland.	Audio recording and field notes

As can be seen in Table 1, both managers and team members from both R&D and TAC teams were represented in the interviews. Face-to-face in-depth interviews were conducted with key participants of the study selected from both R&D and TAC to acquire deep insight into the current state of knowledge sharing between the two units. The participants were selected based on their roles in their respective team and the perception of other team members toward them as trend setters. The R&D participants have a combined experience of 26 years while the TAC participants have a combined experience of 24 years in the case organization (excluding the managers). In addition, most of the participants have experience in other similar companies as well which makes them be a valuable source for cross company knowhow. The two managers participating in the study also have a combined experience of 40 years in the case organization and have played significant roles in various positions with significant contribution in the growth and history of the case company

The interviews were audio recorded and field notes were taken by the researcher. The qualitative data obtained through the interviews and discussions were analyzed through content analysis to acquire in-depth insight in to the cur-

rent state of knowledge sharing in the case company. The audio records were used later on to further analyze the responses. The interviews were conducted in English.

Other essential sources of Data 1 included *observations* and *review of internal documents*. First, as the researcher is also a practitioner in the case organization with experience in both TAC (previously) and R&D (presently) organizations, the researchers observations and experiences have helped greatly in formulating and driving the interviews. Second, since almost all the participants have long years of experience in the case company, their observations were reflective of both historical and futuristic views on the processes and procedures related to knowledge sharing in the case organization. This has helped significantly in forming a complete picture of the current state of knowledge sharing between the two units.

Finally, various documents were reviewed as part of the current state analysis. R&D documentations were reviewed in light of the drawbacks the interview participants pointed out related to the content and quality of the R&D documentations as a means of knowledge sharing between the two units. R&D feature release process and TAC troubleshooting process were also reviewed in light of the process consideration to integrate the proposed solution in to the existing processes.

Data collections 2 and 3

The second (Data 2) and third (Data 3) rounds of data collection and analysis were intended to gather suggestions and feedbacks during building the initial proposal and piloting the initial proposal phases respectively to help validate the proposal and refine it further. The same participants described in Table 1 were the key stakeholders in both Data 2 and Data 3 stages.

The primary data source for Data 2 was collected in one-to-one meeting and discussions with the participants listed in Table 1 for gathering concrete improvement suggestions and ideas (refer Table 6) from the participants for building the initial proposal. Table 2 (Section 3.1) discusses the questions used for Data 1 and Data 2 stages. Data 2 also included feedback collected from the participants on the initial proposal in a joint workshop held on Feb 13, 2015.

Last, the primary data source for Data 3 included feedback collected from the participants on the pilot implementation on Feb 15, 2015 (Table 10). Summing up, in building the proposal phase, not only concrete improvement suggestions from the participants of the study were utilized as input to the proposal but also their feedback to the initial proposal and the pilot implementation was instrumental in refining and validating the proposed solution.

2.4 Validity and Reliability Plan

Validity and reliability are two important characteristics of qualitative researches (Thyer 2001). Validity refers to the credibility of the research, while reliability refers to the trustworthiness and replicability of the research. According to Quinton and Smallbone (2006: 127), the question in validity is whether the result was a response for what was sought for originally. Easterby-Smith et al. (2010: 109) express validity of a research in terms of the extent the outcome of the research represents the research problem accurately.

Easterby-Smith et al. (2010: 109) describes reliability in terms of the consistence of the outcome with different researches using the same research method. Coghlan and Brannick (2010: 10) point out that “Questions of reliability, replicability and universality do not pertain to action research approach.” Instead, rigorous reflection of the issue and the resulting solution is the key. Research validity and reliability require authenticity of data and the consideration of sufficient number of perspectives in to account. The use of multiple sources of data and various perspectives helps validate the findings and outcome of the research.

In this study, the data collection stages are planned to be executed in such a way that the respondents will be able to validate the solution both through feedbacks for the proposal and pilot implementation. The design of the interview questions as well as the selection of the interviewees will play a key role in ensuring the validity and reliability of the study. Participants are selected from both R&D and TAC teams. Participants include both R&D and TAC managers as well as experiences members of both teams.

3 Current State Analysis

This section presents the results of the current state analysis of knowledge sharing between R&D and TAC organizations in the case company. It starts with an overview of the input for the current state analysis and then analyzes the current practices of knowledge sharing between the two units. Finally, it discusses the key findings from of the current state analysis.

3.1 Input for the Current State Analysis (Data 1)

The current state analysis draws from the results of the in-depth semi-structured interviews, participant observations and examination of internal documents (described in Section 2.3 Data Collection and Analysis).

As described in Data 1 collection and analysis stage, the selection of the interviewees ensured that all the essential stakeholders were involved. Participants were selected from both R&D and TAC teams to address the needs of both sides. To gain in-depth insights on the current state of knowledge sharing practices between the two units, the interview questions were designed for an open ended discussion to gather as much information as possible from the interviewees. The table below describes the main questions used to guide the interviews.

Table 2. List of the interview questions.

	Interview Questions
1	How important do you think is knowledge sharing between R&D and TAC? And how do you describe the current level of knowledge sharing between R&D and TAC?
2	What are the main practices for knowledge sharing between R&D and TAC currently?
3	How do you describe the knowledge sharing culture between R&D and TAC? Does the management encourage knowledge sharing? How is the willingness of the individual team members to wards knowledge sharing?
4	Do you think there are sufficient processes, tools, or mechanisms for knowledge sharing between R&D and TAC; especially considering new feature releases?
5	What do you think are the main drawbacks or challenges in the current

	knowledge sharing practices?
6	In your opinion, what is the best way to improve current knowledge sharing practices between R&D and TAC?
7	What relevant information do you think needs to be addressed in future knowledge sharing practices?

As can be seen from Table 2, the interview questions were designed to acquire deep insights from the participants in terms of their view, concern and suggestions regarding the challengers of the current knowledge sharing practices (Data 1) and collect suggestions for improving the current state of knowledge sharing (Data 2, discussed in Section 5) between R&D and TAC in the case organization.

Furthermore, a review of internal documents was conducted and observations of internal processes by the researcher as well as the participants of the study were utilized as data sources in the current state analysis. Various internal documents including R&D Documentations, R&D new feature release process, and TAC Troubleshooting processes were also reviewed as part of Data 1.

3.2 Current Business Processes and Knowledge Sharing Practices

R&D and TAC (Technical Assistance Center) are two of the technical units of the case organization. R&D is responsible for the development of new product features meeting the needs and requirements the customers while TAC is responsible for providing quality support service of the product features for the customers.

Continuous development of new product features is the key for the case organization to remain competitive in a very rapidly changing industry (Telecom). Hence, R&D is engaged in continuously developing and releasing new features in a schedule pre-determined and committed to customers. To meet the high demands of telecom customers, not only R&D needs to be capable of delivering new features continuously, the technical support organization (TAC) also needs to be able to support the new features competently from day one of the release dates. Quality and competent support of new feature release is especially vital as this is typically the time customers need more support because of their un-

familiarity to the new features. To equip the technical support team with the knowledge necessary to deliver quality support to customers, it is essential to share the knowledge relevant for supporting the new features from R&D to TAC in an effective and timely manner.

Analyzing the current practices utilized to share knowledge between R&D and TAC, the primary methods used for knowledge sharing between the two units include: (a) the use of various R&D documentations, (b) the case database, and (c) peer-to-peer communications via email.

The figure below illustrates the current practices of knowledge sharing by R&D and TAC.

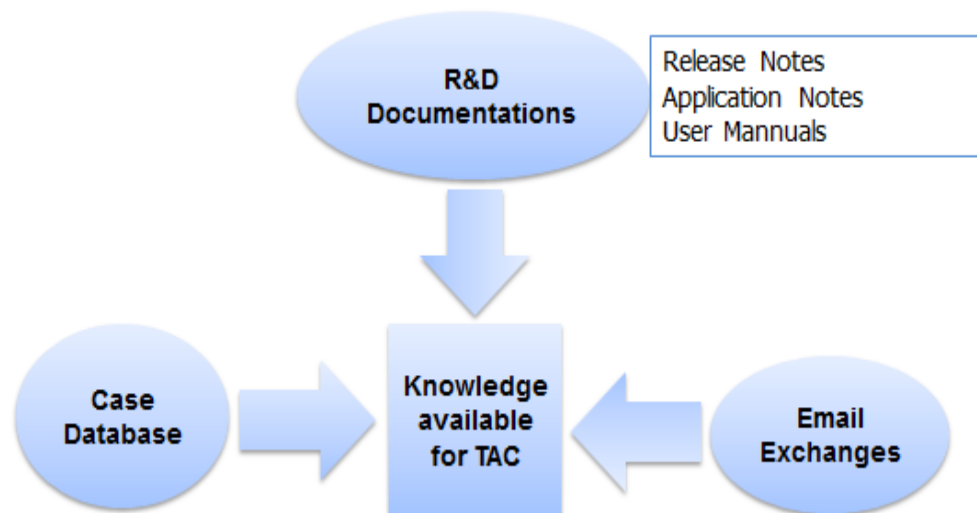


Figure 3. Current knowledge sharing practice between R&D and TAC.

As Figure 3 illustrates, the first practice for knowledge sharing between R&D and TAC is through the use of R&D documentations. In conjunction with the release of the new features, there are mandatory documentations that R&D prepares and disseminates together with the new feature. These documentations include “Application Notes”, “User Manuals”, and “Release Notes”. The Application Note describes the main intended application of the feature in relation with the customer use cases in their network while the “User Manual” provides instructions on how to use the feature in the customer network. The purpose of the Release Note, on the other hand, is to document updates on the specific

feature in time mainly customer visible bugs and fixes. It also serves as a report for customers on the fixes made for bugs reported by the customers.

The second practice of knowledge sharing practiced is currently done through the use of the case database. Typically, at the time of new feature release, the case database will have limited number of cases created internally mainly by test engineers. As customers deploy the feature, however, more and more problems get reported and the case database grows richer with information related to the feature through updates from both R&D and TAC engineers. In time, the database will then serve as a rich source of knowledge for TAC engineers.

Finally, the last practice is the peer-to-peer email exchanges in relation with customer cases. This method serves as an essential method of knowledge sharing between R&D and TAC. The email exchanges, though used as a last resort for knowledge acquisition by TAC engineers, are particularly favored by TAC engineers as it provides the chance to obtain explanations from R&D for the specific issue they have at hand.

3.3 Key Findings from the Current State Analysis

Analysis of the data collected through interviews, observation and document reviews reveal that knowledge sharing between R&D and TAC is an essential step in equipping the support staff with the knowledge necessary to deliver quality support to customer problems. The results of the current practice analysis showed that the current state of knowledge sharing between R&D and TAC has both strength and weakness areas. The key strength and weakness areas are discussed in more detail below.

Strengths Identified

The main strength areas include: (a) the *conducive organizational environment* (b) *the individual willingness* of R&D engineers to share knowledge.

The conducive organizational environment is the first strength point identified in the analysis. From the organizational context, even though the two units are separate in terms of functional organization structure, R&D is expected to provide support to TAC in delivering quality support services to the customer. As such, the two units work with the same objective of ultimately supporting the customer. As the TAC manager (informant 2) noted:

“To meet our service level agreement with customers, it is crucial to transfer new feature knowledge to TAC. Without this knowledge transfer, TAC cannot know what R&D has developed for example how a particular feature works and should behave in customer networks. In that regard we are always in discussion with R&D how to improve knowledge sharing.”

On the same subject the R&D manager (informant 1) also noted:

“Sharing knowledge with TAC is important for us. It is not enough to develop quality features, but also that the support team needs to be able to support the customer in deploying and using our features. For that reason, we always encourage close cooperation between our team and TAC team.”

This indicates that the conducive organizational environment is the result of the recognition, support and encouragement of knowledge sharing by the management as well as the cooperative spirit between the two units in terms of serving the customer

The second strength identified in the current state analysis is the willingness of the R&D engineers to share knowledge. From R&D perspective, the willingness to share knowledge is based on the advantage of reduced time and effort that would be spent by R&D engineers to support customer problems, if TAC is able to support the features competently with minimum possible escalations to R&D. For example, one R&D interviewee pointed out that:

“Sharing knowledge with TAC is good in many ways. Most importantly, it reduces the workload from supporting customer cases. The more information they have about our feature, the less emails to respond to. And in

many case, that consumes a lot of time, especially during new feature releases.”

Hence, the more competently TAC supports the features, the more successfully the features will be utilized in the customer network, and the less the involvement is needed from R&D at a later stage. Thus, knowledge sharing helps R&D engineers minimize the effort and time need to support customer cases thereby leaving time for development work.

Weaknesses Identified

The current state analysis also reveals various challenges in the current knowledge sharing practices between R&D and TAC. Various challenges has been identified under each of the three knowledge sharing methods currently practiced between the two units – R&D Documentations, Case Database, and Email exchanges. These challenges are described in more detail below.

A. R&D Documentations

One of the main challenges raised by multiple TAC interviewees is the lack of sufficient knowledge in TAC on new features before or immediately after the release of the new features. The R&D documentations related to the feature (Release Note, Application Notes and User Manuals) are published at the time of release. One TAC interviewee pointed out the drawback of these documentations as follows:

“The R&D documentations are mainly prepared for customers and in many cases we have the same level of information as the customer when new features are released. This makes it difficult for us to provide additional information or support when the customer requests for one”

Hence, these documentations are mainly targeted for external consumption by the customer, and as a result, lack essential details on the new features that the TAC engineers require to support the features in customer networks.

B. Case database

The challenge is not limited to the timing and content of the documentations, but also the lack of accumulated knowledge base related to new features in the case databases at the time of release. One TAC interviewee expressed the issue related with case databases as follows:

“Normally, the case database is the most important source of information for us in resolving customer issues because it is usually highly likely to find similar issues in one way or another to the case in hand. But for new features the case database does not help much since there will not be many related cases.”

The available knowledge base in the case database grows as more and more customer cases are reported and solved through interaction between TAC and R&D via the case database. But since there is typically very limited number of cases at feature release, it will take relatively long time till sufficient knowledge base would be available to TAC in the case database to support new features.

C. Peer-to-peer email exchanges

At the time of new feature release, the most useful tool for TAC engineers to acquire essential knowledge and information to support customer requests is the use of peer-to-peer email exchanges with the responsible R&D engineers. However, both R&D and TAC engineers have expressed various challenges in relation to the use of mail exchanges as the primary knowledge sharing mechanism for new features.

First, R&D interviewees have pointed out that when new features are released, it is typically that they will be dealing a high number of redundant email exchanges with multiple TAC engineers on the same topic. One R&D engineer described the issue as:

“When new features are released, there isn’t really a process or tool to share some vital information with support engineers that would help them debug customer issues on their own. Because of that, we receive many similar emails from TAC on the same issue. That is not only inefficient use of our time but also affect the quality of our response in time.”

As pointed out by the interviewee above, the high number of redundant email exchanges not only leading to unnecessary waste of R&D time and effort that could otherwise be used for development purposes but also impact the motivation and quality of knowledge sharing.

Another challenge with email exchanges as a primary knowledge sharing mechanism is the difficulty for TAC engineers to get access to the responsible R&D engineers. One TAC interviewee pointed out:

“For new features, it is typically difficult to find the right person in R&D responsible for supporting us. Emails usually end up bouncing from one engineer to another till it finds its way to the right person. There is usually delay each time the email is forwarded and that affects our response time to the customer.”

TAC interviewees have also pointed out that not only email exchanges typically introduce high delay in response time, but also the previous relationship between the TAC engineer and the R&D engineer tend to have an impact on the level of details in the email exchanges. Furthermore, discussions in email exchanges are typically focused on specific customer cases, which typically concern a very specific part of the feature. As such, even after multiple cases related email discussions, TAC engineers would still have bits and pieces of information on the feature but still find it difficult to acquire the wider perspective or big picture of the feature.

In summary, all the three method of knowledge sharing currently practiced between R&D and TAC – R&D Documentations, Case Database, and Emails – have various challenges in addressing the knowledge sharing needs between the two units especially with regard to new features.

3.4 Summary

Presently, the two units (R&D and TAC) of the case organization practice three methods for knowledge sharing – R&D Documentations, Case Databases, and Email Exchanges. Findings of the current state analysis indicate that the current

practices of knowledge sharing have both strengths, that would help improve the knowledge sharing practice further, and weaknesses, that needed to be addressed.

The main strength areas are the conducive orientation of the organizational culture and climate towards knowledge sharing and the willingness of R&D engineer for sharing knowledge with TAC. On the other hand the weaknesses revealed in the current practices relate to all the current three methods of knowledge sharing. The figure below depicts the main challenges identified within the current knowledge sharing practices.

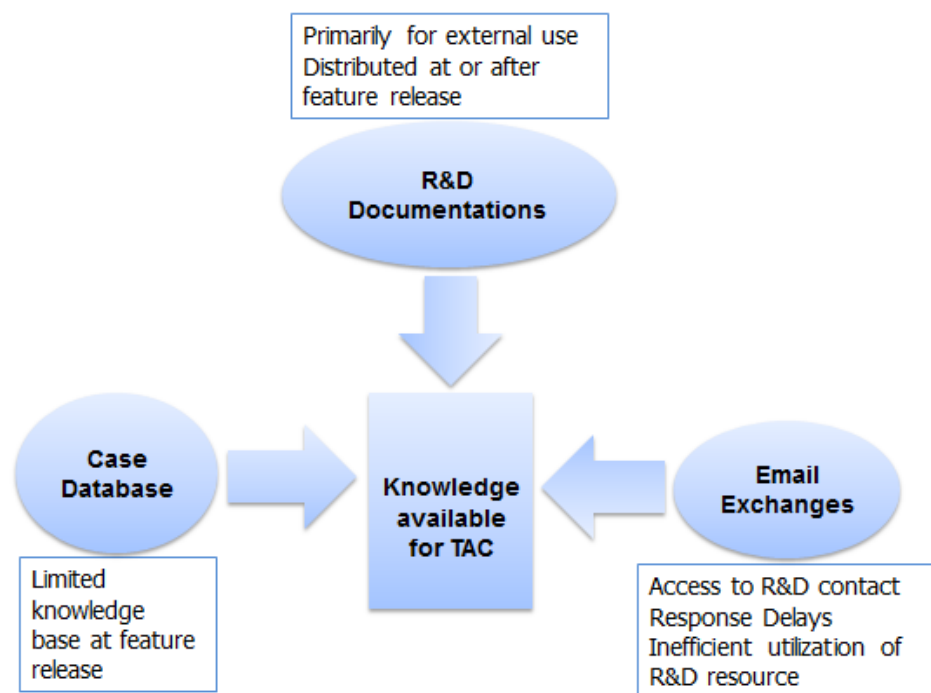


Figure 4. Main challenges in the current knowledge sharing practice between R&D and TAC.

As Figure 4 illustrates various challenges have been identified related to each of the current methods practiced for knowledge sharing. The following table provides a summary of the key strength and challenges of the current state of knowledge sharing between R&D and TAC.

Table 3. Summary of key findings from the current state analysis.

CSA Findings		
Weakness	Strengths	
1. Lack of a common systematic mechanism for knowledge sharing relevant to TAC engineers	Conducive organizational environment	Willingness of individuals
2. Lack of knowledge sharing before or during the new feature release relevant for TAC engineers		
3. Challenge for TAC engineers to acquire a <i>whole picture</i> of new features in a relatively short time		
4. Inefficient utilization of R&D time and resource on redundant email exchanges		
5. Difficulty of <i>access</i> to R&D contacts for TAC engineers		

As Table 3 illustrates, the key challenges in the current knowledge sharing practices can be summarized in five main points. The first, and perhaps the main, challenge, is the lack of common systematic mechanism for knowledge sharing between the two units that would be designed to address the knowledge needs of the technical support team. None of the methods previously identified in the current state analysis are designed with the need of TAC in mind. This makes it difficult not only for TAC engineers to acquire knowledge but also for R&D engineers who seek for a way of informing TAC engineers relevant issues in relation with upcoming releases.

Second, none of the current mechanisms address the need for sharing new feature related knowledge before the feature is released. Third, since TAC engineers are forced to obtain knowledge related to new features through various methods and sources, it makes it difficult for TAC engineers to be able to piece together the knowledge from the different sources to form a complete picture of the feature. Fourth, the redundant email exchange between R&D engineers and multiple TAC engineers seeking the same information at various times leads to

inefficient utilization of R&D time and resource. Finally, TAC engineers often times find it difficult to find the R&D engineer(s) responsible for a particular feature to initiate email conversation. This forces them to make premature case escalation without sufficient information and knowledge base.

In summary, the current state analysis suggests that the current knowledge sharing practices between R&D and TAC organizations in the case company need improvements. To address the gap in knowledge sharing, especially at the new feature release, the next section explores the available knowledge and best practice related to the uncovered gaps.

4 Knowledge Sharing in Organizations

This section discusses the findings from available knowledge and best practice related to knowledge sharing as presented in academic and business publications, as well as suggestions from the knowledge management and organizational learning. Finally, it presents a conceptual framework for improving the knowledge sharing practice between R&D and TAC organizations in the case company.

4.1 Review of the Knowledge Management Literature

Research shows that knowledge sharing is highly correlated with knowledge management and organizational learning. As such, the literature review in this study explores the relationship among these concepts in the organizational context and discusses the role and impact of knowledge sharing on both knowledge management and organizational learning. Figure 5 below provides an overview of the key topics explored in this section.

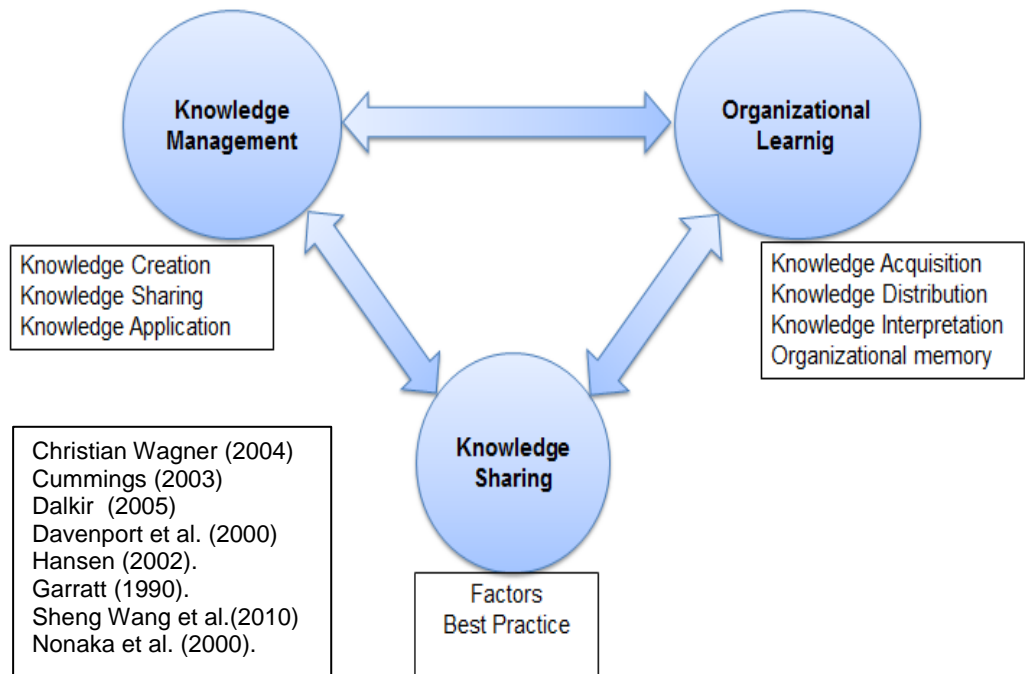


Figure 5. Foci of literature review.

As Figure 5 illustrates, the literature review in this study discusses the three correlated concepts – knowledge sharing, knowledge management, and organizational learning. Nevertheless, the main focus remains to be knowledge sharing and the other two concepts will be explored in the context of knowledge sharing. The factors influencing knowledge sharing behavior in organizations are discussed in depth as well as best practice from business and research that would help enable effective knowledge sharing with in the case organization.

4.2 Concepts Related to Knowledge in Organizations

Presently, knowledge is increasingly seen as a critical resource for organizations for sustaining competitive advantage (Davenport and Prusak 2000). According to Davenport and Prusak (2000), knowledge can be defined as “a set of experiences, values, skills and information related to experts’ viewpoints that provides a frame for combination and evaluation of information and new experiences”. Knowledge is broadly categorized into explicit and tacit knowledge based on how easy it is to share with others (Nonaka et al. 2000). Explicit knowledge refers to the knowledge that can be coded, communicated, processed, and stored relatively easily. It can be found in books, manuals, and the like. In contrast, tacit knowledge is personal and typically not easily or fully expressed. It is not formally codified but embedded in procedures, value, and emotions. The table below provides a summary of the properties of the two knowledge types.

Table 4. A comparison of the properties of tacit vs explicit knowledge (Dalkir 2005: 8)

Properties of Tacit Knowledge	Properties of Explicit Knowledge
<ul style="list-style-type: none"> • Ability to adapt and deal with new and different situations • Expertise, know-how, know-why and care-why • Ability to collaborate, to share a vision, to transmit a culture • Coaching and mentoring to transfer experimental knowledge on face-to-face basis 	<ul style="list-style-type: none"> • Ability to disseminate, to reproduce, to access, and to reapply throughout the organization • Ability to teach, to train • Ability to organize, to systematize; to translate a vision into a mission statement, into operational guidelines • Transfer of knowledge via products, services, and documents processes

As can be seen from the table above, explicit knowledge can be easily organized and shared with others in the organization while tacit knowledge is relatively not easy to codify and share. Tacit knowledge is more challenging since acquiring tacit knowledge requires interaction and collaboration; sharing of experiences, by observation and imitation (Nonaka 2000). Nonaka (2000) remarks that tacit and explicit knowledge are complementary in nature as the process of organizational knowledge creation requires the interaction of tacit and explicit knowledge. Hence the competitive advantage organizations realize from their knowledge base depends on their capability to utilize and develop on their tacit knowledge through knowledge sharing practices.

4.3 Knowledge Sharing

Knowledge possessed by organizations makes a critical resource for value creation that provides sustainable competitive advantage. For organizations to effectively develop and capitalize on their knowledge based assets, it is not sufficient to rely on staffing and training alone but they need to develop the capability to effectively share and utilize their existing knowledge-based resources (Davenport and Prusak 2000). According to Dalkir (2005), unlike tangible resources, knowledge increases its value when shared with others which allows it to have a significant impact on performance when shared. This makes knowledge sharing strategically important asset for organizations to sustain and enhance their competitive advantage.

Knowledge in organizations is embedded in individuals' roles, skills, behaviors and practices (Grant, 1996). According to Grant, to appropriate the value of knowledge, organizations need to be able to share the knowledge possessed by individuals to others. Lubit (2001) remarks that since knowledge sharing turns tacit knowledge (an inimitable competitive advantage of organizations) into core organizational competence, knowledge sharing capability itself can be considered as an inimitable competitive advantage.

Knowledge sharing, in its general sense, involves a social interaction with the exchange of knowledge, experience and skills (Zawawi et al. 2011). Knowledge sharing requires the awareness of knowledge needs, construction of technical

and systematic infrastructure, and availing the right knowledge to those who need it (Seonghee and Boryung 2008). According to Allameh and Ahmad (2012), the main goal of knowledge sharing in organizations is to transform the knowledge and experience of individuals into organizational knowledge resources in order to enhance organizational effectiveness. Hence, knowledge sharing provides the means for individuals to contribute to the competitive advantage of the organization.

Various researchers show that knowledge sharing in organizations has a positive implication on organizational performance (Sheng and Raymond 2010). According to Emad et al. (2014), knowledge sharing involves organizational actors – individuals, teams, or organizations – exchanging knowledge and experience and being influenced by the knowledge and experience of others. Since such sharing practices require the integration of different knowledge, the result of knowledge sharing manifests itself through its impact on the performance of the recipient (Argote et al., 2000). Not only knowledge sharing enhances the performance of the individual recipient but the resulting accumulation of knowledge also allows more efficient utilization of related knowledge as it stimulates the combination of existing and newly acquired knowledge and enhances the organizations ability in making linkages and associations (Cohen and Levinthal 1990). Hence, knowledge sharing not only helps organizations enhance their performance, but also allows them to develop the readiness to respond to changing operating environment.

According to Hansen (2002), knowledge sharing is the communication process in which one or more parts of one or more organizations participate in knowledge transfer for the betterment of all involved parties. The process of knowledge sharing across teams or unit boundaries (e.g. inter-unit knowledge sharing in multi-unit organizations) tend to be more challenging than intra-team knowledge sharing (Hansen 2002). Hansen utilizes the concept of *knowledge networks* to illustrate the need for relatedness in knowledge content among the units and the network of inter-unit relations among the members of the units for successful inter-unit knowledge sharing. Relatedness of knowledge determines the usefulness of the knowledge shared between the units and affects the integrative ability of the knowledge recipient. In multi-unit organizations, the presence and closeness of units with related knowledge is necessary for inter-unit

knowledge sharing to occur and be effective as knowledge flows more efficiently through established relationships spanning subunit boundaries.

Knowledge sharing between units with weak inter-unit network relations tends to lead to *knowledge distortions* (also known as *knowledge depreciation*) described as an incomplete or partial transfer of knowledge that distorts the meaning and application of the knowledge (Argote et al. 2000). Knowledge distortion can be unintentional or deliberate and can be caused by the sharer or intermediary party forgetting details, not passing on the original content, filtering, or withholding aspects of the knowledge or its application. Such knowledge depreciation can occur not only with inter-unit knowledge networks but also with individual interactions within a single unit.

In summary, knowledge sharing is an essential strategic capability that allows organizations to capitalize on knowledge-based resources and its success is vital for sustained organizational performance (Cabrera, 2005). Realizing its potential, many organizations have invested considerably into knowledge management initiatives to develop their knowledge sharing capability. To that end, the next section provides an overview of knowledge management.

4.4 Knowledge Management

Organizations need to manage knowledge carefully since it is a crucial resource for value creation and serves as a source of competitive advantage for the organizations (Grant 1996). Hence, knowledge management capabilities, processes to develop and use knowledge within the organization, are essential for sustained competitiveness (Gold et al. 2001). According to Gold et al. (2001), the organizational capabilities essential for effective knowledge management include knowledge infrastructure (consisting of technology, structure, and culture) along with knowledge processes for acquisition, conversion, and application of knowledge.

Gold et al. (2001) considers knowledge management as a process through which organizations generate value from their knowledge-based assets. Knowledge management is a systematic process involving all activities affecting knowledge: identifying, capturing, creating, organizing, storing, representing,

distributing, reusing, and enabling the adoption of tacit knowledge and explicit knowledge (Probst 2000). According to Dalkir (2005), organizational knowledge can be managed in an explicit form in a cyclic process (called a *knowledge management cycle*) which consists of three main phases: knowledge creation, knowledge sharing, and knowledge application.

The following figure depicts the phases in knowledge management cycle as suggested by Dalkir (2005).

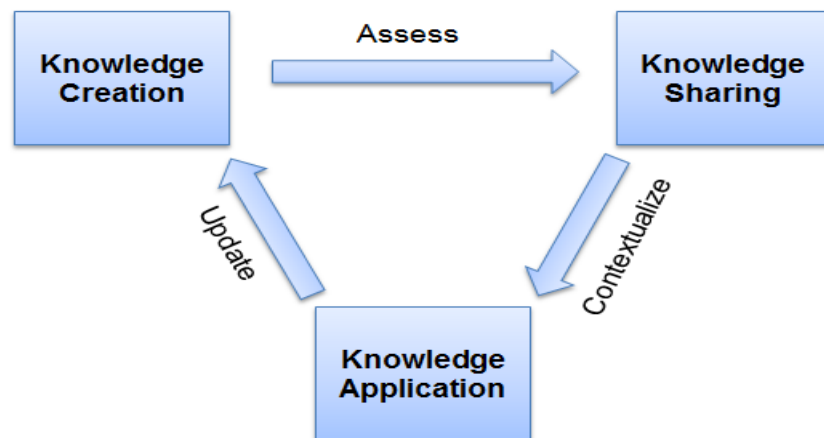


Figure 6. Knowledge management cycle (Dalkir 2005: 43).

Knowledge Creation in Dalkir's knowledge management cycle makes the first stage. This stage deals with the identification and development of existing knowledge and new knowledge. Nonaka (2000) describes organizational knowledge creation as the conversion of tacit individual knowledge to explicit organizational knowledge through the interactions of individuals within the organization. According to Nonaka (2002), the core of the knowledge creation is the four step knowledge conversion process involving socialization, externalization, combination, and internalization. The figure below illustrates the knowledge creation process.



Figure 7. Knowledge creation process (Dalkir 2005: 53. Adopted from Nonaka 1995: 62).

As Figure 7 illustrates, *socialization* involves the interaction of individuals or groups where tacit knowledge shared among the participants through discussions, meetings, and other interactions. *Externalization* involves the conversion of the shared and gained tacit knowledge into explicit knowledge which can be documented or stored in knowledge management systems. *Combination* refers to the creation of new knowledge through the conversion of one form of explicit knowledge into another form of explicit knowledge. Finally, *internalization* refers to the stage where individuals convert explicit knowledge into tacit knowledge. These four stages of knowledge creation form a spiral of knowledge conversion (known as a *knowledge spiral*) from tacit to explicit and from explicit back to tacit, thereby by creating knowledge through continuous and dynamic interaction between the tacit and explicit knowledge forms.

The second phase in Dalkir's knowledge management cycle is *knowledge sharing*. After knowledge creation, the newly acquired knowledge needs to be assessed and validated in terms of content and value for the organization. It then needs to be delivered to potential users through sharing and dissemination.

Knowledge sharing is fundamental to organizational success and is a key determinant factor for the success of knowledge management (Judith et al. 2012). According to Judith et al. (2012), the critical importance of knowledge sharing is that it is the link between the individual, who own the knowledge, and the organizational, where the knowledge is applied and creates value. Knowledge sharing is not only a means of knowledge dissemination but also a crucial element of

the knowledge creation process. When knowledge is shared (which includes both explicit and implicit knowledge) in a different context, the exchange might lead to the creation of new concepts which benefit the organization's interest (Judith et al. 2012). According to Judith et al. (2012), one of the main purposes of knowledge management is to facilitate knowledge sharing between individuals and across units of organization. Shared knowledge enhances the performance of both the individual and the organization while lack of effective sharing leads to fading knowledge, also called *knowledge depreciation* as it loses quality and value in time. Hence, the success of knowledge management highly depends on the success of knowledge sharing.

Finally, Knowledge Application, the third phase in Dalkir's knowledge management cycle makes the stage where the knowledge previously created and shared is put into use. The individuals that apply the knowledge need to understand the content of the knowledge, validate the relevance of the knowledge, and utilize the knowledge in their context.

Summing up, Emad et al. (2014) remark that one of the main goals of knowledge management initiatives is to improve or enable knowledge sharing between individuals and across units for organizations. As Dalkir's knowledge management cycle illustrates, knowledge sharing is not only an integral component of knowledge management but also a key enabler for the whole knowledge management process as it fuels the creation new knowledge.

4.5 Organizational Learning

The ability to learn continuously, leverage and utilize knowledge for innovation, and acquiring new knowledge allows organizations to achieve sustained organizational success and maintain their competitiveness (Liedtka 1999). This organizational capability is essential to retain and benefit the advantages of knowledge management practices (Senge 1990). This ability also makes organizational learning a critical strategic asset for achieving a long term organizational success.

Organizational learning is a dynamic, knowledge-based process where knowledge is transferred along different levels from the individual level to the

organizational level and back to the individual level (Crossan et al. 1999). According to Emad et al. (2014), organizational learning can be considered as the process of transformation of individual knowledge to organizational knowledge. Hence, Pilar et al. (2005) highlights knowledge and knowledge process (the acquisition, creation, dissemination and integration of knowledge) in organizations as key strategic resources for organizational learning.

Jacky (1999) identifies organizational learning as a cyclic process with four components: knowledge acquisition, knowledge distribution, knowledge interpretation, and organizational memory. According to Jacky (1999), organizational learning starts with the acquisition of knowledge from internal and external sources including the organization's own past experience (failure or success), new or existing employees, the experience of other companies, and so on. This newly acquired knowledge will then need to be disseminated throughout the organization through various knowledge sharing mechanisms so that it would benefit the organization through its application by the organization wide employee base and catalyzing new knowledge creation at the same time. The application of the newly acquired and shared knowledge, in many cases, requires the proper contextualizing to the application area at hand. This stage is what is referred as knowledge interpretation. It is defined as the process of finding meaning out of knowledge in the context of its application. Davenport and Prusak (2000) stress that the usefulness of knowledge is determined only after *interpretation*, which is influenced by the individual values, beliefs and absorptive ability. Finally, the newly formed and experienced knowledge will be committed and retained in the memory of the organization in the form of habits, behavior, culture, employees' knowledge base and skill, processes, and procedures.

Thus, organizational learning essentially is a knowledge-based process and hence is strongly related with knowledge management (Garratt 1990). According to Garratt (1990), knowledge management affects organizational learning positively, especially in knowledge-intensive fields, as knowledge management is essential for the development of individuals and organizations learning abilities. Garratt (1990) identifies organizational learning as the goal of knowledge management. Knowledge management enables organizational learning in the creation, dissemination and application of knowledge thereby helping organiza-

tions to continuously identify, implement and institutionalize improvements which will be embedded in the organizations through its routines.

Summing up, as discussed in Jacky's organizational cycle, knowledge sharing is not only an integral part of organizational learning but also a key enabler of the organizational learning process. Emad et al. (2014) also highlight the critical role of knowledge sharing in organizational learning. According to Emad et al. (2014), organizational performance depends on the effective utilizations of organizational knowledge with in the individuals, teams and across different units. Hence, knowledge sharing between individuals and across organizational boundaries is the key enabler of organizational learning (Nordtvedt et al. 2008). Knowledge sharing enables the knowledge conversion process from the individual, where knowledge resides, level to the organizational level, where knowledge is applied.

4.6 Factors Influencing Knowledge Sharing in Organizations

Researches show that knowledge sharing success highly depends on the knowledge sharing behavior (attitude, intention, and motivation) at the individual, group, and organizational level (Sheng and Raymond 2010). Multitudes of factors contribute in shaping the knowledge sharing behavior within organizations. The factors need to be identified and addressed properly so as to foster knowledge sharing in organizations. These factors can be categorized in to three major dimensions: environmental level, individual level, and knowledge level (Sheng and Raymond 2010, Heng-Li and Ted 2008).

4.6.1 Environmental Factors Influencing Knowledge Sharing

Sheng and Raymond (2010) categorize the environmental factors in to three sub-categories: organizational context, interpersonal and team characteristics, and cultural characteristics.

One of the main factors under the organizational context is the organizational culture and climate towards knowledge sharing. Learning orientation, trust and reciprocity and openness of an organization's culture are important enablers of

knowledge sharing. Cooperative organizational climate, as opposed to competitive one, has also been identified to be supportive of knowledge sharing. Another important factor in organizational context is the knowledge sharing orientation of the management. Management support and encouragement has a direct effect on the perception and behavior of the employees towards knowledge sharing. In some cases, management encouragement can be through explicit rewards and incentives which have been found to have a positive impact in knowledge sharing behavior. The last factor discussed under organizational context is the organizational structure of the organization. Organizations can be structured in such a way that they can foster the knowledge sharing capability among the employees. Sheng and Raymond (2010) suggest that functional structures tend to hinder knowledge sharing while open and decentralized structure significantly enhances knowledge sharing among the employees.

Interpersonal and team characteristics is another essential environmental factor to consider for successful knowledge sharing. Essential team characteristics that foster knowledge sharing include the closeness and cohesiveness among the team members, open communication within the team and the way individuals are empowered for leadership within the team. Sheng and Raymond also suggest that certain individual personalities such as sociability, agreeability, and extravertness are positively associated with knowledge sharing. Diversity of the team is also another important issue to be addressed. According to Sheng and Raymond, individuals who feel minority status in a heterogeneous team because of race, gender, marital status, or education have a tendency to be reserved in knowledge sharing. Acknowledgement of expertise by the team members and leadership is crucial to boost the knowledge sharing confidence of the minority group. Finally, social networking plays a critical role in knowledge sharing. The stronger the social ties among the knowledge sharing parties, the higher the degree and quality of knowledge sharing within and across teams.

In more culturally diverse environment like multinational organizations, culture and language are essential environmental factors determining the success of knowledge sharing across borders. Cultural and language differences typically can pose challenges for knowledge sharing. According to Sheng and Raymond (2010), cultures with collectivistic tendency are more positively related with

knowledge sharing than those with individualistic tendency. Rewards and incentives are also related positively in fostering knowledge sharing across cultural boundaries.

4.6.2 Individual Factors Influencing Knowledge Sharing

On the individual level, various factors determine the knowledge sharing behavior and ability of the individual. Sheng et al. 2010 and Heng-Li et al. (2008) discuss three essential factors to consider on the individual level – the personality of the individual in relation with knowledge sharing, the motivation of the individual for sharing knowledge, and knowledge sharing capability of the individual.

First, the personality of the individual has an impact in the knowledge sharing process. According to Sheng and Raymond (2010), certain characteristics including openness to new experience, confidence in knowledge sharing, and acceptance of negative evaluation are positively related to knowledge sharing success of the individual.

The second important individual factor for knowledge sharing is the motivational factor. As knowledge sharing is highly personal experience, the motivation of the individual to share knowledge is a critical success determinate. Without the willingness and action of the individual knowledge sharing cannot happen. Among the more researched factors influencing the individual's motivation for knowledge sharing are: (a) the belief of knowledge ownership, (b) perceived cost-benefits, (c) interpersonal trust, and (d) individual attitudes.

The *belief in knowledge ownership* refers to the perspective of the individual on who owns the knowledge – the individual or the organization. According to Sheng and Raymond (2010), the belief of self-ownership (the knowledge belonging to the individual) is more positively related to knowledge sharing as this is linked to the individual's pride and internal satisfaction from sharing their own knowledge.

Perceived benefits and costs of knowledge sharing are other important motivational factors in knowledge sharing. Perceived benefits such as social respect, professional reputation, and tangible incentives are positively associated with knowledge sharing while perceived costs such as time and effort spent, unfamiliarity with the subject, and loss of knowledge power have a negative influence on knowledge sharing.

Interpersonal trust is another key factor influencing the motivation to share knowledge because, in most cases, knowledge sharing happens with the expectation of reciprocity – meaning that the sharer expects a reversal of the sharing roles in the future. According to Sheng and Raymond (2010), individuals tend to share more with people they believe are honest, fair and have integrity.

Finally, the individual's motivation to share knowledge is influenced by beliefs and attitudes. For example, the expectation of the usefulness of their knowledge, the belief that their knowledge is benefiting others and that through sharing they can improve their relationship with others have a positive associations with their motivation to share knowledge. The perspective of the individual on knowledge sharing as in-role (part of the formal job description) or extra-role behavior also influences the motivation for knowledge sharing, because when considered in-role, knowledge sharing is expected and rewarded through evaluation.

The third important determinant factor of knowledge sharing success at the individual level is the knowledge sharing capability of the individuals. The main goal of knowledge sharing is the successful transfer of knowledge from the sender to the recipient (Emad et al. 2014). As such, the success of knowledge sharing highly depends on the ability of the sender to organize and share the required knowledge and the absorptive ability of the receiver to contextualize and apply the knowledge obtained through a network of relationships (Cumings and Teng 2003). Inability to successfully share knowledge leads to knowledge depreciation (a diminish in the quality and value of knowledge) which results in decreased individual and organizational performance. Cumings and Teng (2003) define knowledge sharing capability as the combination of the individual's ability, motivation, and opportunity to share knowledge. The ability to share knowledge refers to the similarity in knowledge base of the

sender and receiver of knowledge that enables understanding between the sharing parties. The motivation relates to the willingness of the individuals to share their knowledge while the opportunity refers to the availability of sufficient knowledge sharing mechanism such as trainings, job rotations, and tools and processes. Cummings and Teng (2003) remark that individuals being able to understand and organize the knowledge they receive through a network of relations and being able to codify and synthesize the knowledge properly in a way that can be transferred to further recipients is vital for the success of knowledge sharing in organizations.

4.6.3 Knowledge Related Factors Influencing Knowledge Sharing

The success of knowledge sharing is also influenced by the characteristics of knowledge (Heng-Li and Ted 2008). Two main categories of characteristics have been discussed in various researches in relation to knowledge sharing: shareability and scarcity.

The shareability, or the ease of sharing the knowledge, is the most common characteristics used to categorize knowledge. Based on its shareability characteristics, knowledge can be classified as explicit or tacit. As discussed in previous sections, explicit knowledge can easily be documented and shared with others while tacit knowledge is personal, obscure and difficult to share with others. Managing implicit knowledge requires first to be converted to explicit knowledge through the knowledge conversion process as described in 'Section 4.3'.

The other characteristic, in relation to its effect on knowledge sharing, to categorize knowledge is based on scarcity. According to Heng-Li and Ted (2008), the scarcity of knowledge determines its economic value to the individual, and hence, the willingness of the individual to share the knowledge – the scarcer the knowledge the organization needs, the higher the economic value of the knowledge possessed by the individual. Becerra-Fernandez et al. (2004) distinguish knowledge into general and specific knowledge based on its economic value. General knowledge is possessed by many individuals within the organization and can be shared easily while specific knowledge belongs to limited number of individuals and cannot be shared easily. According to Heng-Li and

Ted (2008), this characteristic of knowledge is the basis for the economic motivation of individuals for knowledge sharing. This is especially true in knowledge-intensive organizations. Since specific knowledge is powerful and scarce resource in such organizations, sharing knowledge would not be in the best interests of the individual. In this case, the economic interest of the individual and the knowledge sharing need of the organization would be in conflict because for the individual sharing scarce knowledge would lead to lose of the knowledge advantage. Heng-Li and Ted (2008) suggest that organizations can resolve such conflict by instigating the proper innovation process that promotes unselfish knowledge sharing coupled with the proper incentive mechanisms.

4.7 Best Practice of Knowledge Sharing in Organizations

With the realization of the critical role of knowledge sharing in sustained organizational performance, organizations have been implementing numerous methods and tools to foster knowledge sharing inside and outside the organization. The following sections provide an overview of commonly used knowledge sharing methods and tools discussed in literatures.

4.7.1 Knowledge Sharing Methods in Organizations

The knowledge sharing methods organizations use range from technologically assisted to face-to-face methods supporting knowledge sharing in a closed-network person-to-person form or in an open-network form sharing through a central open repository (Pheladi et al. 2014). The methods organizations choose depend on and need to be adapted to the specific needs of the organization. Pheladi et al. (2014) discusses the following compilation of knowledge sharing methods commonly used by organizations.

Intranets and extranets

Intranets and extranets are organization wide computer networks which can serve as a platform for knowledge sharing. The difference between intranets and extranets is that access to intranets is limited to inside the organization while extranets allow limited and controlled access from outside the organization. Intranets and extranets with the right type of application software infra-

structure can be used for knowledge sharing, documents and content storage, collaboration and interactions, and so on.

Retrospects

A retrospect is an after event meeting at the end of a specific undertaking or project where participants of the project review and reflect on the events involved or occurred during the project or undertaking. This allows for the collective telling of the entire journey of the project there by the participants gain understanding of the whole project beyond their specific part of implementation. Retrospects are used identify challenges, learn from success and failures and fill the gaps for future undertakings.

Mentoring

Mentoring is one of the most common knowledge sharing method practiced in organizations. Mentoring involves a learning relationship between a mentor, a highly experienced individual, and a mentee, a less experienced individual, where the mentor provides guidance and advice to the mentee. For the learning to happen, the mentor needs to share knowledge with the mentee which makes mentoring a knowledge sharing platform.

Coaching

Coaching is another relatively common practice in organizations. Coaching involves a process where a selected coach, a highly experienced individual, helps a coachee, a less experienced individual; develop the abilities, skills and qualifications necessary to achieve the organizations goal. Mentoring is typically associated with details of a specific knowledge while coaching takes a broader perspective of achieving organizational vision and goals.

Peer assist

Peer assist is a knowledge sharing methodology based on feedback or brainstorming on a particular subject or problem thereby allowing gathering lessons learned from the participants.

Formal group-based knowledge sharing

The role of knowledge sharing not only in knowledge creation, but also the use of knowledge and ultimately on the performance of both the individual and the

organization has been increasingly understood by organizations in recent times. With this understanding, the use of group based task forces is becoming more common especially in knowledge intensive work areas. Such arrangements facilitate the integration of individual knowledge to the collective organizational level where it will be accessible to a larger audience for use. Formal knowledge sharing groups are useful from information sharing, critical questioning, and time management perspectives that ultimately help enhance the performance of the group.

Knowledge network

A knowledge network as a knowledge sharing method is a network formed by group of individuals with common interest on a particular subject area in order to exchange knowledge and learn from each other. Knowledge networks are typically considered as formal method of knowledge sharing endorsed through corporate policies.

Communities of practice

Communities of practice are groups of people with a common shared interest who together on a regular basis to discuss and share knowledge on the particular topic of interest to gain a deeper understanding collectively. Unlike knowledge networks, communities of practice are generally informal and are time bound; typically formed in response to a particular topic of concern. The interaction among member of the communities of practice can be offline through face-to-face meetings or online through the use of social media and group ware technologies. The main strengths of communities of practice include the ability to promote best practices, develop individual's professional skills, and help organizations retain their talent base.

Knowledge cafés

Knowledge cafés are emerging means of knowledge sharing in organizations involving a group of individuals with similar problem or topic of interest getting together to interactively solve the problem through sharing of their knowledge. Knowledge café events involve a guest speaker(s) that open the discourse, followed by open-ended questions that serve as a basis for conversation, detail discussions in small groups of four to five participants, and finally a feedback session to the larger audience.

Knowledge fairs

Knowledge fairs are means for knowledge and information sharing on a particular theme through various techniques including kiosks, presentations, panels, showcases, and demonstrations. These techniques are typically used for knowledge sharing with the outside world and are typically useful to disseminate large amount of information in a single event.

Chat shows

Chat shows are fun and informal ways for sharing knowledge and information typically in format of television chat shows with host and guests. Guests can come internally from within the organization or externally from outside including customers, technology experts, or industry analysts. Audience questions are highly encouraged and are the main means for extracting knowledge from the guests.

In summary, various methods exist in literature for implementing effective knowledge sharing in organizations. Based on their specific knowledge sharing needs and requirements, organizations need to select and adopt the right methods to implement effective knowledge sharing in the organization.

4.7.2 Knowledge Sharing Tools in Organizations

Generally speaking, the main goal of knowledge sharing tools is to facilitate interactions between the sharing parties (sender and receiver) so as to enable exchange of knowledge and experience and engage in problem solving (Phe-ladi et al. 2014). With the help of intranets and extranets, organizations have adopted multitude of knowledge sharing tools to foster knowledge sharing (Darius 2007). According to Wanger (2004), the most common collaborative tools organizations utilize for knowledge sharing including e-mails, static and database-backed web pages, Internet chat (instant messaging), discussion forum, video and audio streaming, video and audio conferencing, weblogs (blogs), and wiki.

Wikis in particular have become one of the most widely adopted tools for knowledge sharing, especially in knowledge-intensive organizations. For example, Wanger (2004) remarks wikis as one of the prominent knowledge sharing tools in R&D and technical support environments where interaction and collaboration are of paramount importance for new product development and troubleshooting of product failures. From the time Wikis were developed in 1995 for software development applications, they have been adopted across diverse disciplines for a range of applications due to their rich feature set and ease of customization.

According to Wanger (2004), a wiki (*from the Hawaiian word equivalent to 'quick'*) is defined as “a freely expandable collection of interlinked Web pages, a hypertext system for storing and modifying information – a database where each page is easily editable by any user with a forms-capable Web browser client”. Wikis provide organizations with the option for a very low cost (much of today's Wiki software is available as open source software) collaborative platform with various features and characteristics including total freedom for users to share content without supervision, simple and uniform navigation format, and ease of use (creating, deleting, and editing pages with limited or no training required). Wikis have the capability for group creation of pages; storage and retrieval of documents, presentations, and images; content searching; tracking of changes and revisions; notification of content changes to users; and online discussions.

These set of features make wikis invaluable tools for knowledge sharing in organizations. The high level of collaboration enabled by wikis facilitate a more effective knowledge sharing through a more interactive and conversational approach.

4.8 Conceptual Framework of This Thesis

The literature review focused on exploring and drawing up on existing knowledge as for knowledge sharing in organizations. As various researchers suggest, knowledge sharing is a challenging subject for many organizations as it depends on establishing the right organizational behavior for knowledge sharing which is influenced by multitude of factors. Hence, in selecting and implementing knowledge sharing *practices*, organizations need to identify and address the knowledge sharing *factors* relevant in their context. The selected knowledge sharing mechanism needs to take these factors into consideration to enable effective knowledge sharing. Based on that, the conceptual framework for this study can be illustrated as shown in the figure below.

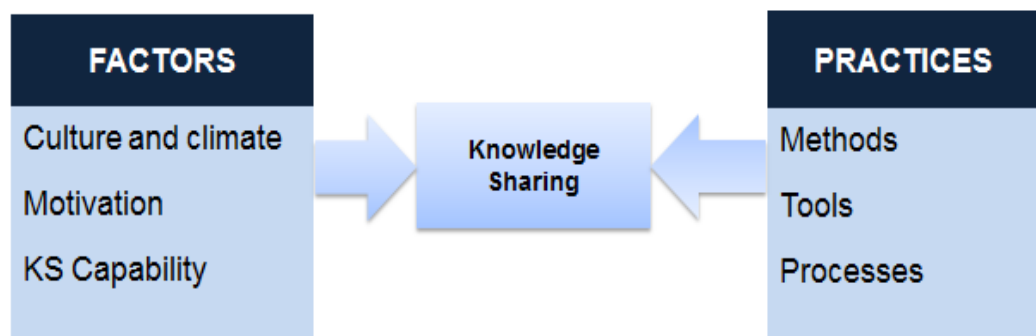


Figure 8. Conceptual framework for improving knowledge sharing in the case organizations.

Figure 8 depicts the conceptual framework for improving knowledge sharing between R&D and TAC organizations in the case company. The conceptual framework has two essential components – (a) factors influencing knowledge sharing behavior and (b) practices that can be utilized to enable and enhance knowledge sharing in the case company. In the context of the case organization, three key factors influencing the knowledge sharing between R&D and TAC have been identified – the organizational culture and climate supporting knowledge sharing, the motivation of the individuals for knowledge sharing, and the knowledge sharing (KS) capability of the individuals.

In the next section, with in-depth analysis of these key determinant factors in the case organization, the most optimal best practice (methods, tools, and processes) will be selected to improve the knowledge sharing practice between R&D and TAC organizations in the case organization.

5 Proposal for Improving Knowledge Sharing Between R&D and TAC

This section presents the proposal for improving the knowledge sharing practices between R&D and TAC. First, it provides an overview of the current state of knowledge sharing and discusses the related concepts found from literature. Second, it describes the proposed solution. And finally, it provides an explanation on how the proposed solution addresses the challenges in the current knowledge sharing between R&D and TAC.

5.1 Overview of Knowledge Sharing Between R&D and TAC

Findings of the current state analysis (CSA) of knowledge sharing between R&D and TAC show that, presently, there are three methods practiced to share knowledge between the two units: (a) R&D documentations, (b) Case Database, and (c) email exchanges. The findings show that the current state of knowledge sharing between the two units has both strengths and weaknesses.

The strengths include: (a) conducive organizational environment and (b) the willingness of the individuals to share knowledge. Among the major challenges, on the other hand, are: (a) the lack of knowledge sharing before or at new feature release relevant for TAC engineers, (b) difficulty of access to R&D contacts for TAC engineers, (c) inefficient utilization of R&D time and resource on redundant email exchanges, (d) lack of common systematic tool for knowledge sharing relevant to TAC engineers, and (e) the challenge for TAC engineers to acquire whole picture of new features in relatively short time.

From the point of view of the conceptual framework defined for this study, the findings of the CSA correspond to the factors influencing the knowledge sharing behavior in the case organization, while the selected practice will be utilized to enhance the existing strength and address the challenges. The table below illustrates how the strength and weaknesses of the CSA findings are mapped to the conceptual framework.

Table 5. Mapping of the CSA findings against elements of the conceptual framework.

CSA		CF	
Strength		Factors	Practices
1	Conducive organizational environment	Culture and climate	Methods, Tools, Processes
2	Willingness of individuals to share knowledge	Motivation	
Weakness			
3	Lack of <i>a common systematic mechanism</i> for knowledge sharing relevant to TAC engineers	Knowledge sharing capability	
4	Lack of knowledge sharing <i>before or during the new feature release</i> relevant for TAC engineers		
5	Challenge for TAC engineers to acquire <i>a whole picture</i> of new features in a relatively short time		
6	Inefficient <i>utilization</i> of the R&D time and resource on redundant email exchanges		
7	Difficulty of <i>access</i> to R&D contacts for TAC engineers		

As can be seen in Table 5, the strength areas identified in the CSA findings map directly to the first two factors identified in the conceptual framework – (a) culture and Climate and (b) Motivation – while the weaknesses from the CSA findings can be mapped to the third factor in the conceptual framework – knowledge sharing capability.

Literature shows that conducive organizational culture and climate is critical factor in fostering effective knowledge sharing behavior in organizations. To that end, the findings of the current state analysis show that the case company culture is conducive and the management of the case organization has the proper recognition and support for knowledge sharing between the two units. Another factor is the cooperative, rather than competitive, climate between the two units. TAC supports customers with the features R&D developed for customers. With-

out the success of one unit, the other cannot achieve its goal. This lays the foundation for cooperation between the two units.

The *willingness and motivation* of R&D engineers to share knowledge with TAC seems to be mainly driven by the reciprocity factor inherent in the nature of cooperation between the two units. Reciprocity is one of the main factors positively associated with individuals' motivation for knowledge sharing in organizations. In one-to-one interviews, R&D engineers have indicated that even if more and improved knowledge sharing between the two units require more time and effort, the benefit of TAC engineers being able to competently support their feature ought weighs the cost of time and effort.

On the other hand, the current state analysis also reveals a number of challenges in the current knowledge sharing practices ranging from lack of tool relevant for TAC engineers in the context of knowledge sharing related to new features to the difficulty of access to R&D engineers responsible for the new features. These challenges are in one way or another related to inadequacy in knowledge sharing capability – the third factor in the conceptual framework. Knowledge sharing capability refers to ability and opportunity of the individuals (both sending and receiving parties) for sharing knowledge. Knowledge sharing ability of the sender refers to the ability of the sender to recognize the knowledge needs of the recipient, to organize, and deliver the knowledge to the recipient in an optimal way. For the recipient side, knowledge sharing ability refers to the ability to synthesize the knowledge obtained from various sources and apply it in their own context. The opportunity side of knowledge sharing capability refers to the various mechanisms that enable and provide the opportunity for the sender and receiver to share knowledge. A simple example is coaching as a knowledge sharing method providing both the coach and coachee the opportunity to interact and share knowledge.

In conclusion, the essence of this study, and the proposed solution, lies in leveraging the existing strengths as opportunities and addressing the challenges identified by enhancing knowledge sharing capability between the two units in the case organization. The next section discusses the process of building the proposal to that end.

5.2 Building the Initial Proposal (Data 2)

This proposal is developed based on the input of key stakeholders (Data 2) and the findings from knowledge sharing best practice in literature. Participants of the study were selected from both R&D and TAC to address the concerns of both sides (listed in Table 1, Section 2.3). Detail interviews were conducted with the participants to gather their ideas and suggestions for improving the current knowledge sharing practice between the two units. Once a draft proposal has been created, the proposal was distributed to the participants through emails, documents describing the proposal, and a wiki page depicting the proposed solution. Feedbacks were then collected from the participants and utilized to improve the draft proposal further.

Various suggestions (mapped to practices in the conceptual framework) were made from the participants towards the proposed solution. The table below summarizes the suggestions for improvements from the participants.

Table 6. Summary of improvement suggestions from the participants.

Improvement Suggestions	Description	CF Practice
1. Create a mechanism to facilitate knowledge sharing between R&D and TAC	Enable effective knowledge sharing between R&D and TAC Facilitate two way communication between R&D and TAC Optimized for knowledge needs of TAC engineers	Method Tool Process
2. R&D presentation for new features	Providing overview and know-how for the new features, including: <ul style="list-style-type: none"> • How the feature works. • How to configure the feature • How to test and verify that feature is working as designed. 	Method
3. Debugging session for new features	Provide TAC engineers hands-on experience on using and troubleshooting the new feature.	Method
5. R&D contact for new features	Help TAC engineers understand the new features. Address concerns or questions from TAC engineer At least for major releases	Tool Process
6. Networking events	Improve the inter-unit relations between R&D and TAC	Method

As can be seen in Table 6, the participants of the study have provided concrete suggestion towards improving the current state of knowledge sharing between the two units. The participants of the study stressed the need for improvements on the knowledge sharing practice between R&D and TAC. Participants stressed the need to create an effective knowledge sharing *mechanism* optimized for the needs of technical support engineers. Implementation of such a mechanism would give R&D engineers the opportunity to share relevant knowledge with TAC engineers *in a common systematic manner*. Another suggestion is to arrange *presentations and debug sessions* following new feature releases. The presentations can provide TAC engineers an overview of the feature while the debug sessions help TAC engineers to gain hands-on experience on using and troubleshooting the new feature. TAC engineers have also pointed out the need for *improvement in R&D documentations* to include relevant details for TAC engineers in terms of configuring and troubleshooting feature. Finally, both R&D and TAC participants have expressed the need for networking events that would help develop the social network between the two units.

The next sub-section presents the proposal built from the improvement suggestions of the participants of the study and best practice in literature for improving knowledge sharing between the two units.

5.3 Proposed Solution

This proposal aims to put forward concrete and actionable recommendations to improve the current state of knowledge sharing between R&D and TAC. The conceptual framework of the study identified three key factors for the success of knowledge sharing in the case organization: (a) organizational culture and climate, (b) individuals motivation to share knowledge, and (c) knowledge sharing capability of the individuals. On the other hand, in the current state analysis the first two key factors ((a) and (b) above) were identified to be on the strength side while various challenges were identified related to the third key factor – knowledge sharing capability. Furthermore, participants of the study provided various concrete suggestions, related to methods, tools, and processes under the conceptual framework, on how to improve the knowledge sharing practice between R&D and TAC in the case organization.

Based on the suggestions from the participants and best practice found in literature, this proposal puts forward three prioritized recommendations to improve knowledge sharing between R&D and TAC: (a) implementing Feature Pages, (b) conducting Feature Knowledge Transfer (FKT) sessions, and (c) engaging R&D and TAC members in Cross-Team Networking (CTN) events. The table below summarizes the prioritized list of recommendations proposed for improving knowledge sharing between R&D and TAC.

Table 7. Summary of recommendations for improving knowledge sharing between R&D and TAC.

	Practice		Descriptions	Participant Suggestions
1	Method	Feature Page	<ul style="list-style-type: none"> • Wiki based common systematic mechanism for organizing and sharing knowledge between R&D and TAC • Feature list with update notification 	Create a mechanism to facilitate knowledge sharing between R&D and TAC R&D contact for new features
	Tool	Feature Template	<ul style="list-style-type: none"> • Structured: Enhancing the inter-unit knowledge sharing capability 	
	Process	Integrated in to <i>existing processes</i>	<ul style="list-style-type: none"> • Included in the release gate criteria under R&D feature release process • Included in "TAC Tools" under TAC troubleshooting process • Responsibility: Feature owners 	
2	Method	Feature Knowledge Transfer (FKT)	<ul style="list-style-type: none"> • Feature presentations • Live demonstrations • Hands-on debugging sessions • Live video streaming • On-demand access to recorded material 	R&D presentation for new features Debugging session for new features
	Tool	Existing tools		
	Process	Existing process	<ul style="list-style-type: none"> • Responsibility: Feature owner, TAC/RD managers 	
3	Method	Cross-Team Networking	<ul style="list-style-type: none"> • Inter-unit relation development • Chat Shows: Fun informal means for knowledge sharing and interaction 	Networking events
	Tools	Existing tools		
	Process	Existing process	<ul style="list-style-type: none"> • Responsibility: TAC/R&D managers 	

Table 7 illustrates the recommendations the proposal puts forward to improve the current state of knowledge sharing between R&D and TAC. The corresponding improvement suggestion from the participants are also indicated alongside the recommendations to illustrate the origin of the recommendations. The Feature Page is first priority recommendation to that end as it provides the primary mechanism for knowledge sharing between the two units. The second priority recommendation, Feature Knowledge Transfer (FKT), is intended to enhance the knowledge delivery to TAC based on the content of the Feature Page through various interactive means including presentations and demonstrations. Last, the Cross-Team Networking (CTN) events are intended as a means to improve the inter-unit relationships between R&D and TAC members thereby building trust and knowledge sharing culture between the units.

The following section describes the recommendations in more detail.

5.3.1 Feature Page

The Feature Page is the primary method proposed for improving the current level of knowledge sharing between R&D and TAC. It is essentially a wiki page containing a comprehensive knowledge base on the particular feature. It provides a common systematic way of organizing and sharing knowledge between R&D and TAC. It is a live document updated throughout the life time of the feature through interactions and conversations between R&D and TAC engineers.

The Feature Page uses wiki based technology thereby leveraging the existing wiki infrastructure in the organization. The familiarity of wikis for both R&D and TAC, its ease of use, and its rich set of features make the wiki based solution an optimal choice as the underlying technology. One of the vital wiki features used in here is the ability of categorizing wiki pages and automatic update notification based on subscription. For this purpose, a new wiki category (“categoryTAC”) has been created. The “categoryTAC” wiki page allows TAC engineers to see all available Feature Pages listed in one wiki page by title and subscribing to the “categoryTAC” wiki page allows TAC engineers to receive automated notification for update on any existing or upcoming new Feature Pages. This helps TAC engineers not only to see a listing of all Feature Pages but also to stay up to date with the latest changes in the Feature Pages.

As for the *process* consideration, the Feature Page is proposed to be integrated in the R&D new feature release process as one of the release gate criteria (Appendix 1). This ensures not only that the Feature Page will be an in-role responsibility of R&D engineers but also that the Feature Page will be available well before the feature released. The Feature Page is also proposed to be listed under “TAC Tools” in “TAC Troubleshooting Guide” among the list of tools used for the troubleshooting (Appendix 2). This ensures the visibility of the Feature Page in aiding troubleshooting both for existing and new coming TAC engineers.

The content of Feature Page is structured with the help of the “Feature Template” developed in close cooperation with both R&D and TAC participants. The Feature Template contains a list of topics to guide R&D engineers in organizing the feature related knowledge they share with TAC engineers and ensures that the Feature Page contains all the necessary knowledge base relevant for TAC engineers to support the feature in customer networks, thereby enhancing the inter-unit knowledge sharing capability. The below section provides the details of the Feature Template.

5.3.2 Feature Template

The Feature Template is a tool co-created with participants from both R&D and TAC. The main purpose of the Feature Template is to provide R&D engineers the capability to organize the knowledge and information related to new features in a pre-determined structure with topics relevant to TAC engineers. The topics of the Feature Template were selected based on the suggestion of both R&D and TAC participants. This ensures the relevance of the topics for both R&D and TAC.

The figure below depicts the content of the Feature Template as it appears in the Feature Page.

1. General Overview
 1. Background
 2. Feature description summary
2. Application
3. Feature breakdown
 1. Supported sub-features
 2. Restrictions
 3. Interoperability
4. Specifications
 1. Functional Specifications
 2. Related Standards
5. Configuration
6. Diagnostics
7. Known Issues
8. Materials
9. Enhancements
10. FAQ
11. Miscellaneous
12. Contact Information

Figure 9. Depiction of the Feature Template as it appears in the Feature Page.

As can be seen in Figure 9, the *Feature Template* has twelve main sections. The below table provides a brief description of the sections and the topics suggested by the participants for the Feature Template.

Table 8. Brief description of the Feature Template.

Sections	Suggested Topics
A. General Overview	Background Feature description summary
B. Application	Intended application Customer use case scenarios
C. Feature Breakdown	Sub-features Restrictions Interoperability
D. Specification	Functional specification Related Standards
E. Configuration	How to configure and use the feature Configuration commands

F. Diagnostics	Diagnostic capabilities, troubleshooting suggestions, debugging commands, methods of procedure, helpful information for escalation, ...
G. Known Issues	List of known issues
H. Materials	Related internal/external documents Presentations, videos, ...
I. Enhancements	Suggestions for improvement Implementation or documentation
J. Frequently Asked Questions (FAQ)	Frequent inquiries, good to knows, ...
K. Miscellaneous	Miscellaneous information Announcements ...
L. Contact Information	Feature owner(s)

Table 8 above depicts a summary of the main sections and topics included in the Feature Template. A description of sections of the Feature Template is given below.

A. General Overview

This section provides the reader an overall picture of the feature. It includes background information and a summary of the feature and sub-features. The background information can include customer or industry information related to the feature. It can also describe its relationship with other existing features.

B. Application

This section details the end use application the feature is intended to be used for in the customer network. The benefit of the feature for the customer can also be explained here. Diagrams can be used in this section to illustrate the application of the feature. In case there is a specific customer the feature is developed for, the specific use case of the feature in the particular customer network can be described here.

C. Feature breakdown

The feature breakdown section provides details on components of the feature. It describes supported sub-features. It details the compliance of the current feature implementation against standards. It describes restrictions in the current implementation and provides work around for the restrictions as well as estimate when the restriction will be addressed permanently. Finally, this section provides interoperability information detailing the conditions, requirements and setups required to use the feature in a multivendor environment where the case organizations product is utilized together with products from other vendors.

D. Specification

This section provides links to both external standard specifications published by the industry standardization bodies governing how the feature is expected to work and internal hardware and software specification documents for the feature (called Functional Specifications). Even though this is documents highly R&D oriented, they can be utilized as advanced reference materials for experienced TAC engineers to verify the feature is working as per the design specifications.

E. Configuration

This section describes the various scenarios and options to configure the feature and take the feature in use. It provides a list the commands used to configure the feature and description how to utilize the commands with expected outputs. It should also address potential cases of misconfiguration which typically accounts for significant amount of case escalations from customers.

F. Diagnostics

The Diagnostics section provides details on how to utilize the features diagnostic capabilities in troubleshooting potential customer problems. It describes what kind of diagnostic tools are embedded in the feature including a list of debugging commands. It also discusses what external tools to utilize for troubleshooting the feature and how to utilize them. It should provide explanation on the output of the troubleshooting tools and provide a guideline how to interpret the outputs in determining whether the feature is working as expected or not. Included here also are troubleshooting suggestion, best practices, and methods of procedure on how to effectively troubleshoot the feature in customer net-

works. Finally, in case of case escalations from TAC related to the feature, this section provides guidelines on what relevant information to collect and forward to R&D.

G. Known Issues

This section acts a record of previously known and solved issues as well as on-going issues related with the feature. This log of issues is updated by the feature owner upon receiving case escalations from TAC. It includes the case identification number, a summary of the issue, current status (fixed or possible workaround), and release information (which release the issue is found and which release has or is expected to have the fix). This is particularly very useful information for TAC engineers as it reduces the time needed to search the case database to verify whether a particular issue is a known issue or a new one. It also provides a quick way for TAC engineers to familiarize themselves with history of issues and support needs related with the feature.

H. Materials

This section lists internal and external documents relevant to design, implementation, and deployment of the feature. This includes studies and tests conducted while developing the feature. It also includes documents about other features related to this feature. Customer case studies, if available, can show how the feature is deployed in live customer networks. Finally, materials used or recorded (video) during Feature Knowledge Transfer will be linked here.

I. Enhancements

This section is dedicated to collect improvement suggestions on the feature. The suggestions can come from both R&D and TAC engineers. This provides a mechanism for TAC engineers to share their experience and observation in supporting the feature on customer networks and provide R&D engineers valuable insights into the customer deployments and support needs. R&D engineers can utilize these suggestions to improve the feature further. Suggestions can also be related to improvements on the contents of the Feature Page. This way the Feature Page remains relevant for TAC engineers.

J. Frequently Asked Questions (FAQ)

The purpose of this section is to share frequently made inquiries about the feature through peer-to-peer email exchanges to the wider audience thereby avoiding redundant inquiries. The FAQ section will be updated by the feature owner up on receiving and assessing multiple similar inquires on a particular topic. Entries can also be logged here if the feature owner anticipates such similar concerns from TAC engineers in the future or believes is a good-to-know information. This saves not only R&D time and effort on redundant inquiries, but also allows TAC engineers to quickly find answers to some of the most common concerns and questions.

K. Miscellaneous

The miscellaneous is intended to be used for miscellaneous information the feature owner deems important. One such information can be announcements for upcoming Feature Knowledge Transfer sessions.

L. Contact Information

Here information about the feature owner and immediate supervisor will be available. In case the feature has additional sub-feature owners, they will be made available too. This directly resolves the concern of TAC engineers regarding the difficulty of getting the contact of responsible R&D personnel for a particular feature.

Summing up, the Feature Template provides a structure for R&D engineers to organize the knowledge base communicated through the Feature Page. The selection of the topics in the template based on the suggestion of the participants ensures the relevance of the Feature Page for both R&D and TAC engineers. Most importantly, the selected topics ensure that R&D engineers know what knowledge is relevant to TAC engineers and TAC engineers get all the knowledge they need; there by enhancing the knowledge sharing capability between the two units.

5.3.3 Feature Knowledge Transfer (FKT)

Feature Knowledge Transfer (FKT) is the second *method* proposed for improving knowledge sharing between R&D and TAC. FKT sessions can contain three sessions - feature presentations, live demonstrations, and hands-on debugging sessions. The content used for the FKT sessions will essentially be based on the content of the Feature Page (increasing the usefulness of the Feature Page).

The purpose of the feature presentation is to provide overview and know-how for the new features including description of how the feature works, how to configure the feature, and how to test and verify that feature is working as specified. Depending on the feature, the presenter can accompany the presentation with live demonstration demonstrating how the feature works in live scenario. Finally, debugging sessions can be arranged to provide TAC engineers hands-on experience on using and troubleshooting the new feature. The FKT sessions can also be video streamed live and made available as video-on-demand for wider audience in the organization utilizing the existing video conferencing facility in many locations within the organization.

As for the related *process*, arranging and delivering FKT sessions will follow the same existing processes for conducting presentations, demonstrations, or trainings. Feature Page (under “*Miscellaneous*” topic) can be used to announce upcoming sessions or discuss the need for FKT sessions for the feature. This is particularly helpful considering the fact that not all features might require FKT sessions following release and other features might require multiple such sessions.

5.3.4 Cross-Team Networking (CTN)

The third *method* proposed for improving knowledge sharing between R&D and TAC is through the use of Cross-Team Networking (CTN) events. Inter-unit relations play a significant role in facilitating inter-unit knowledge sharing. Strong relationship results strong trust and sense of cooperation between the units. Hence, the case organization can organize social events involving the two units

to develop inter-unit relations. The case organization can leverage the existing team development events by extending the participants to include team members from the other unit. As such the existing process of organizing and facilitating team development activities can be followed for conducting CTN as well.

One recommended way of utilizing the social event beyond relation development is to organize “chat shows” as part of the networking events. This is specially recommended for TAC managers as they can utilize the existing team development programs and invite R&D feature owners as guests in the chat show. The TAC managers or selected TAC member can then act as a host facilitating the chat show. Through a fun and informal conversation between the audience (the rest of TAC member) and the guest, knowledge sharing can be achieved in the social events.

5.4 Summary

Based on the concrete improvement suggestions and best practices found in literature, three prioritized recommendations have been proposed to improve knowledge sharing between R&D and TAC: (a) Feature Pages, (b) Feature Knowledge Transfer (FKT) sessions, and (c) joint Social Events. The Feature Page provides one-stop location for comprehensive knowledge base related to the feature, while the feature owners can supplement the delivery of this knowledge base to TAC through FKT sessions involving presentations, live demonstrations, and hands-on debugging sessions. Finally, the Cross-Team Networking (CTN) events will help enhance the social ties between R&D and TAC which will enhance the knowledge sharing culture between the two units as knowledge flows more easily along established relations.

Built on the concrete suggestions from participants and best practices from literature, this proposal provides solutions to all the challenges identified in the analysis of the current state of knowledge sharing between R&D and TAC. The table below provides a summary of the findings of the current state analysis (CSA) and the features of the proposal addressing those challenges.

Table 9. Summary of CSA findings and corresponding solutions in the proposal.

CSA	Proposal
Lack of common systematic tool for knowledge sharing relevant to TAC engineers	Feature Page
Lack of knowledge sharing before or at new feature release relevant for TAC engineers	Feature Page ready before feature release Integrated with R&D feature release process Feature Knowledge Transfer sessions
Challenge for TAC engineers to acquire whole picture of new features in relatively short time	Feature Page: Comprehensive knowledge base tailored to TAC
Inefficient utilization of R&D time and resource on redundant email exchanges	Feature Page: Common visibility and access to all FAQ for frequent inquiries
Difficulty of access to R&D contacts for TAC engineers	Feature Page: Feature owner contact Information Socializing events

As Table 9 illustrates, the proposal delivers on the promise of addressing each of the CSA findings in multiple options. The Feature Page addresses directly the lack of common systematic tool for knowledge sharing tailored for the needs of TAC engineers. The integration of the Feature Page with the existing R&D feature release process ensures that knowledge sharing is guaranteed well before the feature is released giving TAC engineer time to familiarize with the feature before it is deployed in customer network. This helps TAC engineers support new features competently thereby enhancing the quality of services delivered to the customer at the time when customers typically need more support at the introduction of new feature.

The fact that the Feature Page is now integrated in the release *process* also makes knowledge sharing an in-role activity evaluated through a formal evaluation process. This in turn will enhance *the motivation* for knowledge sharing among R&D engineers. The Feature Page also enhances the capability of TAC engineers in creating and understanding whole picture of the feature. Instead of being forced to synthesize the whole picture of the feature from knowledge and information they acquire from multiple sources (R&D documentations, case databases and email exchanges), the Feature Page will provide a comprehensive

yet structured knowledge base on the feature fitting the absorptive ability of TAC engineers.

If the proposal implemented, the availability of such comprehensive knowledge on the feature for all TAC engineers well before the release of the feature will also reduce significantly the inefficient utilization of R&D time and resource on redundant email exchanges. In addition, subsequent frequently asked questions will be made visible to all TAC engineers, hence further reducing the need for peer-to-peer email exchanges for knowledge sharing. Finally, TAC engineers will no longer find it difficult to find the R&D contact responsible for a particular feature as it will be made available through the Feature Page. Furthermore, the Cross-Team Networking events will help members of both teams to develop social ties enhancing the knowledge sharing possibilities between the two units.

6 Validation of the Proposal

This section discusses the validation process for the proposed solution. First, it discusses the pilot implementation for the proposed solution to validate the proposal including feedback from the participants on the pilot implementation. Second, it describes the final proposal. Last, it discusses the responsibilities and guidelines for users relevant in implementing the proposed practices in the case company.

6.1 Validation of the Initial Proposal (Data 3)

In order to validate the initial proposal, the proposed solution (as described in Section 5.3) was presented to the key stakeholders (refer Table 1) in a meeting held on February 13, 2015. The purpose of the meeting was to present the initial proposal to the stakeholders and plan for pilot implementation.

In the meeting, the proposal was presented and discussions were held on the recommended practices. All The participants expressed very positive feedback on the proposed practices. Furthermore, due to time constraints, it was decided to pilot a Feature Page for one feature that was going to be released within two weeks' time. Moreover, all the three recommended practices (Feature Pages, FKT, and CTN) were accepted preliminarily pending for further piloting of the Feature Page for the selected feature. Finally, the R&D manger expressed strong support for including the Feature Page as a new feature release gate criteria while the TAC manger expressed strong interest for the joint CTN event to participate R&D engineers in TAC team development events.

In summary, the discussions held on February 13, 2015 have helped validate the initial proposal through the participation and support of the key stakeholders. The section below described the piloting of the selected feature as per the decision in the same meeting.

6.1.1 Pilot Implementation

This section discusses the pilot Feature Page implemented for one selected feature based on the decision in the meeting held on February 13, 2015. The researcher is the feature owner for the selected feature and took the responsibility for the pilot implementation. To that end, the researcher, first, developed the wiki page shown in Figure 10 below that facilitates the creation of new Feature Pages based on the Feature Template co-developed with the participants in this study.

[Edit](#), [History](#), [Subscribe](#), [Add Link](#), [Remove Link](#)

Feature Pages

This wiki page displays a list of Feature Pages currently available and provides an optimized mechanism to create new Feature Pages. The content of the Feature Page is generated using the Feature Template (feature_template.bat). The script creates a wiki page with the title provided, table of contents, and description of the content intended under each topic. The Feature Template can be modified by modifying the feature_template.bat script.

IMPORTANT: subscribing to this wiki page or individual Feature Pages allows R&D and TAC engineers to receive notification of updates by email.

Create new Feature Page

Create new Feature Page by giving the title (preferably descriptive of the corresponding feature) and clicking **Create page** button below.

Enter Feature Page Title:

Features

1. [GNSS Based Synchronization](#)

Figure 10. Feature Pages wiki page.

As Figure 10 illustrates, the Feature Pages wiki page not only automates the creation of new Feature Page's for R&D engineers but also displays a list of all the available features with a link to their Feature Page's. Furthermore, subscrib-

ing to the Feature Pages wiki page shown as “[Subscribe](#)” in the figure above allows TAC and R&D engineers to receive automatic updates when new features are added.

As can be seen in the figure above, “GNSS Based Synchronization” is the feature selected for pilot implementation. By entering the title in “Create page” box as shown in the figure above, the Feature Page for “GNSS Based Synchronization” was generated automatically and also listed as the first feature in the list. Clicking on the new link ([GNSS Based Synchronization](#)) would lead to the Feature Page created for the feature. The below figure depicts the resulting Feature Page for “GNSS Based Synchronization”.

[Edit](#), [History](#), [Subscribe](#), [Add Link](#), [Remove Link](#)

GNSS Based Synchronization

1. Table of Content
2. General Overview
 1. Background
 2. Feature description summary
3. Application
4. Feature breakdown
 1. Supported features sub-features
 2. Restrictions
 3. Interoperability
5. Specifications
 1. Functional Specifications
 2. Related Standards
6. Configuration
7. Diagnostics
8. Known Issues
9. Materials
10. Enhancements
11. FAQ
12. Miscellaneous
13. Contact Information

Figure 11. Extract of Feature Page from pilot implementation.

Figure 11 shows an extract of the Feature Page created in the pilot implementation using the tool developed to automate Feature Page generation. As the figure illustrates the content of the Feature Page’s is generated based on the Feature Template developed with topics recommended by participants of the study.

6.1.2 Feedback on Pilot Implementation

As per the decision in the meeting held on February 13, 2015, Feature Page was implemented for one feature selected for pilot implementation. Once the Feature Page for that particular feature was implemented, feedback was requested from the stakeholders (refer Table 1) with open-ended questionnaires distributed to the stakeholders by email on February 15, 2015. The table below describes the questions used for feedback (Data 3).

Table 10. List of questions for feedback on pilot implementation.

Feedback Questionnaires	
1	Did you find the pilot Feature Page implemented up to your expectation?
2	What is your feedback on the structure and quality of the topics addressed in the pilot Feature Page?
3	Have you subscribed to the Feature Pages wiki? And would you recommend for members of you team to do the same?
4	Would you recommend the Feature Page implementation for all features?
5	How do you describe the effectiveness of the Feature Page as a knowledge sharing mechanism between R&D and TAC?
6	What improvement areas would you like to suggest to further improve the Feature Page and/or Feature Template for the future?

As can be seen in Table 10, the questionnaires were designed to gather as much feedback as possible from the stakeholders in an open discussion format. The qualitative data from the feedbacks were analyzed with content analysis.

All participants expressed strong enthusiasm to the proposed solutions and the pilot implementation. All stakeholders provided their feedback on the same day the questionnaires were distributed (February 15, 2015). Not only all the participants subscribed to the Feature Pages wiki page, but also almost all TAC engineers and the R&D team under the scope of this study subscribed to the Feature Pages within days' time. Furthermore, both R&D and TAC engineers expressed that the pilot implementation demonstrated very well the effectiveness of the Feature Page as a knowledge sharing mechanism between the two units.

R&D engineers expressed the structure of the contents in the Feature Page helps organize the knowledge base on the feature very well and TAC engineers also expressed the coverage of the topics addresses their knowledge need comprehensively.

Based on the initial proposal presented to the stakeholders on February 13, 2015 and the result of the pilot implementation and validation, both TAC and R&D managers approved the proposed solution. Accordingly, TAC will include the Feature Pages under the “TAC Tools” in the troubleshooting process (Appendix 2) and the R&D team in the scope of this study will start utilizing the Feature Pages as one of the feature release gate criteria (Appendix 1). Furthermore, both TAC and R&D managers involved in this study have agreed to recommend the proposed solution for higher management for companywide implementation.

6.2 Final Proposal

Built with concrete suggestions from the participants of the study and best practice found in literature, the final proposal puts forward three prioritized recommendations co-created with the participants of the study both through improvement suggestions and feedback to the initial proposal to improve knowledge sharing between R&D and TAC – implementing Feature Pages, conducting Feature Knowledge Transfer (FKT) sessions, and Cross-Team Networking (CTN) events. The figure below summarizes the prioritized practices recommended for improving knowledge sharing between R&D and TAC organizations in the case company.

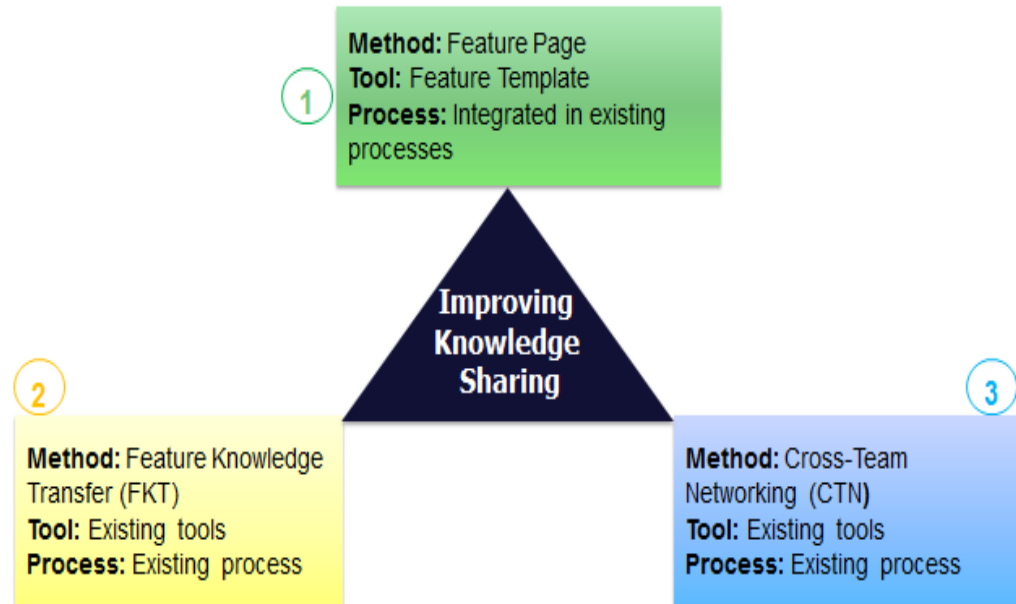


Figure 12. Recommended practices for improving knowledge sharing between R&D and TAC.

As Figure 12 depicts, the Feature Page is the primary mechanism for knowledge sharing between the two units as it is designed to provide a comprehensive knowledge base on the feature and act as the source for the content to be used in the FKT sessions. The Feature Page utilizes the Feature Template tool to structure and organize its content. The Feature Template is developed with topics suggested by the participants of the study making sure its relevance to both units. The Feature Page is integrated in the existing feature release process as a release gate criteria ensuring the availability of comprehensive knowledge base shared before the feature is released.

The second recommended practice, Feature Knowledge Transfer (FKT), provides an additional mechanism supplementing the Feature Page as a knowledge sharing mechanism. The contents of the FKT sessions will primarily be based on the knowledge base available in the Feature Page and the delivery mechanisms in the FKT sessions can include presentations, live demonstrations, and hands-on debugging sessions depending on the need and complexity of the feature.

Finally, the Cross-Team Networking (CTN) events will help enhance the social ties between R&D and TAC which will enhance the knowledge sharing culture between the two units as knowledge flows more easily along established relations. Furthermore, Chat Shows can be organized as part of the CTN events to utilize the events not only for networking but also for knowledge sharing through fun and informal question and answer sessions.

In summary, built of best practice and inputs and feedback from both R&D and TAC participants, this proposal addresses the needs and concerns of both R&D and TAC teams for improving the knowledge sharing between the two units. Implementing the prioritized recommended actions will help the case company improve the current knowledge sharing practice between R&D and TAC thereby ensuring competent, quality technical support service to its customers.

6.3 Responsibilities and Guidelines for Users

As recommended in the validation session, this study also provides a description of the responsibilities associated with the proposed solutions as well as guidelines for practitioners of the proposed solution.

There are four key stakeholders in realizing the proposed solution – R&D engineers (also feature owners), R&D managers, TAC engineers, and TAC managers. The table below summarizes the key responsibilities in implementing the proposed solutions.

Table 11. Key responsibilities for the proposed solution.

Practice	Responsibility
Feature Pages	Feature owners (R&D engineers)
Feature Knowledge Transfer (FKT)	Feature owner, TAC and R&D managers
Cross-Team Networking (CTN)	TAC and R&D managers

As can be seen in Table 11, the *responsibility* for creating and maintaining the Feature Page is mainly that of the feature owner's. Even though updating the

Feature Page is mainly the feature owner's responsibility, TAC engineers are also allowed to update the Feature Page especially on those sections that are dedicated for conversational purposes (for e.g. providing enhancement ideas or feedback). Furthermore, the *responsibility* of preparing and delivering the FKT session will primarily be that of the feature owner's while TAC and R&D managers can assist in arranging the sessions and facilities. On the other hand, the *responsibility* of organizing and facilitating Cross-Team Networking (CTN) events belong to TAC and R&D managers.

Guidelines have also been prepared for each of the four key stakeholders providing details on how to implement the proposed solutions as part of the day to day business activity. The tables below discuss the guidelines for each stakeholder on the use of the three recommendations in the proposed solution.

Table 12. Guideline for R&D managers.

Practice	Guideline
Feature Pages	<ul style="list-style-type: none"> • Ensure Feature Page is implemented for the new feature before it is released as part of the feature release criteria. • Occasionally monitors Feature Pages to ensure they get updated as time passes.
Feature Knowledge Transfer (FKT)	<ul style="list-style-type: none"> • Assist in arranging and organizing Feature Knowledge Transfer (FKT) sessions. • Co-ordinate feature owners in case multiple FKT sessions need to be conducted simultaneously.
Cross-Team Networking (CTN)	<ul style="list-style-type: none"> • Arrange and organize mixed networking events by inviting selected members of TAC to promote inter-personal relations across the two teams. • Co-ordinate with TAC managers to ensure that R&D engineers get the time necessary to participate in CTN events arranged by TAC. • Utilize feedbacks from participants to improve future CTN events.

Table 12 discusses the guidelines for R&D managers for implementing and monitoring the proposed recommendations. It outlines the essential activities for R&D managers in conducting the new practices. The main activities involve: ensure Feature Pages are implemented and maintained at high quality, ensure FKT sessions are conducted as needed, and organize CTN events. Similarly, the below table describes the guidelines for R&D engineers.

Table 13. Guideline for R&D engineers.

Practice	Guideline
Feature Pages	<ul style="list-style-type: none"> • Use the Feature Pages wiki to create new Feature Page for the feature you own by giving title and clicking create (refer Figure 10 above). The Feature Page must be created beforehand to pass the feature release criteria. • The new Feature Page will be created automatically with topics structured according to the Feature Template and a link will be included among the list of available Feature Pages at the bottom of the wiki page. The creation of the new Feature Page will also be automatically notified to all the subscribers of the Feature Page. Hence, TAC engineers will automatically know a new feature is coming up and where to get more information about it. • Use the link for your Feature Page to go to the newly created Feature Page. • Subscribe to the Feature Page so that you will be notified automatically whenever the page is updated. • Edit the page by clicking the "Edit" tab at the top and "Save" the changes. • As soon as the changes are saved all subscribed individuals will receive update notification of the changes.
Feature Knowledge Transfer (FKT)	<ul style="list-style-type: none"> • Asses the need for, arrange, and organize Feature Knowledge Transfer sessions. • Prepare the necessary materials based on content from the Feature Page and deliver or lead the FKT session. • Utilize the existing presentation and video conferencing tools to enhance the experience of FKT sessions. • Provide links for the materials used (and recorded) during the FKT sessions. • Gather feedback from participants to improve the FKT sessions. • Monitor requests for further FKT sessions (through email or wiki page) and act accordingly. • Announce upcoming FKT sessions through the Feature Page.
Cross-Team Networking (CTN)	<ul style="list-style-type: none"> • Participate in mixed team networking events and develop inter-personal relationships with individual TAC members. • If requested, take the role of Guest in Chat Shows arranged by TAC team; interacting with the audience (TAC members) through informal question and answer sessions. • Provide feedbacks on the CTN events for future improvements.

Table 13 discusses the guidelines for R&D engineers. It provides details on the activities and usage of the essential tools for practicing each of the three proposed practices. The main activities involve: create and maintain Feature Pages, conduct FKT sessions, and participate in CTN events. The use of the Feature Template tool has also been described. As can be seen in the description, the use of the Feature Template tool has been automated and is intuitive enough for any R&D engineer. Similarly, the below table describes the guidelines for TAC engineers.

Table 14. Guideline for TAC engineers.

Practice	Guideline
Feature Pages	<ul style="list-style-type: none"> • Subscribe to the Feature Pages wiki page. This ensures that you will receive automatic notifications when new Feature Pages are created or existing Feature Page is updated. • Utilize the Feature Page to acquire sufficient knowledge base on new features before and after the features are released and deployed in customer network. • Utilize the Feature Pages as part of the daily troubleshooting process. • Use “FAQ” and “Known Issues” section to quickly learn hot topics other team members are inquiring about and list of customer issues currently under investigation or already fixed. • Provide your improvement ideas and suggestions (on the feature or the wiki page content) through the Feature Page “Enhancements” section.
Feature Knowledge Transfer (FKT)	<ul style="list-style-type: none"> • Participate actively in FKT sessions to enhance the learning experience for all participants. • Request for FKT session through TAC managers or through the Feature Page “Miscellaneous” section. Check the same section for future upcoming FKT sessions. • Provide feedback on FKT session to help improve the quality and content of future FKT sessions.
Cross-Team Networking (CTN)	<ul style="list-style-type: none"> • Participate in and utilize CTN events arranged by both R&D and TAC teams to actively develop inter-personal relations with R&D engineers. • As audience, utilize Chat Shows arranged in CTN events to interact with and learn from the Guests (R&D engineers) actively through informal question and answer sessions. • Provide feedbacks on the CTN events for future improvements.

Table 14 discusses the guidelines for TAC engineers. It provides details on the activities and usage of the essential mechanisms for practicing the proposed practices. The main activities involve: utilize Feature Pages as knowledge source and troubleshooting resource, engage actively with R&D engineers in maintaining the quality for the Feature Pages through feedbacks and conversations, and participate actively in FKT sessions and CTN events. Finally, the below table describes the guidelines for TAC Managers.

Table 15. Guideline for TAC Managers.

Practice	Guideline
Feature Pages	<ul style="list-style-type: none"> • Ensure TAC engineers are aware of and utilize Feature Pages as part of the troubleshooting process.
Feature Knowledge Transfer (FKT)	<ul style="list-style-type: none"> • Assist in arranging and organizing Feature Knowledge Transfer (FKT) sessions. • Request for Feature Knowledge Transfer sessions if their teams needs further sessions.
Cross-Team Networking (CTN)	<ul style="list-style-type: none"> • Arrange and organize mixed networking events by inviting selected members of R&D to promote inter-personal relations across the two teams. • Arrange Chat Shows as part of the CTN sessions to enhance knowledge sharing in fun and informal manner. • Take (or delegate) the role of Host in the Chat Shows facilitating the interaction between the audience (TAC members) and the Guest (R&D engineers). • Co-ordinate with R&D managers to ensure that R&D engineers get the time necessary to participate in CTN events arranged by TAC. Likewise, ensure TAC engineers get the time necessary to participate in R&D CTN events. • Utilize feedbacks from participants to improve future CTN events.

Table 15 discusses the guidelines for TAC managers. It outlines the essential activities for TAC managers in conducting the proposed practices. The main activities involve: ensure the awareness and utilization of Feature Pages by TAC engineers, ensure FKT sessions are conducted as needed, and organize CTN events.

In summary, the tables above illustrate the guidelines for each stakeholder (R&D engineers, R&D managers, TAC engineers, and TAC managers) to practice the recommended solutions as part of the day to day business activity. As can be seen in the table, each stakeholder has a simple and well defined activities and responsibilities. This makes the proposed solution ready for use that can be taken in to action immediately with all tools and guidelines readily available in detail.

7 Discussion and Conclusions

This section discusses and summarizes the results of the thesis. First, it provides a summary of the thesis. Second, it discusses the managerial implications of the study. Finally, it evaluates the thesis and discusses reliability and validity of the research process and outcomes.

7.1 Summary

The focus of this study was on improving the knowledge sharing practice between R&D and technical supports organizations in the case company with the purpose to enhance the support capability of the technical support organization for new feature releases.

The research approach applied in this study was action research. In-depth interviews with key stakeholders were used as a primary source of data for the current state analysis. After key strengths and weakness areas were analyzed in the current state analysis, the main improvement area were identified to be the lack of common systematic mechanism for knowledge sharing that supports the knowledge need of the technical support organization.

In-depth literature review was then conducted to explore available knowledge on implementing effective knowledge sharing mechanisms in organizations. The literature review was utilized to identify and analyze the key success determinant factors for effective knowledge sharing implementation as well as the best practices (including methods, tools, and processes) utilized for knowledge sharing in organizations. Based on the input from the literature review and concrete improvement suggestions from the participants of the study, an initial solution was proposed and presented to the key stakeholders.

The proposed solution includes three practices for improving the current knowledge sharing between the two units – (a) implementing wiki-based Feature Pages for new features, (b) conducting Feature Knowledge Transfer (FKT) sessions, and (c) organizing Cross-Team Networking events. After the initial proposal was presented and feedback was gathered from the key stakeholders

on the initial proposal, a decision was made to pilot a Feature Page for one selected new feature.

The selected feature was piloted and the key stakeholders were once again requested for feedback on the pilot implementation. The response for both the initial proposal and the pilot implementation was overwhelmingly positive and the stakeholders showed their enthusiasm through their word of mouth advertisement of the proposed solution. Not only the participants of the study subscribed as users of the newly piloted Feature Pages, but almost all TAC engineers subscribed within a couple of days' time. Based on the initial proposal presentation and the success of the pilot implementation, both TAC and R&D managers also approved the proposed recommendations.

In summary, the study has produced validated, practical, and ready-to-use recommendations for improving knowledge sharing between R&D and TAC. The proposed solutions enhance the support capability of the technical support organization for new feature releases by enabling effective, timely knowledge sharing between the two units.

7.2 Managerial Implications

The following managerial implications have been identified to ensure the implementation of the proposed recommendations for improving knowledge sharing between R&D and TAC.

MI-1. Integrate Feature Pages into the existing processes.

R&D managers must ensure Feature Pages as part of the new feature release gate criteria while TAC managers must ensure that Feature Pages are utilized as part of the TAC troubleshooting process.

MI-2. Evaluate knowledge sharing as in-role activity.

With the Feature Page integrated in the release criteria, knowledge sharing is now an in-role (as opposed to extra-role) activity for R&D engineers. Hence, R&D managers should monitor and evaluate the coverage and quality of Feature Pages' content as part of the performance of R&D engineers.

MI-3. Assist in organizing Feature Knowledge Transfer (FKT) sessions.

Both R&D and TAC managers should assist in organizing Feature Knowledge Transfer sessions for new feature. TAC managers (with the help of their team) should evaluate the need for further FKT sessions and coordinate with both R&D managers and engineers accordingly.

MI-4. Organize Cross-Team Networking (CTN) events.

Both R&D and TAC managers need to arrange and organize mixed networking events by inviting selected members of the other team to promote inter-personal relations across the two teams. Furthermore, the managers can organize Chat Shows as part of the CTN sessions to enhance knowledge sharing in fun and informal manner. The managers should ensure the availability of their team members to participate in CTN events organized by the other team.

7.3 Evaluation of the Thesis

In order to evaluate the thesis, first, the outcome of the study compared against the research objective is discussed as defined at the beginning of this study. Second, the reliability and validity of the thesis are evaluated based on the reliability and validity plan described in Section 2.4.

7.3.1 Outcome vs Objective

The objective of the study was to improve knowledge sharing between R&D and technical support organizations in the case company. The research problem was formulated as: How to improve knowledge sharing between R&D and TAC for supporting new feature releases in the case company?

The current state analysis identified the lack of common systematic mechanism for knowledge sharing relevant for the knowledge needs of the technical support organization as the main bottleneck in the knowledge sharing practice between the two units. With concrete suggestions from participants of study and input from the literature review, three prioritized practices were recommend in this study for improving knowledge sharing between the two units – Feature Pages, Feature Knowledge Transfer (FKT) sessions, and Cross-Team Networking

events. Feedback of the participants and the success of validation through piloting confirm that the outcomes of this study fully meet the objective of the study.

The continuous, high level of engagement of the key stakeholders from both R&D and TAC has been the main strength of this study. The insight and experience of the researcher in both units has also been a valuable asset in driving the engagement and confidence of the key participants of the study and practitioners of the outcome. On the other hand, the study was limited to one R&D team in the case company. Even though, this is believed to be a solid representation of all R&D teams, further improvements can be made in the future by involving more R&D teams.

In summary, knowledge sharing between R&D and TAC is vital to meet the stringiest service quality requirements of telecom customers. This study provides a concrete, validated mechanism to enable effective knowledge sharing between the two units in a way optimized to the knowledge needs of both TAC and R&D. The continual success of such knowledge sharing implementations requires not only the recognition of the prevailing knowledge transfer practice and culture but also the continuous systematic improvement on the knowledge sharing mechanism. To that end the proposed solution not only provides mechanism for knowledge sharing but also ways for improving the mechanism itself through conversational interactions between the two units. Hence, the proposed solution enables the case organization meet its current and future knowledge sharing needs through continuous systematic improvements.

7.3.2 Reliability and Validity

The reliability and validity steps of this thesis were planned and described in Section 2.4 of this thesis. Among the implemented measures, the reliability and validity of this study considered the authenticity of data and the consideration of sufficient number of perspectives in to account. The use of multiple sources of data and various perspectives helped validate the findings and outcome of the research.

The validity of the study was ensured through the use of multiple primary data sources for triangulation. The main data source in the study was the in-depth in-

interview from key stakeholders in the case company. The participants were selected from both units (R&D and TAC) including managers and experienced team members with the necessary level of knowhow and experience in the company. Furthermore, the reliability of this study is ensured through the use of established research methods and extensive analysis and application of available knowledge and best practice in relevant literature.

The reliability and validity of the study were strengthened in the validation stage of the study through pilot implementation of the proposed solution with overwhelming acceptance from key stakeholders. The placement of the data collection stages throughout the study process ensured that the respondents were able to co-create and validate the solution both through concrete suggestions and feedbacks.

Finally, drawing from the principles of action research, the study relied on the participation of the key stakeholders with the researcher as a participant in the implementation of the desired change in the knowledge sharing practice in the case company. The researcher's experience in both units and the over 90 years of combined experience of the participants of the study in the case company were instrumental in reflecting on the current and desired state of knowledge sharing in the case company. The selection of key stakeholders (managers as well as team members) with extensive experience in the case company has ensured wide participation and avoids possible bias, thereby strengthening the reliability and validity of the study.

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Appendix 1. R&D Gate criteria for new feature release.

1. Info model - DONE
2. All implemented - DONE
- 3. Feature Page - DONE**
4. SAS - DONE
5. SW design specifications - DONE
6. MCL submission gate criteria - DONE
7. Test coverage - DONE
8. Defects - DONE
9. Requirements mapping - DONE
10. Testing reviews - DONE
11. QC Test Plan - DONE
12. Regression script review - DONE
13. Scalability - DONE (N/A)
14. Regression transfer - DONE
15. Customer documentation - DONE
16. Limitations - DONE
17. Lessons learned - DONE

Appendix 2. Recommended “TAC TOOLS” under TAC Troubleshooting Guide

1. ClearCase
2. ClearQuest
3. R&D Documentations
- 4. Feature Page**
5. GS3 Search
6. Callstack Resolver
7. Tech-Support Parser
8. Binary log Decoder
9. CoreDump Analyzer
10. PPN Library
11. Product RoadMaps
12. War Room
13. FTP Server
14. Customer Remote Connections