ICT Enabled Knowledge Sharing – Impact of ICT on Knowledge Sharing Barriers

- The Case of Avanade -

Master Thesis in IT Management [EIK034]

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Rana Alamgir
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ABSTRACT

Studies in recent years have revealed that use of ICT can significantly impact knowledge sharing in organizations by enhancing the knowledge sharing process, reducing knowledge sharing barriers, and introducing technology barriers. While this has been identified in many studies and a significant research has been carried out to identify knowledge sharing barriers, there exists a considerable dearth of research when the question of ‘which knowledge sharing barriers can ICT reduce and how?’ is posed. This thesis aims to address this question by studying the case of an organization using ICT for knowledge sharing. The study was carried out using questionnaire and interview findings and results showed that if ICT is effectively used, a number of knowledge sharing barriers - in addition to time and space barriers - can be successfully reduced. Organizational and individual knowledge sharing barriers saw most reduction by ICT while technology barriers did not see any reduction by use of ICT alone. This is in coherence with different studies that use of ICT for knowledge sharing introduces its own technology barriers. However the results show that if employees are tech-savvy and management considerably supports employee involvement in the process of design and deployment of ICT enabled knowledge sharing, technology barriers can also be greatly reduced and even entirely eliminated.
ICT Enabled Knowledge Sharing – The Impact of ICT on Knowledge Sharing Barriers

THEESIS OUTLINE

Date: 7th June 2011
Course: Master Thesis in IT Management (EIK034)
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Title

Purpose
- To identify knowledge sharing barriers that ICT can reduce in organizations.
- Identify underlying reasons as to how ICT helps in reducing these knowledge sharing barriers.

Target Audience
- Primary target audience: Organizations using ICT for knowledge sharing.
- Secondary audience: Organizations using knowledge sharing and researchers/individuals.

Research Questions
1. Which knowledge sharing barriers can ICT reduce in organizations?
2. How does ICT help in reducing knowledge sharing barriers?

Methods Used
- Questionnaires
- Interviews

Keywords
Knowledge management, knowledge sharing, knowledge transfer, knowledge enterprise, barriers in knowledge sharing, knowledge sharing obstacles, ICT knowledge sharing, ICT enabled knowledge sharing, technology knowledge sharing.

Sources and Databases
Malardalens University databases, journal databases, library journals, websites and textbooks. Databases used are Google Scholar, Emerald, ABI/INFORM Global (ProQuest), ACM Digital Library and LibHub.

Findings
- ICT was found to have reduced severity for 10 out of 13 organizational barriers.
- ICT was found to have reduced severity for 5 out of 10 individual barriers.
- Employee know-how of technology and significant involvement in the knowledge sharing process was found to have eliminated all technology barriers.

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Acronyms and Abbreviations

ICT: Information and Communication Technology
IT: Information Technology
KM: Knowledge Management
KMS: Knowledge Management Systems
DBMS: Database Management Systems
DIS: Document Imaging System
This chapter comprises research and strategic questions to guide the research, discusses purpose and scope of research and provides information on target audience of the research. Information concerning the case organization is also provided in this chapter.

"In the emerging economy, a firm's only advantage is its ability to leverage and utilize its knowledge." ...Larry Prusak, Executive Director - The Institute for Knowledge Management.

Knowledge is required regardless of occupation and utilization of knowledge has developed almost all theories on strategy. Because of the diverse nature of knowledge, Knowledge Management (KM) and organizational learning have received significant attention over the last few decades. Knowledge management is a strategy process related issue and it is the key issue in strategy process research. Knowledge has been considered as a vehicle of evolving business model that eventually makes business progress. To achieve a new strategic goal by changing the current one involves a lot of factors. After the introduction of resource-based view (RBV), knowledge started to be considered as source of competitive advantage because of the complicated duplication (hard to copy) nature of it. Natures of knowledge, creation of knowledge, sharing of knowledge are some significant concerns of the today’s managers. (Hedman and Kalling 2002, pg. 95).

Hedman and Kalling (2002, pg. 215) have discussed that transforming personal knowledge into shared knowledge should be included in a KM system and sharing of knowledge can obtain new knowledge that can be potentially useful for an organization (Bessant and Tidd 2007, pg. 195). Because of the diverse nature of knowledge, it is complicated to create and access knowledge (Hedman and Kalling 2002, pg. 95). Bessant and Tidd (2007, pg. 194-195) have named the process of knowledge sharing as a “communities of practice” which is a group of human related by shared task. As human nature is diverse, the sharing of knowledge among human entity can face some hurdles.

One the major issues that organizations face in the area of knowledge management and learning is that they do not know what they know (Bessant and Tidd 2007, pg. 194). In this regard, identifying and sharing knowledge has been identified as a key concern for organizations (Bessant and Tidd 2007, pg. 186). The term knowledge sharing here as defined by Bessant and Tidd (2007) refers to a process by which existing information from different sources is shared in the organization in a way that leads to formation of new knowledge for the organization. Apparently, this might seem rather straightforward; however in practice, the issue is not a simple one because key and previously-unknown knowledge mostly originates from individuals, which is then translated into organizational knowledge (Bessant and Tidd 2007, pg. 190). This means that knowledge is inherently tacit and vague in nature and therefore it presents critical realization challenges to organizations that rely heavily on knowledge management (agreeably, this is the case today with most large enterprises).
Many have argued the use of technology in knowledge sharing. Some think that, successful knowledge sharing can be possible without the use of technology (IT) (e.g. McDermott and O’Dell, 2001; Hibbard and Carillo, 1998) and on the other hand, some researchers think that use of technology in knowledge sharing is essential for globally spread organizations (Duffy, 2000; Lang, 2001). IT as a technology can be a helpful tool for effective knowledge sharing and can facilitate knowledge sharing in both time and space dimensions. However IT adoption itself has its own barriers and incorporating human behavior aspects into IT is a challenge. So, IT may not be considered as a tool for successful knowledge sharing but should be integrated in as a helping hand. (Mirghani et al., 2006).

1.1 MOTIVATION AND JUSTIFICATION

Different researchers have emphasized IT/ICT as an element crucial to the linkage of information and knowledge integration in organizations (Argyris and Schon, 1978; Duncan, 1972; Teece, 1998). For organizations and industries to benefit better from their ICT enabled knowledge sharing implementations, they need to consider and evaluate their knowledge sharing implementations in context of ICT. Studies on knowledge sharing imply that this is important because although the primary motive behind using ICT is to enhance knowledge sharing and solve existing knowledge sharing issues (Hendriks, 1999), yet in the process ICT introduces its own technology barriers in addition to influencing other knowledge sharing barriers and knowledge sharing process (Han and Anantatmula, 2007, Hendriks, 2001). By influencing barriers, the meaning is that ICT removes some of the existing knowledge sharing barriers. In this thesis, this investigation is taken into consideration i.e. the knowledge sharing barriers that ICT can eliminate or significantly reduce. The study is important because use of ICT is becoming widespread and viewing knowledge sharing from ICT perspective is becoming inevitable for organizations. Therefore, for organizations to reap optimal benefits from their ICT enabled knowledge sharing investments; they need to consider knowledge sharing and ICT together as two sides of the same coin. Such an approach is developed in this thesis that will allow organizations to confront the situation from a strategic perspective.

1.2 PROBLEM STATEMENT

This thesis is guided by the following strategic question:

How can ICT help organizations implement knowledge sharing in a better way?

One way to implement knowledge sharing in a better way is to overcome knowledge sharing barriers. If Project participants know the barriers they can be better prepared in the planning and implementation phases. In this thesis, it is advocated that to overcome knowledge sharing barriers, ICT should be considered because studies prove that ICT can impact knowledge sharing by enhancing knowledge sharing and by removing knowledge sharing barriers (although it also introduces its own barriers; the phenomenon is discussed later in detail in Chapter 2).

To answer the strategic question, two research questions are drafted:
1. Which knowledge sharing barriers can ICT reduce in organizations?

2. How does ICT help in reducing knowledge sharing barriers?

To answer these questions, thesis identifies barriers in ICT enabled knowledge sharing environment. A success case of a modern organization is considered to examine knowledge sharing barriers reduced by ICT with a further reasoning of how ICT does it. By having ICT reduce knowledge sharing barriers, a better knowledge sharing environment can be implemented. A further benefit of this approach is that if such barriers are reduced, organizations can consider only ICT-environment specific barriers as relevant instead of considering and treating all knowledge sharing barriers as applicable.

1.3 PURPOSE OF RESEARCH

The purpose of this research is to describe and analyze knowledge sharing barriers that ICT can reduce in organizations. This research also identifies underlying reasons as to how ICT helps in reducing knowledge sharing barriers.

1.4 SCOPE OF RESEARCH

This thesis is guided by the following scope of research:

- Research focuses on a particular issue in knowledge management i.e. ICT enabled knowledge sharing with research implications intended primarily for organizations.
- This thesis is designed as a case study; therefore the research is restricted to one particular organization (Avanade) that fits the case of research i.e. uses ICT for knowledge sharing for different operations such as knowledge storage, transfer, sharing etc. Whereas knowledge storage specifically refers to computer systems for data and information storage, transfer and sharing here means use of Internet, Intranets, emails and other technology-based tools to disseminate and propagate knowledge across an organization. It is understood that although meetings in organizations are usually based on human-interaction, yet inputs from such meetings are recorded, saved and disbursed using ICT in entire organization.
- The organization is chosen based on the condition that it runs a formal knowledge sharing program aimed at sharing knowledge and benefiting from it.
- Systems and processes used for knowledge sharing only within the organization (and not outside) are considered.

1.5 TARGET AUDIENCE

As indicated in the strategic question of this thesis, the primary target audience for this research is organizations using ICT for knowledge sharing however considering research’s close relevance, organizations using knowledge sharing without ICT may also benefit from this research. In addition, researchers and individuals studying knowledge sharing will also find this thesis beneficial.
Avanade is a multinational solution developing and IT consultancy firm. Avanade has joint venture with Accenture and Microsoft. The company uses Microsoft platform to develop software solutions for corporate customers. Avanade has over 10,000 consultants worldwide and thousands of real world deployments. Avanade’s parent company (Microsoft and Accenture) has a strong history that yields a powerful mix of business, industry and technology insights for any project. Avanade claims to have a proven track record that helps them to have the best minds together to solve any business challenge. (Avanade n.d)

Being part of a team is serious matter for Avanade’s employees. They solve problems by collaborating Avanade’s community worldwide in order to provide with the best possible customer service. (Avanade career Inc, n.d)

1.6.1 Knowledge Sharing in Avanade

“I’ve always felt that Avanade stresses both the giving and receiving of knowledge as an integral part of everyone’s personal and combined success.” – RJ, Solution developer, (Avanade n.d)

1.6.1.1 Digital collaboration

‘Avanade believes that digital collaboration –that is use of technology for enhancing the valuable connection among people and information, can improve business performance. This includes how people in organization works with information and with each other. One of the Avanade’s vision through digital collaboration is connecting the world of the knowledge worker with the operational view of the enterprise and with relevant external information—i.e., integrating familiar, easy-to-use spreadsheets, email, and virtual workspaces with information from corporate systems like ERP/CRM and third-party services—empowering employees with data and information that is critical to decision making but typically not easily accessed or used in enterprises today. (Avanade digital collaboration n.d)

1.6.1.2 Digital collaboration - the current landscape

Several collaboration technologies have been adopted by Avanade, those are briefly discussed below – (Avanade digital collaboration n.d)

1.6.1.3 Familiar and ease of use technology

Emails, text and instant messaging are used in Avanade as a general way of collaboration because of the ease of use and familiarity of the technology.
1.6.1.4 Virtual workspace

Avanade uses virtual workspace to share documents, discussion and calendar among the colleagues. In Avanade it is called webwiki. Wikis allow a user community to contribute and edit content in real time with the ultimate goal of increasing the value of the content by harnessing the collective knowledge of the community through continuous refinement and updates. The wikis are usually tightly connected to the projects, and therefore never shared throughout the whole organization. When a new consultant joins a new project, he/she can easily go through the project wiki and get a picture of what technologies that have been used and who is doing what. When a consultant leaves a project, he/she spends extra time for knowledge transferring by writing posts in the project wiki about his/her area of responsibility for that project.

1.6.1.5 Virtual conferencing

Real time audio and video sessions are used for virtual training and corporate communications. A dedicated connection is provided during the communication.

1.6.2 Knowledge sharing strategies in Avanade

Knowledge sharing in Avanade happens in a number of ways: (Avanade career Inc, n.d)

1.6.2.1 Learning from others

- Avanade has a number of technical communities and these communities generate three or more threads per week.
- Avanade re-uses existing intellectual assets from the repository where the intellectual assets are saved for future use.
- Through coaching and mentoring from leaders and others. Avanade’s strong knowledge sharing culture helps them doing it efficiently.

1.6.2.2 Learning from direct experience

All Avanade consultants as a part of their job required documenting their key experiences and strategies learnt from customer projects in order to reinforce what people know. This is a process of developing intellectual assets.

1.6.2.3 Learning through structured training

Each Avanade consultant is provided with 120 hours of structured training per year. All consultants have to be Microsoft certified (MCSE, MCSD etc.) Besides these, live webcast on specialized topic is offered throughout the year.
1.6.2.4 Learning through Self-Study Modes

All Avanade employees are provided with the following materials that they have to study by themselves.

- On-demand recordings (short one- to two-hour recordings) on specialized topics.
- Virtual library (e-books from Books24x7).
- Microsoft Official Curriculum (MOC) Kits.
- Microsoft conference and airlift materials (e.g., from TechEd, PDC).
- MSDN & TechNet access.
- Research services Gartner, IDC and more.
- Certification practice exams.

1.6.2.5 Virtual Community of Practice

Avanade has virtual communities of practice where all Avanade consultants all over the world can discuss their problems. There are communities for different areas such as .net communities, CRM communities etc. Usually an email is sent to the corresponding community mentioning the specific problem. The person who knows the solution answers the email. Below is a screen shot of a mailbox where on the left side, all the communities have been shown.

*Figure 1 - Avanade’s Virtual Communities for Knowledge Sharing (Source: Avanade)*
CHAPTER 2 - METHODOLOGY

This chapter details the research process adopted for this thesis. It elaborates issues related to research design, research method and overall thesis plan.

2.1 RESEARCH DESIGN

By research design, the meaning is the type of research technique adopted to conduct a morphological analysis for this thesis. Fisher (2007, pg.39) has discussed several research designs such as case study, mathematical models, action research, comparative analysis etc. This thesis is designed to be conducted as a case study. The major motivation and rationale behind this selection can be deduced from existing research on introduction of ICT for knowledge sharing - according to which ICT has several motives and benefits to offer in knowledge sharing. It is widely acknowledged that ICT enhances the knowledge sharing process considerably because of which it becomes logical to investigate a case of a successful organization. A case study according to Fisher (2007) tries to gain rather ‘in-depth’ know-how of ‘how’ this change affects the entire process. In other words, an investigation of underlying reasons, in addition to facts is possible. In doing so, new findings can lead to new research and outcomes. In this case study, a number of research methods (discussed in next section) will be used to carry out the research.

2.2 RESEARCH APPROACH: REALIST STANCE

The intended research approach in this thesis work can be most closely related to ‘realist research’ mentioned in Fisher (2007). Realist research, according to Fisher (2007, pg. 41), identifies and evaluates options for action. Characteristics mainly include establishing cause and effect relationships and performing statistical analysis (Fisher 2007, pg.42). “Research in this mode would involve structuring a problem by breaking it into its constituent parts. The relationship between these parts would then be studied, looking for recurrent patterns and associations. These patterns would then be used to establish principles or laws that could be used to select among a series of possible solutions to the problem” (Fisher 2007). From a practical point of view, “much realist research is based upon a comparison of qualitative case studies, which are analyzed to see whether there are any connections between variables” (Fisher 2007, pg. 42).

For this thesis, the research is broken down into three categories of barriers to study the most important barriers and possibly investigate the relationship between them. Since Fisher (2007) mentions cause and effect relationships as a characteristic of realist research, this research investigates the effect of introducing ICT in knowledge sharing environment by identifying key barriers. As mentioned in this thesis, a major cause behind introducing ICT in knowledge sharing is to remove existing barriers causing inefficient knowledge sharing however; the effect that this creates is twofold:
1. Enhanced knowledge sharing
2. Introduction of ICT’s own (technology) barriers

In other words, this event of ICT introduction affects the entire knowledge sharing environment. In such a scenario, it is beneficial to study the knowledge sharing barriers in the backdrop of ICT which affects the knowledge sharing process. The process is depicted in Figure 2.

![Figure 2 - Cause and Effect Diagram for ICT enabled Knowledge Sharing](Source: Authors’ Illustration)

The effect of introducing ICT in knowledge sharing is studied using different research methods. Based on research findings, recommendations and conclusions are presented at the end.

### 2.3 METHODS

“A case study uses a variety of research methods and can happily accommodate quantitative data and qualitative material” (Fisher 2007, pg. 60). Research methods used in this thesis consist of the following:

- Questionnaires
- Interviews

The questionnaire was distributed in Avanade via the interview source (Mr. Christian Monaco). According to Mr. Christian, a total of 96 employees work in Avanade Sweden about 25 of which are more experienced or more involved in Avanade’s Digital Collaboration. To receive best responses from most experienced employees, 25 questionnaires were distributed and 10 responses were received, thus achieving a response rate of 40%. It is important to mention that use of questionnaire was not aimed at conducting a survey but to gather responses on key knowledge sharing barriers in Avanade. Once these barriers were known, the following was established by interviews for each barrier:

- Barrier that ICT can reduce
- Barrier that ICT cannot reduce

It is important to mention that due to time and access limitations, it was not possible for the authors to conduct thorough interviews with all respondents and therefore questionnaires were used as replacement of 25 interviews to make it easy for respondents to identify the barriers in a short period of time.
The questionnaire used in this thesis uses a mix of closed and open ended questions. Closed questions make up most of the questionnaire and interviews. This was done to specifically ask respondents of barriers based on which the analysis was performed.

### 2.4 THESIS PLAN

This section presents the research plan for this thesis. By research plan we mean the breakdown of thesis into smaller, manageable, structured phases or steps. Each of these phases creates an output that is used as an input into the next phase. Figure 3 shows the thesis plan.

![Figure 3 - Thesis Plan (Source: Authors' Illustration)](image)

#### 2.4.1 Broad Literature Study on Knowledge Management

Most research needs to begin with a literature review: earlier studies on and around the topic of research. These include books, journals articles, and online pages for example government websites, corporate websites and catalogs (Ghauri and Gronhaug 2005, pg. 91).

#### 2.4.2 Select Area of Interest

Fisher (2007, pg. 31) recommends that researchers should choose a topic that interests them and even possibly excites them. Furthermore, the chosen topic should also arise some interest to some external audiences. Keeping the said argument in mind we have chosen one important area
of knowledge management i.e. knowledge sharing in organizations with focus on key barriers in ICT enabled knowledge sharing.

2.4.3 Formulate Problem Statement

It is the first step which is wrestling with problems Ghauri et al (2005, pg. 44). Fisher (2007, pg. 34) has mentioned two types of question that could be formulated to accomplish a master thesis. This includes a research question which can be answered by doing in depth research and a strategic question which can be answered by judgment and will. The problem statement for this thesis uses both.

2.4.4 Formulate Research Methodology

This thesis uses both primary and secondary data to identify barriers that ICT can reduce in knowledge sharing. A qualitative research of existing literature (secondary data) is first carried out to identify reported knowledge sharing barriers. This is followed by primary data gathering using questionnaires and interviews to investigate the research question. Table 1 list down research methods used in this thesis.

<table>
<thead>
<tr>
<th>Method</th>
<th>Goal</th>
</tr>
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<tbody>
<tr>
<td>Qualitative research of literature</td>
<td>Examine research done in area of ICT enabled knowledge sharing, identify and describe noted barriers.</td>
</tr>
<tr>
<td>(Secondary data)</td>
<td></td>
</tr>
<tr>
<td>Questionnaire findings (Primary data)</td>
<td>Make questionnaire based on literature study and disperse questionnaire to case organization.</td>
</tr>
<tr>
<td>Interview (Primary data)</td>
<td>Conduct interview(s) to investigate reasoning behind questionnaire responses.</td>
</tr>
</tbody>
</table>

Table 1 - Research Methods Used (Source: Authors' Illustration)

2.4.5 Collect Empirical Data

Mentioned in Fisher (2007, pg. 159), research methods to collect data include:

- Interviews
- Panels
- Questionnaire
- Observation
- Documentary

Proposed research method for this thesis is a mix of structured (pre-coded) and open-ended questionnaire. The questionnaire lists the triad of knowledge sharing barriers and seeks responses for most critical knowledge sharing barriers in ICT context. Mentioned throughout this thesis, the conceptual framework, cause and effect diagram and framework for interpreting the research material are relevant models in this process. Graphs and charts will be used to depict results.
2.4.6 Interpret Research Material

Before concluding research, gathered research material is interpreted and analyzed at this step to draw conclusions of importance.

2.4.7 Present Conclusions and Recommendations

After analyzing the empirical data using the data-interpretation framework, this phase answers the research and strategic questions.
CHAPTER 3 - LITERATURE REVIEW

This chapter provides a detailed literature study of existing research on study area. Furthermore, a conceptual framework illustrating the key concepts of the research is presented at the end of this chapter. Collectively, the literature study and conceptual framework provides the required theoretical framework for this thesis.

3.1 LITERATURE MAP

Figure 4 shows a literature map on knowledge sharing.

Areas marked in bold exhibit our interest for this thesis work. Motivation and justification for this area has already been discussed in first chapter however it is important to mention that ICT driven knowledge sharing open an area of potential interest for organizations because of ICT’s widespread use in organizational activity. In this, a mere focus on key barriers in knowledge sharing is instead broad and rather not fully relevant in ICT driven knowledge sharing environments. Therefore, this thesis takes an approach designed and conceived specifically for ICT driven knowledge sharing environments.
3.1.1 Databases and Keywords

This search was mainly conducted using the university databases, journal databases, library journals, websites and textbooks. Databases used were Google Scholar, Emerald, ABI/INFORM Global (ProQuest), ACM Digital Library and LibHub.

Keywords such as knowledge management, knowledge sharing, knowledge transfer, knowledge enterprise, barriers in knowledge sharing, knowledge sharing obstacles, ICT knowledge sharing, ICT enabled knowledge sharing, technology knowledge sharing were used.

3.2 KNOWLEDGE SHARING IN ORGANIZATIONS

Nonaka and Takeuchi (1995) have described knowledge management as the ability of a firm (as a whole) to create new knowledge, spread the knowledge throughout the organization and reflect the result in its product, services and system. Individual initially creates knowledge by interacting with each other and that knowledge becomes organizational knowledge. Organization cannot create knowledge without individuals and the impact of knowledge on the organization is likely to be less effective if the knowledge is not shared within the organization properly. So, it is clear that an active individual who is communicating with others within the organization creates knowledge.

Hedman and Kalling (2002) describe that organizations are such arenas where different human entities compete for resources to build knowledge within its own unit. It also depends on numbers of entity involved; the more member, the tougher the competition. Knowledge sharing is used as a process of bridging the gap between actual performance and performance target (McGrath, 1996). Knowledge sharing can improve competence but the structure of organization can hinder the process. It is important that the culture and organizational structure should be able to strengthen firm’s ability to reinforce internally existing knowledge.

There are two types of group’s characteristics within organization that generate competence by sharing knowledge: comprehension and deftness. When the knowledge of some individuals can be linked and the group is responding like the complexity is understood is referred to as comprehension. A group is referred to as deft when the individuals under the group are able to communicate and make use of relevant information and facts. In a football team, comprehension is the aggregated skills base of the players and deftness is the ability of each player to communicate with other player and develop competitiveness. (McGrath et al., 1995)
3.3 KNOWLEDGE SHARING AND TECHNOLOGY

Varying perceptions in researchers exist on utility of ICT for knowledge sharing. Since ICT is perceived to have introduced strengths as well as shortcomings (barriers) in knowledge sharing, it is important to view this issue from both standpoints. Once a collective view is developed as theoretical basis for this thesis, it would help in evaluating barriers as perceived practically by organizations.

Despite much apprehension on IT and ICT’s role in organization, the becoming reality remains that ICT’s role in organizations continues to rise\(^1\). This IT spread has created a far reaching impact on organizations and industries. The area of knowledge management in organizations is no exception where ICT has found new ways in enhancing knowledge sharing. While ICT’s increasing role in KM is studied widely by researchers, it has become evident enough to account ICT as one of the major pillars of KM. Figure 6 exhibits the four pillars of knowledge management as perceived by Stankosky and Baldanza (2000) in their KM conceptual framework. In essence, this conceptual framework provides a very suitable basis for viewing KM from four different perspectives or frames, namely the leadership, organization, technology and learning. Each of these frames can offer valuable insight into knowledge sharing in context of a particular pillar of importance. This thesis will view knowledge sharing from perspective of technology i.e. ICT.

\(^1\) Study by U.S. Department of Commerce, Bureau of Economic Analysis, National Income and Product Accounts, 2008: Total IT investment (defined as hardware, software, and communications equipment) rose from 32% to 51% between 1980 and 2008. Gartner group predicts growth in world IT spending of 5.1% (to 3.6 trillion $) in 2011 [more at: http://www.gartner.com/it/page.jsp?id=1513614]
A major motivation behind increasing shift towards ICT enabled knowledge sharing seems to be the many benefits of time and space elimination that ICT is considered to offer. The growing perception here is that introduction of ICT can enhance knowledge sharing by lowering temporal and spatial barriers between knowledge workers and improving access to information about knowledge (Hendriks 1999, pg. 91). This suggests that ICT has noticeably enhanced knowledge sharing in many ways, for example, as noted here, ICT has either entirely eliminated or considerably reduced the time and geographical distances that influence knowledge sharing but in doing so, ICT has also introduced its own problems (Hendriks, 1999, pg. 91). However, the benefits and motivation for ICT’s use seem to overshadow its shortcomings and consequently, considering ICT as an integral part of KM framework seems to be the logical trail.

To understand how ICT impacts knowledge sharing in organizations, Figures 7 and 8 exhibit knowledge sharing environments with and without ICT introduction. Paired bold arrows in Figure 8 exhibit enhanced knowledge sharing with ICT but at cost of expanding the barrier space.
As apparent from figures above, ICT’s negative impact on knowledge sharing is introduction of intrinsic technology barriers. ICT’s positive influence on knowledge sharing is enhancement of the knowledge sharing process (which also becomes a major motivation to introduce ICT for knowledge sharing). It is also important to understand that introduction of technology in knowledge sharing influences other organizational and individual barriers, for example, ICT influencing employee motivation for knowledge sharing because of introduction of technology (Hendriks, 1999; DeLong, 1996).
Hendriks (1999), in his work has identified four major goals of using ICT for knowledge sharing (Figure 9). These can be viewed as primary purposes for introducing ICT in knowledge sharing and lead to following knowledge sharing process enhancements: First, ICT may itself be instrumental in lowering at least some of the barriers associated with knowledge sharing. Under this, different researchers have recognized different barrier types that ICT can help to overcome, for example, social, physical and temporal distances identified by Ruggles (1997) etc but there seems to be a general agreement on positive input of ICT in knowledge sharing. Secondly, ICT is also seen as facilitating access to information bases storing data, using for example document imaging systems (DIS). This, according to Hendriks (1999, pg. 94) can help groups of people to identify each other’s documents without having to read them or memorize them. Third, use of ICT may be with the motive of improving the processes associated with knowledge sharing. By this, Hendriks (1999) means either ICT supporting the knowledge sharing process or ICT partially taking over the knowledge sharing process. Lastly, ICT can enhance meta-knowledge (knowledge about knowledge) in knowledge sharing. This essentially means locating elements or sources that have knowledge required to address issues or situations.

![ICTGoals in Knowledge Sharing](image)

**Figure 9 - ICT Support for Knowledge Sharing (Source: Authors’ Illustration Adapted from Hendriks (1999))**

Mentioned earlier in context of four pillars of KM, Mohamed, Stankosky and Murray (2006, pg. 104) have also agreed that “if properly used IT can accelerate knowledge-sharing capabilities in both time and space dimensions”. This is in general agreement with view of other researchers, in particular of Hendriks (1999) here and portrays an essential issue in knowledge sharing that ICT can confront successfully.

But even while exhilarating it is to leverage ICT for knowledge sharing, it does not mean that ICT can solve all problems (barriers) in knowledge management and sharing. Reported widely is a major misconception with the use of ICT that it is some kind of ultimate magic bullet for all knowledge sharing problems (Mohamed, Stankosky and Murray 2006, pg. 105; Han and Anantatmula 2007, pg. 422) and perhaps all organizational problems extending beyond knowledge sharing. A widely reported dilemma of organizations is that they continue to believe that their ICT investments alone can resolve all knowledge sharing issues; however this often
turns out in disappointment (Reimus, 1997). The issue can be attributed to inciting benefits and convenience of ICT, such as, ease/enhancement of operations, time and cost reductions, decision intelligence etc, however it is to be reemphasized that ICT in itself cannot be declared absolute. Research suggests that a mere investment in ICT will not guarantee overcoming knowledge sharing problems without taking into account the whole organizational perspective in ICT context. Studies further proclaim that ICT has its shortcomings relating to knowledge issues such as retrieving tacit knowledge, double-loop learning, cognitive abilities etc, especially when compared to human brain (Mohamed, Stankosky and Murray, 2006). The issue can be extensively discussed but more importantly this leads us to an important finding in ICT enabled knowledge sharing implementation. Use of ICT in knowledge sharing should not be viewed as an absolute solution rather as implied by researchers such as Hendriks (1999) and Mohamed, Stankosky and Murray (2006) in their conceptual framework, ICT should be viewed as having role of a facilitator in knowledge sharing. The word facilitator, however, should not mislead and it is argued that this facilitating role is not a minuscule one but more of a pillar supporting knowledge sharing to a large extent both at operational (storing, transferring, manipulating knowledge etc) and strategic (gaining competitive advantage) levels. It is further argued that if organizations are to extract optimal benefits from their ICT enabled knowledge sharing implementations, a change in thinking towards ICT is required, a change that views ICT from a balanced viewpoint and not as an absolute remedy. This is because in knowledge sharing, a major cause cited of technology failure is an over-emphasis on ICT at expense of people issues Geraint (1998). On the other hand, “an overemphasis on only the limitations of ICT, introduces the real risk of ‘throwing away the baby with the bathwater’. The risks associated with ICT can be seen as rivers to be crossed in order to connect the individual stretches of land that symbolize the advantages of using ICT” (Hendriks, 2001). Hence, a balanced approach is required, one that does not over-emphasize either ICT or other knowledge sharing issues over one another. One obvious solution advocated in this thesis is to view knowledge sharing barriers in ICT context and understand which barriers ICT can reduce. If such an approach is developed, ICT’s influence on organization can be better reaped as well as studied. Technology barriers, introduced as ICT’s shortcoming, are nevertheless part of the package and will also be better understood (alongside other barriers) if viewed from such a perspective.

### 3.3.1 Role of Technology in Knowledge Management and Sharing

Role and motivation of technology as a pillar in KM process presents an encouraging picture for organizations vying ICT enabled knowledge sharing. As implied above, this role is often at least operational however; a strategic push given by ICT is becoming strongly noted too. This brings us to a crucial question on knowledge management and sharing in organization: What can technology offer in knowledge sharing?

Knowledge management is of particular relevance to IS research because the functionalities of information technologies play a critical role in shaping organizational efforts for knowledge creation, acquisition, integration, valuation, and use. Information systems have been central to firm efforts to enable business processes, flows of information, and sources of knowledge to be integrated and for synergies from such combinations to be realized. The focus of the deployment of knowledge management systems in firms has been on developing searchable document repositories to support the digital capture, storage, retrieval, and distribution of an organization’s
explicitly documented knowledge. Knowledge management systems also encompass other technology-based initiatives such as the creation of databases of experts, the development of decision aids and expert systems, and the hardwiring of social networks to aid access to resources of non-collocated individuals (Alavi and Leidner 2001).

Following have been identified by researchers as functional roles of ICT in knowledge sharing:

- Data codification, storage and retrieval employing standard DBMS systems
- Data transfer and communication by use of Internet, e-mails, portals etc
- e-Communities and online/virtual meeting points
- Specialized knowledge management systems for organizations
- Data mining, warehousing
- Expert and intelligent systems for decision support

### 3.4 BARRIERS IN KNOWLEDGE SHARING

This section discusses knowledge sharing barriers as majorly noted and characterized by researchers. Since different researchers view the issue from different perspective and in different knowledge sharing implementations (organizations, communities of practice, focus groups etc), different basis for barrier categorization have emerged (e.g. motivational barriers, learning barriers, organizational barriers etc). Because a number of barriers categories exist, an approach is required to view these barriers from organizational perspective. For this thesis, following three knowledge sharing barrier categories have been established to offer a focus of organizational viewpoint:

- Organizational Barriers to knowledge sharing
- Individual Barriers to knowledge sharing
- Technological Barriers to knowledge sharing

An important finding from literature study is that at an organizational level; nearly all knowledge sharing barriers can be characterized as being relevant to at least one of the above mentioned categories.

#### 3.4.1 Organizational Barriers

With regards to knowledge management, organizational and behavioral change management has been reported as a critical success factor in implementation of information systems (Alavi and Joachimsthaler, 1992). This suggests a strong link of ICT to knowledge management at organizational echelons.

The problem of sharing knowledge within the organization is hardly mentioned in the organizational theory. This could be because that knowledge is freely flowing within the organization and also outside the organizational boundary. Another reason could be that knowledge as a resource is embedded into individuals and to control the flow of knowledge is as critical as controlling the behavior of the knowledge possessors. (Cristensen, 2007).
Studies have shown that, barriers to sharing knowledge within organization are based on the corporate environment and conditions (Riege, 2005). Many literature studies have shown that, knowledge sharing could be difficult because of the following organizational problems listed in Table 2.

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Description</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integration of knowledge sharing in organizational</td>
<td>For successful knowledge sharing, it is important to include knowledge sharing in the strategy and goal of the organization. Unclear or sometimes missing of the integration of knowledge sharing in the strategy of an organization can hinder proper knowledge sharing practice.</td>
<td>Doz and Schlegelmilch, 1999; Hansen et al., 1999</td>
</tr>
<tr>
<td>strategy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of technology investment</td>
<td>This means organization’s willingness to invest in technology for knowledge sharing.</td>
<td>Han and Anantatmula, 2007</td>
</tr>
<tr>
<td>Lack of training for knowledge sharing and/or</td>
<td>Training of employees to learn technology, especially relevant for special KMS and knowledge sharing in general.</td>
<td>Han and Anantatmula, 2007</td>
</tr>
<tr>
<td>learning technology and processes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor leadership communication about knowledge sharing</td>
<td>It is important that the benefits and values of knowledge sharing are properly communicated among the employees. But because of poor leadership approach and management communication, knowledge-sharing benefits are unknown to the knowledge possessors and thus barrier occurs to knowledge sharing.</td>
<td>Riege, 2005</td>
</tr>
<tr>
<td>Lack of space</td>
<td>Sometimes there is lack of places or spaces within the organization for properly sharing, reflecting or even generating new knowledge. It also includes how much does available facility helps or is important to employees in sharing knowledge.</td>
<td>Gold et al., 2001; Han and Anantatmula, 2007</td>
</tr>
<tr>
<td>Lack of management support, motivation and rewards</td>
<td>Lack of management support, motivation to knowledge sharing can reduce the practice. For example, transparent reward system within the organization. Knowledge possessors should have the motivation for volunteer participation of knowledge sharing practice.</td>
<td>Ellis, 2001; Finerty, 1997; McDermott, 1999; O’Dell and Grayson, 1998; Han and Anantatmula, 2007; Happel et al, 2007</td>
</tr>
<tr>
<td>system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-supportive organizational structure and culture</td>
<td>The organizational culture and structure is not supportive to knowledge sharing as organization</td>
<td>Probst et al., 2000; Han and Anantatmula, 2007</td>
</tr>
</tbody>
</table>
Table 2 – Organizational Barriers in Knowledge Sharing (Source: Authors’ Compilation)

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Description</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of priority of knowledge retention</td>
<td>Highly skilled employees are mobile in the business world now and they know their value in the job market. So, when they leave the organization, their knowledge and know how skills follow them. So lack of priority of knowledge retention from highly skilled employees can produce knowledge sharing barrier.</td>
<td>Master, 1999; Stauffer, 1999</td>
</tr>
<tr>
<td>Lack of supportive resource</td>
<td>Lack of proper infrastructure or resources to support efficient knowledge sharing practices and opportunities.</td>
<td>Reige, 2005; Coleman, 1999; Schlegelmilch and Chini, 2003; Devenport, 1997</td>
</tr>
<tr>
<td>High competition among internal units</td>
<td>High external or internal competitions among the internal business units or functional areas and among subsidiaries led by confliction goals and competing interest can surface knowledge sharing barrier.</td>
<td>Katz and Allen, 1982; O’Dell and Grayson, 1998; Michailova and Husted, 2003</td>
</tr>
<tr>
<td>One-way flow of knowledge sharing</td>
<td>Depending on the structure of authority or direction of flow of knowledge (ex. Top-down or bottom-up) or even restrictions of work areas, knowledge sharing can be obstacle.</td>
<td>Michailova and Husted, 2003; O’Dell and Grayson, 1998; Probst et al., 2000</td>
</tr>
<tr>
<td>Unmanageable unit size</td>
<td>Sometimes the size of business units is too large and because of that it is unmanageable to facilitate the proper sharing practices.</td>
<td>Connelly and Kelloway, 2003; Sveiby and Simons, 2002</td>
</tr>
<tr>
<td>Cost of sharing knowledge</td>
<td>Cost incurred in capturing, categorizing, setting access rights for knowledge.</td>
<td>Happel et al., 2007</td>
</tr>
</tbody>
</table>

3.4.2 Individual Barriers

Individual (or personal) knowledge sharing barriers pose a significant challenge to organizations using ICT for knowledge sharing. A large part of this can be attributed to the complex human factor involved in organizations which makes it highly susceptible to environmental changes such as organizational policies or use of technology. It is why that many studies emphasize on individual’s views on use of technology in knowledge sharing environment. On importance of individual concerns, Riege (2005) notes that “just about every book written on KM comments on the distribution of the right knowledge from the right people to the right people at the right time being one of the biggest challenges in knowledge sharing”. This makes individual barriers in
knowledge sharing a central matter of debate in KM. Listed in Table 3 are most notable individual barriers in knowledge sharing:

<table>
<thead>
<tr>
<th><strong>Barrier</strong></th>
<th><strong>Description</strong></th>
<th><strong>Sources</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Poor communication skills</strong></td>
<td>Sometimes poor communication skills (verbal and written) can hinder knowledge sharing. Employees social network inside and outside the company, their personal ability to communicate with others can be vital in knowledge sharing.</td>
<td>Argote et al., 1990; Baron and Markman, 2000; Ingram and Baum, 1997; Nahapiet and Ghoshal, 1998; Davenport and Prusak, 1998; Hendriks, 1999; Meyer, 2002</td>
</tr>
<tr>
<td><strong>Lack of time to share knowledge</strong></td>
<td>Even though managers are aware about the benefit of knowledge sharing but due to time constraints it is not always possible for them to practice knowledge sharing. Rather employees are more interested to involve in task that is more beneficial to them. Sometimes there is lack of time to identify colleagues in need of specific knowledge or who are even interested in sharing knowledge. Managers believe that if the employees are not always working then they are not productive. This could be an obstacle for time constrains for knowledge sharing.</td>
<td>Riege, 2005; Ardichvili et al., 2002; O’Dell and Grayson, 1998; Michailova and Husted, 2003; Skyrme, 2000</td>
</tr>
<tr>
<td><strong>Fear of job security</strong></td>
<td>Sometimes employees believe that if they can keep the knowledge inside and provide good output, they could be promoted. On the other hand, if someone else learns from him and provide better output then that could jeopardize job security.</td>
<td>Riege, 2005; Ardichvili et al., 2002; Happel et al., 2007; Lelic, 2001</td>
</tr>
<tr>
<td><strong>Low awareness of possessed knowledge</strong></td>
<td>Some employees are uncertain about the value of knowledge they are possessing. This could hinder them to volunteer in knowledge sharing.</td>
<td>Riege, 2005; O’Dell and Grayson, 1998</td>
</tr>
<tr>
<td><strong>Dominance in sharing explicit over tacit knowledge</strong></td>
<td>Since tacit knowledge is harder to transfer than explicit knowledge, employees tend to practice more explicit knowledge sharing over tacit knowledge.</td>
<td>Riege, 2005</td>
</tr>
<tr>
<td><strong>Asserting own position authority</strong></td>
<td>In some companies, the managers are reluctant to work with middle level or lower level employees and learn from them as they believe that there is a difference in experience.</td>
<td>Jarvenpaa and Staples, 2001; Murray, 2002; Rowley, 2002. Michailova and Husted, 2003</td>
</tr>
</tbody>
</table>
### Table 3 - Individual Barriers in Knowledge Sharing (Source: Authors’ Compilation)

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Description</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>National culture and cross cultural barriers</td>
<td>And also some employees tend to receive credit for their own work and thus could be an obstacle for sharing knowledge.</td>
<td>Chow et al., 2000; McDermott and O’Dell, 2001; Ford and Chan, 2003; Husted and Michailova, 2002; Michailova and Husted, 2003; Moeller and Svahn, 2004; and Straub et al., 2002; Fai and Marschan-Piekari, 2003; Feely and Harzing, 2003; Marschan et al., 1997</td>
</tr>
<tr>
<td>Lack of trust</td>
<td>This barrier may have little relevance for domestic companies, but very important for big multinational companies. Language, employee’s national culture, cross-cultural barriers can be an obstacle for knowledge sharing among international subsidiaries.</td>
<td>Reige, 2005; De Long and Fahey, 2000; McAllister, 1995</td>
</tr>
<tr>
<td>Manager’s tolerance to mistakes</td>
<td>Trust among the knowledge possessors plays an important role in knowledge sharing. Doubting the quality of knowledge and the faithfulness of the knowledge career can hinder efficient knowledge sharing.</td>
<td>Michailova and Husted, 2003; Nonaka and Takeuchi, 1995; Spender, 1996</td>
</tr>
<tr>
<td>Miscellaneous barriers</td>
<td>Sometimes managers are intolerant about employees making mistakes and learning from it. So, instead of capturing and evaluating past mistakes, managers more like to cover up the mistakes or blame someone for that. So, learning from mistakes is overlooked.</td>
<td>Sveiby and Simons, 2002; Sveiby, 2003</td>
</tr>
</tbody>
</table>

### 3.4.3 Technology Barriers

When ICT is introduced as a motive to enhance knowledge sharing, an inevitable certainty is introduction of ICT’s own barriers in knowledge sharing. It is rational for organizations to consider technology barriers when using ICT for sharing knowledge. Following, in Table 4, are noted technology barriers:

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Description</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mismatches with employees’ need</td>
<td>If the adopted technology does not closely fit the requirements or does not fit with the normal “way of doing” of employees, then the</td>
<td>Riege, 2005; O’Dell and Grayson, 1998; Keyes, 2008</td>
</tr>
</tbody>
</table>
### Table 4 - Technology Barriers in Knowledge Sharing (Source: Authors’ Compilation)

| **Compatibility of technology** | New adopted technology for knowledge sharing should fit with the current system that has a different purpose of use. So, lack of compatibility can raise barriers to knowledge sharing. It has been mentioned by one researcher that to integrate a system that will suit all functional areas within global organizations is almost impossible. | Riege, 2005; Keyes, 2008, Han and Anantatmula, 2007 |
| **Unfamiliarity of IT/IS system** | Most people are not reluctant to use technology, but the unfamiliarity of the new system can produce sharing barriers. Lack of training is one reason for not getting familiar with IT system. | Riege, 2005, Connelly and Kelloway, 2003, Han and Anantatmula, 2007 |
| **Unrealistic expectations** | Sometimes there is unrealistic expectation on what technology “can do”, arise reluctance of using the system and thus arise knowledge sharing barriers. | Riege, 2005; Lam and Chua, 2005 |
| **Lack of technical support** | All systems have own drawbacks. No system is faultless or no system can guarantee that it will not crash. Lack of technical support for recovery from a faulty situation or ability to anticipate future problem can hinder efficient knowledge sharing. | Riege, 2005; Keyes, 2008, Han and Anantatmula, 2007 |

### 3.5 Conceptual Framework

A conceptual framework, deduced from key concepts of the literature study, is presented below. The framework is intended to depict the possible relationship among key concepts used in this thesis work. The central goal of this framework is to provide organizations and researchers with a way to better understand their knowledge sharing implementation driven by ICT. It is argued that this better understanding will develop if an ICT enabled knowledge sharing environment (instead of general knowledge sharing environment) is considered for key barriers in knowledge sharing. Key concepts include presence of knowledge owners and receivers in every organization. Knowledge flows from knowledge owners to receivers (or reconstructors). It is
however known that in the process of sharing and transferring information, barriers surface which hinder the knowledge flow. These barriers are categorized as organizational, individual and technology barriers in this thesis.

For purpose of barriers hindering the knowledge sharing process, a concept of barrier space has been introduced in this thesis. Barrier space refers to an imaginary space that barriers occupy in the knowledge sharing process. The larger the barrier space grows, the harder it becomes to share knowledge. It is therefore desired to reduce the barrier space in organizations (which in this thesis is recommended to be achieved by using ICT). Figure 10 shows the conceptual framework.

![Figure 10 - Conceptual Framework (Source: Authors’ Illustration)](image-url)
CHAPTER 4 - FINDINGS AND DISCUSSION

This chapter presents research findings from questionnaires and interviews.

The findings presented in this chapter are based on questionnaire and interviews conducted in Avanade Corporation.

4.1 RESEARCH FINDINGS

This section includes following findings about Avanade:
- Questionnaire findings
- Interview findings

4.1.1 Questionnaire Responses

Research findings from questionnaires and interviews are presented in this section. The findings are barrier-wise categorized. Bar and line graphs have been used to portray results.

4.1.1.1 Organizational Barriers

Figure 11 shows consolidated view of responses for all organizational barriers. For detailed barrier-wise results, refer to Appendix B.

Figure 11 - Questionnaire Responses for Organizational Barriers (Source: Authors' Illustration)
4.1.1.2 Individual Barriers

Figure 12 shows consolidated view of responses for all individual barriers. For detailed barrier-wise results, refer to Appendix B.

![Figure 12 - Questionnaire Responses for Individual Barriers (Source: Authors' Illustration)](image1)

4.1.1.3 Technology Barriers

Figure 13 shows consolidated view of responses for all technology barriers. For detailed barrier-wise results, refer to Appendix B.

![Figure 13 - Questionnaire Responses for Technology Barriers (Source: Authors' Illustration)](image2)
4.1.2 Interview Findings

This section documents interview findings. Two interviews were conducted with Mr. Christian Monaco (IT Consultant at Avanade) after questionnaire findings and were aimed at identifying barriers ICT can reduce along with underlying reasoning.

4.1.2.1 Organizational Barriers

Table 5 lists down interview findings for organizational barriers.

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Questionnaire Response</th>
<th>Finding (ICT's Role in Reducing Barrier Severity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-integration in Organizational Strategy</td>
<td>Reported unimportant by 70% of respondents</td>
<td>Use of ICT makes knowledge sharing easier and much more productive. More and more IT applications are now specially written with aim of enhancing knowledge sharing by virtual collaboration. Because of this, knowledge sharing has become easier and more sustainable and it is easier to use ICT-based knowledge sharing. With these benefits and more, ICT can push organizations to use knowledge sharing at a strategic level by including it in its organizational strategy.</td>
</tr>
<tr>
<td>Lack of technology Investment</td>
<td>Reported unimportant by 60% respondents</td>
<td>In Avanade, knowledge sharing is formally used and is highly driven by technology. ICT helps overcome this barrier because organization prefers to keep IT systems updated and views ICT enabled knowledge sharing as a strategic asset.</td>
</tr>
<tr>
<td>Lack of Technology Training</td>
<td>Reported unimportant by 80% respondents</td>
<td>Technology is itself a barrier but in Avanade, employees are tech-savvy and minimal formal trainings are required because by using easy-to-use online collaboration platforms, employees can well-verse themselves with new tools required for knowledge sharing. Furthermore, with ICT-dependent knowledge sharing becoming a formal part of organizational strategy, ICT reduces the tendency of management to shy away from technology training for employees.</td>
</tr>
<tr>
<td>Poor Management Communication</td>
<td>Reported unimportant by 90% respondents</td>
<td>An apparent benefit of using ICT-based collaboration tools is that benefits of knowledge sharing come commercially advertised with these tools so minimum effort or responsibility lies on the management to communicate the benefits to the employees. The employees are as much aware of the benefits as is the management through commercial tools. Professional certifications in these tools are also largely aimed at communicating the benefits. ICT can also help reduce this barrier because when ICT investment is made, it becomes part of organizational strategy.</td>
</tr>
<tr>
<td>Barrier</td>
<td>Questionnaire Response</td>
<td>Finding (ICT’s Role in Reducing Barrier Severity)</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------------------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>Lack of space</td>
<td>Reported unimportant by 90% respondents</td>
<td>strategy and abundant communication takes places between employees and management because organization understands the importance of its investments. ICT based online portals and wikis also help reduce communication gap between employees and management. ICT helps eliminate this barrier considerably because with online portals, wikis and email based knowledge sharing; traditional requirements of physical space are no more important or at least as crucial. With ICT based knowledge sharing, a round-the-clock knowledge sharing is possible from own office-space (or homes) than dedicated room requirements.</td>
</tr>
<tr>
<td>Lack of Motivation</td>
<td>Reported unimportant by 0% respondents.</td>
<td>ICT does not considerably help remove this barrier because it’s an issue of personal employee attitude towards work and knowledge sharing. Several issues can influence employee motivation to share knowledge.</td>
</tr>
<tr>
<td>Non-supportive Organizational Culture and Structure</td>
<td>Reported unimportant by 70% respondents.</td>
<td>ICT does not play a major role in reducing this barrier because culture and climate of organization has bigger influence.</td>
</tr>
<tr>
<td>Lack of Interest in Knowledge Retention</td>
<td>Reported unimportant by 80% employees.</td>
<td>Knowledge retention is a much-debated critical matter in organizations. ICT helps solve this problem because in contrast to traditional non-ICT driven knowledge sharing where knowledge carriers (knowledge-rich employees) take their knowledge with them upon exit from the organization, ICT can help retain their knowledge in codified forms even after they have left.</td>
</tr>
<tr>
<td>Lack of Proper Infrastructure and Resource</td>
<td>Reported unimportant by 90% respondents.</td>
<td>In Avanade, more than 90% of the knowledge sharing takes place using virtual communities without needing any physical space requirements or special human resource. The only infrastructure required for Avanade’s digital collaboration includes the same office data network and computers used for other office work with which users can connect into virtual space for knowledge sharing.</td>
</tr>
<tr>
<td>High-Competition between Departments</td>
<td>Reported unimportant by 70% respondents.</td>
<td>ICT does not play a considerable role in removing this barrier.</td>
</tr>
</tbody>
</table>
| Big Department Size           | Reported unimportant by 80% respondents. | ICT can greatly reduce this barrier because in contrast to traditional knowledge sharing environments where a number of employees
### Table 5 - Interview Findings for Organizational Barriers (Source: Authors’ Analysis)

#### 4.1.2.2 Individual Barriers

Table 6 lists down interview findings for individual barriers.

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Questionnaire Response</th>
<th>Finding (ICT’s Role in Reducing Barrier Severity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor communication skills</td>
<td>Reported unimportant by 60% respondents</td>
<td>Contrary to traditional knowledge sharing, largely driven by oral communication and manual methods, ICT enabled knowledge sharing on portals and online communities is mostly writing driven which eliminates the barrier caused by poor speaking skills. Written information can be better understood and interpreted.</td>
</tr>
<tr>
<td>Lack of time to share knowledge</td>
<td>Reported unimportant by 80% respondents</td>
<td>With ICT enabled knowledge sharing, the barrier of time is almost eliminated because employees can connect to online portals at their convenience and share knowledge anytime of the day.</td>
</tr>
<tr>
<td>Fear of job security</td>
<td>Reported unimportant by 90% respondents</td>
<td>With ICT based collaboration tools, every employee is assigned a unique username and password and all shared knowledge is shown with employee’s identity. Because of this, employees feel more comfortable sharing their knowledge without fearing for their ideas to be stolen and their jobs jeopardized.</td>
</tr>
<tr>
<td>Low awareness of possessed knowledge</td>
<td>Reported unimportant by 0% respondents</td>
<td>ICT does not really help in removing this barrier.</td>
</tr>
</tbody>
</table>
## ICT Enabled Knowledge Sharing – The Impact of ICT on Knowledge Sharing Barriers

### Table 6 - Interview Findings for Individual Barriers (Source: Authors' Analysis)

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Questionnaire Response</th>
<th>Finding (ICT's Role in Reducing Barrier Severity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dominance in sharing explicit over tacit knowledge</td>
<td>Reported unimportant by 10% respondents</td>
<td>ICT does not help overcome this barrier (because it is a complex phenomenon to change knowledge from tacit to explicit)</td>
</tr>
<tr>
<td>Asserting own position authority</td>
<td>Reported unimportant by 80% respondents</td>
<td>With ICT enabled knowledge sharing, the flow of knowledge in the organization is in all directions and employees can learn from each other without having to indulge in face to face meets where they may be reluctant to endorse or accept junior’s views to learn from them. With knowledge portals, senior managers can read and learn from junior’s experience so ICT helps reduce the barrier considerably.</td>
</tr>
<tr>
<td>National culture and cross cultural barriers</td>
<td>Reported unimportant by 90% respondents</td>
<td>ICT cannot help overcome cross-cultural barriers significantly but may help reduce this barrier partially because most knowledge sharing is done in English language and translator tools are available alongside to resolve languages issues.</td>
</tr>
<tr>
<td>Lack of trust</td>
<td>Reported unimportant by 70% respondents</td>
<td>With ICT enabled knowledge sharing, all information that is shared is visible to all or multiple people which can be cross-verified by other employees for its authenticity. The source of knowledge is uniquely known with their identities so people tend to share truthfully. Also, ideas can be shared without concerns of having them stolen (possible in meetings based sharing) because everything is visible with employee’s username.</td>
</tr>
<tr>
<td>Manager’s tolerance to mistakes</td>
<td>Reported unimportant by 90% respondents</td>
<td>ICT does not reduce this barrier.</td>
</tr>
<tr>
<td>Miscellaneous barriers</td>
<td>Reported unimportant by 10% respondents</td>
<td>ICT does not reduce this barrier.</td>
</tr>
</tbody>
</table>

### 4.1.2.3 Technology Barriers

Table 7 lists down interview findings for technology barriers.

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Questionnaire Response</th>
<th>Finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mismatches with employees’ need</td>
<td>Reported unimportant by 60% respondents</td>
<td>At Avanade, employees are considerably involved in the design, development and deployment of technology driven knowledge sharing. Management relies considerably on the feedback of employees to make decisions on</td>
</tr>
</tbody>
</table>
using ICT for knowledge sharing e.g. for applications. Also employees themselves envision and develop organizational knowledge sharing. These all factors combined have helped eliminate this barrier considerably.

Since at Avanade, employees are tech-savvy and considerably involved in the design of knowledge sharing process, technology compatibility issues have not surfaced.

Employees are familiar with IT/IS systems because they are active part of ICT driven knowledge sharing. Employees are also very well versed with technology.

Since technology for knowledge sharing is adopted keeping in mind employee’s expectations, needs and requirements, employees generally know what the technology can do for them in knowledge sharing and how to best leverage it for organizational use.

Adequate management support of knowledge sharing and investments make sure that adequate technical support is available in case of system failures.

<table>
<thead>
<tr>
<th>Compatibility of technology</th>
<th>Reported unimportant by 90% respondents</th>
<th>Since at Avanade, employees are tech-savvy and considerably involved in the design of knowledge sharing process, technology compatibility issues have not surfaced.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unfamiliarity of IT/IS system</td>
<td>Reported unimportant by 90% respondents</td>
<td>Employees are familiar with IT/IS systems because they are active part of ICT driven knowledge sharing. Employees are also very well versed with technology.</td>
</tr>
<tr>
<td>Unrealistic expectations</td>
<td>Reported unimportant by 80% respondents</td>
<td>Since technology for knowledge sharing is adopted keeping in mind employee’s expectations, needs and requirements, employees generally know what the technology can do for them in knowledge sharing and how to best leverage it for organizational use.</td>
</tr>
<tr>
<td>Lack of technical support</td>
<td>Reported unimportant by 90% respondents</td>
<td>Adequate management support of knowledge sharing and investments make sure that adequate technical support is available in case of system failures.</td>
</tr>
</tbody>
</table>

| Table 7 - Interview Findings for Technology Barriers (Source: Authors’ Analysis) |

4.2 OVERALL VIEW OF FINDINGS

This section presents a consolidated view of all findings. Figure 14 shows the percentage of barriers reported unimportant by more than 50% of respondents. A baseline value of 50% is taken to portray the majority opinion against each barrier. Any barrier reported unimportant by less than 50% respondents is not accounted for here. Figure 15 shows findings based on interviews and depicts reduction in knowledge sharing barriers by use of ICT. Research findings show the following overall results:

- **Organizational barriers**: 12 out of 13 barriers (92%) were reported unimportant by more than 50% of respondents. ICT was found to have reduced severity of 10 barriers (76%).

- **Individual barriers**: 7 out of 10 barriers (70%) were reported unimportant by more than 50% of respondents. ICT was found to have reduced severity of 5 barriers (50%).

- **Technology barriers**: 5 out of 5 barriers (100%) were reported unimportant by more than 50% of respondents. ICT alone was not found to have reduced the severity of any barrier however; management support and employee know-how of technology and involvement in knowledge sharing implementation was found to have reduced severity of all technology barriers.
Figure 14 - Overall View of Questionnaire Responses (Source: Authors' Illustration)

Figure 15 - Overall View: Percentage of Barriers ICT found to have reduced severity of (Source: Authors' Illustration)
4.3 DISCUSSION

From questionnaire findings it was revealed that in Avanade’s case, many of the knowledge sharing barriers do not exist or do not significantly hinder the knowledge sharing process. This holds true for all of the barrier categories. A major plausible reason to this, also suggested in the interviews, seems to be that at Avanade, their ICT enabled knowledge sharing is very well-established. This knowledge sharing process (known as digital collaboration in Avanade) is envisioned, designed and implemented by the employees themselves and equally supported by the management. This can suggest the importance of employees when designing or setting up knowledge sharing in organizations. A good knowledge sharing process, one that considers and uses feedback from end users of the system (employees in this case) in its design may well considerably reduce knowledge sharing barriers in the organization. On the other hand, an equally opposite situation may surface if employees considerations and preferences are not taken into account which could possibly lead to expansion of barrier space in the organization by introducing or escalating organization, technological and individual barriers.

Avanade’s case also suggests how ICT can be effectively used for knowledge sharing. An effective ICT based knowledge sharing environment in essence makes use of specialized IT applications for digital collaboration. As evident from Avanade’s case, ICT is used at higher levels than mere computers and networks. Specialized knowledge sharing platforms, intended to accelerate and enhance knowledge sharing, have been implemented. In addition to emails, the organization extensively makes use of web portals, wikis etc to bring to ‘harness the hundred headed brain’.

Observing from the facts, it is to be acknowledged that ICT’s role in Avanade’s knowledge management is of a major pillar as suggested by Mohamed, Stankosky and Murray (2006) in their knowledge management framework. As echoed in the interview findings, a large part of Avanade’s success in knowledge sharing is also because of the fact that employees are tech-savvy and undergo trainings and workshops before commencing their jobs in the organization. Because of this, they already have exposure to the technology used for knowledge sharing and technology barriers do not possess a significant issue in organization. The findings are also in agreement with Hendriks (1999) that use of ICT for knowledge sharing enhances the knowledge sharing process as well as helps reduce knowledge sharing barriers. From the interview findings it became clear that a number of organizational and individual barriers were able to be reduced by use of ICT. The inherent benefits that web portals and virtual communities of practice offer seem to take away a number of problems haunting traditional knowledge sharing environments. This is because with web portals and virtual knowledge sharing communities, employees find the knowledge sharing environment much more trustworthy and conducive. Trustworthy because knowledge shared is documented and visible to everyone with employee’s unique username which reduces personal fears of not sharing knowledge because ideas might be stolen or that someone might benefit more. The process also becomes much more enhanced and conducive because a number of barriers are reduced and better (ICT) tools are available to facilitate knowledge sharing. ICT with its additional roles also helps at operational and functional levels of the organization by providing better means of knowledge storage and transfer.
CHAPTER 5 - CONCLUSION AND RECOMMENDATIONS

This chapter answers the strategic and research questions formulated for this thesis. Implications of managerial and practical relevance are also included in this chapter.

From this study, it became evident that ICT was able to considerably reduce organizational and individual barriers. While reduction of time and space barriers by ICT has been noted by many researchers, it became apparent that other knowledge sharing barriers that ICT may reduce considerably or potentially eliminate in organizations are: one way flow of information, big department size, cost of knowledge sharing, lack of technology training and lack of interest for knowledge retention. These organizational barriers were seen to have been mostly strongly affected by ICT.

Individual barriers that most strongly saw reduction were: lack of time, fear of job security, asserting own position and authority (reluctance to learn from junior employees), and lack of trust among employees.

With regards to technology barriers, important observations were noted. Although ICT was not seen to have reduced any technology barriers, it became known that inclusion of employees in the design and deployment of ICT enabled knowledge sharing will significantly reduce technology barriers in organizations. In Avanade’s case, management support of organizational knowledge sharing followed by empowering employees to set up knowledge sharing environment according to their own needs, significantly reduced the technology barriers.

Based on this study, it can be concluded that use of ICT has renewed interest of organizations in knowledge sharing. It is evident that ICT enabled knowledge sharing brings a number of benefits for these organizations and industries. In this thesis, it is advocated that for organizations to better implement their knowledge sharing implementations, they should consider adopting ICT at greater levels. While ICT will nevertheless be able to play the role of a facilitator in knowledge sharing, greater and strategic benefits may be achieved if a strategic approach towards ICT is adopted and organizations formally adopt ICT for knowledge sharing. This will allow them to integrate ICT enabled knowledge sharing in their organizational strategy which will also push for appropriate technology investments needed for knowledge sharing. A formal approach, is thus, highly recommended for organizations to reduce knowledge sharing barriers, and in fact may well be said to be a prerequisite for ICT to play its instrumental role in reducing barriers.
LIST OF REFERENCES

Books


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Journal Articles


Master, M., 1999, Making it work.*Across the Board*, 36 (8), pp. 21-4.


ICT Enabled Knowledge Sharing – The Impact of ICT on Knowledge Sharing Barriers


**Journal Articles retrieved from online database**


**Conference paper, Training, meeting**


Sveiby, K.-E. (2003), Personal Conversation, Griffith Business School, Brisbane, 8 October.

**World Wide Web and other Electronic Resources**


Appendix A - Questionnaire

“A ll my knowledge comes from research” - S tan S akai

This questionnaire is a part of thesis in IT management by two students from Malardalsens University, Sweden. We request for 15-20 minutes of your time to fill out this quick questionnaire.

Information given will be strictly used for academic purposes only.

Your honest and valuable input will greatly help us conclude our research.

Thesis Information
Title: ICT enabled Knowledge Sharing: The Impact of ICT on Knowledge Sharing Barriers
Purpose: Aims to identify knowledge sharing problems (barriers) that ICT can reduce by examining these problems in a technology-driven environment
Authored by: Rana Alamgir and Ahmed Shahid
Supervised by: Dr. Ole Liljefors

Please read before you begin
Knowledge sharing can be defined as an activity through which information, skills, expertise, experiences etc gained by someone are exchanged with other people in a community or an organization. The goal is to pass on what someone knows to others. In an organization this refers to sharing own information in a collaborative environment. There are many ways to share own information (or knowledge) with other employees, for example, by connecting with other employees through shared communities, meetings, workshops, trainings etc. However, sharing information or knowledge is not an easy process because of many problems that make knowledge difficult to be conveyed to others. These problems, also called barriers of knowledge sharing process, refer to any factors that hinder or obstruct employees from sharing their knowledge with others in the organization. This questionnaire aims to identify these barriers by asking for your responses.

Note: Terms ‘knowledge’/‘knowledge sharing’ and ‘information’/‘information sharing’ have been generalized and are synonymous in this questionnaire.

Directions
This form uses clickable check-boxes and text fields. To give your opinion, please click the check-box or type in a text field. Don’t forget to press ‘Save’ when done. You can mail the questionnaire to blue_allure@hotmail.com or rana_xp@hotmail.com

Personal Information (If you want to remain anonymous, you only need to provide organization name)
Name:
Designation:
Gender: Male ☐ Female ☐
Organization name:
Industry type:
PART 1: General Questions

1. On daily basis, how much time do you spend in information sharing in your organization? (This can include information sharing through online communities, emails to discuss problem(s), meetings, seminars, trainings you give or receive etc.)

2. How do you perceive use of technology for information sharing (choose one)?
   - Technology enhances information sharing considerably
   - Technology does not matter in information sharing
   - Technology makes information sharing difficult

3. Which way do you mostly use to share information with others in your organization? Choose only one main option and as many sub-options as you think are applicable
   - Computer based
     - e-mails
     - Internet
     - An online intra-organizational information sharing community
     - Specialized Knowledge Management System software
     - Other, please specify:
   - Human interaction based
     - Meetings
     - Conferences/Seminars
     - Other, please specify:

PART 2: Problems in Information Sharing

This part of questionnaire aims to identify problems (barriers) in information sharing.

IMPORTANT: Please limit the responses to your own particular organizational environment i.e. problems you perceive as most critical in your own organization.

Problems listed here are known to have an effect on information sharing process. For each statement, please check mark (by clicking) ONLY ONE of the given options to indicate problem difficulty level.

A) Organization Problems

1. Non-integration in Organizational Strategy: Organization does not consider information sharing to be strategically important and has not integrated it in its goals and strategy
   - It is a critical level problem
   - It is an important problem
   - It is a medium level problem
   - It is not an important problem

2. Lack of Technology Investment: Organization does not invest in using technology for information sharing
   - It is a critical level problem
   - It is an important problem
   - It is a medium level problem
   - It is not an important problem

3. Lack of Technology Training: Sufficient training to learn technology for information sharing is not provided
4. **Poor Management Communication:** Management does not properly communicate benefits of information sharing to employees
- It is a critical level problem
- It is an important problem
- It is a medium level problem
- It is not an important problem

5. **Lack of Space:** Sufficient and favorable physical space is a pre-requisite to information sharing but not provided (e.g. conference or meeting rooms)
- It is a critical level problem
- It is an important problem
- It is a medium level problem
- It is not an important problem

6. **Lack of Motivation and Support:** Management does not motivate employees to share information and does not offer any rewards for sharing information
- It is a critical level problem
- It is an important problem
- It is a medium level problem
- It is not an important problem

7. **Non-supportive Organizational Culture and Structure:** Organizational culture and structure are not favorable for information sharing
- It is a critical level problem
- It is an important problem
- It is a medium level problem
- It is not an important problem

8. **Lack of Interest in Information Retention:** Organization does not view information-rich employees as important and does not try to retain them
- It is a critical level problem
- It is an important problem
- It is a medium level problem
- It is not an important problem

9. **Lack of Proper Infrastructure and Resource:** Organization lacks proper infrastructure or resources to support information sharing
- It is a critical level problem
- It is an important problem
- It is a medium level problem
- It is not an important problem

10. **High Competition between Departments:** There is strong competition between organization’s departments due to which employees do not share knowledge
- It is a critical level problem
- It is an important problem
- It is a medium level problem
- It is not an important problem

11. **Big Department Size:** Organization’s units or departments are too big in size to manage information sharing in them
- It is a critical level problem
- It is an important problem
- It is a medium level problem
- It is not an important problem
12. **One-way Flow of Information**: Information is shared in only one direction (i.e. only one party benefits) but not two-ways
- It is a critical level problem
- It is an important problem
- It is a medium level problem
- It is not an important problem

13. **Cost of Information Sharing**: Cost of utilizing human or technological resources for information capturing and categorizing is too high
- It is a critical level problem
- It is an important problem
- It is a medium level problem
- It is not an important problem

**B) Employee Problems**

1. **Poor Communication Skills**: Employees have poor verbal and written communication skills
- It is a critical level problem
- It is an important problem
- It is a medium level problem
- It is not an important problem

2. **Lack of Time**: Employees are given too little time for information sharing because managers consider other tasks important
- It is a critical level problem
- It is an important problem
- It is a medium level problem
- It is not an important problem

3. **Fear of Job Security**: Employees fear that sharing information may put their jobs at risks because someone else might benefit better from their information
- It is a critical level problem
- It is an important problem
- It is a medium level problem
- It is not an important problem

4. **Low Awareness of Value of Information**: Employees think that what they know is not valuable or beneficial for others therefore there is no need to share it
- It is a critical level problem
- It is an important problem
- It is a medium level problem
- It is not an important problem

5. **Unavailability of Information in Written Form**: Information to be shared is not available in written and documented form
- It is a critical level problem
- It is an important problem
- It is a medium level problem
- It is not an important problem

6. **Pride of Position and Authority**: Senior employees are unwilling to learn from junior employees because senior employees think they have a bigger position, more experience and/or authority in organization
- It is a critical level problem
- It is an important problem
- It is a medium level problem
- It is not an important problem
7. **Culture and Language:** Employees from different cultures, languages and backgrounds are involved in information sharing
   - [ ] It is a critical level problem
   - [ ] It is an important problem
   - [ ] It is a medium level problem
   - [ ] It is not an important problem

8. **Lack of Trust:** There is lack of trust amongst employees due to which they may not honestly share information with others
   - [ ] It is a critical level problem
   - [ ] It is an important problem
   - [ ] It is a medium level problem
   - [ ] It is not an important problem

9. **Intolerance to Mistakes and not Learning from them:** Learning from employee’s mistakes (for future lessons) is ignored by managers because they are intolerant to mistakes
   - [ ] It is a critical level problem
   - [ ] It is an important problem
   - [ ] It is a medium level problem
   - [ ] It is not an important problem

10. **Age, Education and Experience:** Employee’s of different age, gender, education and experience are involved in information sharing
    - [ ] It is a critical level problem
    - [ ] It is an important problem
    - [ ] It is a medium level problem
    - [ ] It is not an important problem

**C) Technology Problems**

1. **Mismatch with Employees Work Requirements:** Technology used for information sharing (such as special software systems or online information sharing communities etc) does not match with employees work requirements
   - [ ] It is a critical level problem
   - [ ] It is an important problem
   - [ ] It is a medium level problem
   - [ ] It is not an important problem

2. **New Technology Incompatible with Existing Technology:** Newly adopted technology for information sharing does not work with existing technology
   - [ ] It is a critical level problem
   - [ ] It is an important problem
   - [ ] It is a medium level problem
   - [ ] It is not an important problem

3. **Lack of Familiarity with Technology:** Employees do not know how to use technology for information sharing
   - [ ] It is a critical level problem
   - [ ] It is an important problem
   - [ ] It is a medium level problem
   - [ ] It is not an important problem

4. **Uncertainty about Technology Potential:** Employees are not sure about what technology can do in information sharing
   - [ ] It is a critical level problem
   - [ ] It is an important problem
   - [ ] It is a medium level problem
5. **Lack of Technical Support**: There is lack of technical support in case of crash of technology
- [ ] It is not an important problem
- [ ] It is a critical level problem
- [ ] It is an important problem
- [ ] It is a medium level problem
- [ ] It is not an important problem

**Part 3: Comments**

Please give any comments that you might think are important for information sharing. You might want to tell us any other problems that you experience in information sharing in your organization.
Appendix B - Barrier-wise Questionnaire Responses

Organizational Barriers
Barrier-wise questionnaire findings for organizational barriers are given below.

Non-integration in Organizational Strategy

- 70% of respondents did not perceive this barrier as an important problem while 20% viewed the barrier as a medium level problem. 10% thought of the barrier as an important problem and none of the respondents thought it is a critical barrier.

Lack of Technology Investment

- 60% of respondents did not perceive this barrier as an important problem while 30% viewed the barrier as a medium level problem. 10% of respondents viewed the problem as important and none of the respondents viewed the barrier as critical.

Lack of Technology Training

- 80% of respondents did not perceive this barrier as an important problem while 20% viewed the barrier as a medium level problem. None of the respondents viewed the barrier as critical or important.
90% of respondents did not perceive this barrier as an important problem while 10% viewed the barrier as a medium level problem. None of the respondents viewed the barrier as critical or important.

90% of respondents did not perceive this barrier as an important problem while 10% viewed the barrier as a medium level problem. None of the respondents viewed the barrier as critical or important.

60% of respondents perceived this barrier as an important problem while 30% viewed the barrier as critical. 10% of respondents thought the barrier was of medium severity but none of the respondents viewed the barrier as not important.
70% of respondents did not perceive this barrier as an important problem while 20% viewed the barrier as a medium level problem. 10% of respondents thought it is an important problem but none of the respondents viewed it as a critical problem.

80% of respondents did not perceive this barrier as an important problem while 10% viewed the barrier as a medium level problem. None of the respondents viewed the barrier as critical but 10% of respondents thought it is an important problem.

90% of respondents did not perceive this barrier as an important problem while 10% viewed the barrier as a medium level problem. None of the respondents viewed the barrier as critical or important.
70% of respondents did not perceive this barrier as an important problem while 30% viewed the barrier as a medium level problem. None of the respondents viewed the barrier as critical or important.

80% of respondents did not perceive the barrier as an important problem while 20% viewed the barrier as an important problem. None of the respondents viewed the barrier as critical or of medium level.

90% of respondents did not perceive the barrier as an important problem while 10% viewed the barrier as a medium level problem. None of the respondents viewed the barrier as critical or important.
80% of respondents did not perceive the barrier as an important problem while 20% viewed the barrier as a medium level problem. None of the respondents viewed the barrier as critical or important.

**Individual Barriers**

Barrier-wise questionnaire findings for individual barriers are given below.

60% of respondents did not perceive this barrier as an important problem while 10% viewed the barrier as important and 30% thought it’s a medium level problem. None of the respondents viewed the barrier as critical.

80% of respondents did not perceive this barrier as an important problem while 20% viewed the barrier as a medium level problem. None of the respondents viewed the barrier as critical or important.
90% of respondents did not perceive this barrier as an important problem while 10% viewed the barrier as a medium level problem. None of the respondents viewed the barrier as critical or important.

80% of respondents perceived this barrier as an important problem while 20% viewed the barrier as critical. None of the respondents viewed the barrier as not important or medium.

70% of respondents perceived this barrier as an important problem while 10% viewed the barrier as medium, 10% as not important and 10% critical.
80% of respondents did not perceive this barrier as an important problem while 20% viewed the barrier as a medium level problem. None of the respondents viewed the barriers as important or critical.

90% of respondents did not perceive this barrier as an important problem while 10% viewed the barrier as a medium level problem. None of the respondents viewed the barrier as critical or important.

70% of respondents did not perceive this barrier as an important problem while 30% viewed the barrier as a medium level problem. None of the respondents viewed the barrier as critical or important.
90% of respondents did not perceive this barrier as an important problem while 10% viewed the barrier as a medium level problem. None of the respondents viewed the barrier as critical or important.

70% of respondents perceived this barrier as an important problem while 10% viewed the barrier as a critical level problem. 10% of the respondents thought the problem was not important and 10% thought it is a medium level problem.

**Technology Barriers**
Barrier-wise questionnaire findings for technology barriers are given below.

60% of respondents did not perceive this barrier as an important problem while 10% viewed the barrier as important and 30% thought it’s a medium level problem. None of the respondents viewed the barrier as critical.
90% of respondents did not perceive this barrier as an important problem while 10% viewed the barrier as a medium level problem. None of the respondents viewed the barrier as critical or important.

80% of respondents did not perceive this barrier as an important problem while 20% viewed the barrier as a medium level problem. None of the respondents viewed the barrier as not important or medium.
90% of respondents did not perceive this barrier as an important problem while 10% viewed the barrier as a medium level problem. None of the respondents viewed the barriers as important or critical.