Inter- and Intra-Project Knowledge Transfer—Analysis of Knowledge Transfer Techniques

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Abstract

Many studies in the area of project management and social networks have identified the significance of project knowledge transfer within and between projects. However, only few studies have examined the intra- and inter-projects knowledge transfer activities. Knowledge in projects can be transferred via face-to-face interactions on the one hand, and via IT-based tools on the other. Although companies have allocated many resources to the IT tools, it has been found that they are not always effectively utilized, and people prefer to look for knowledge using social face-to-face interactions. This paper explores how to leverage effectively two alternative knowledge transfer techniques, face-to-face and IT-based tools to facilitate knowledge transfer and enhance knowledge creation for intra- and inter-project knowledge transfer. The paper extends the previous research on the relationships between and within teams by examining the project's external and internal knowledge networks concurrently. Social network qualitative analysis, using a case study within a small-medium enterprise, was used to examine the knowledge transfer activities within and between projects, and to investigate knowledge transfer techniques. This paper demonstrates the significance of overlapping employees working simultaneously on two or more projects and their impact on facilitating knowledge transfer between projects within a small/medium organization. This research is also crucial to gaining better understanding of different knowledge transfer techniques used for intra- and inter-project knowledge exchange. The research provides recommendations on how to achieve better knowledge transfer within and between projects in order to fully utilize a project's knowledge and achieve better project performance.

Keywords: face-to-face, inter-project knowledge transfer, intra-project knowledge transfer, IT-based tools, social networks

Introduction

Knowledge is a powerful asset for organizations (Alavi & Leidner, 2001; Liebowitz, 2005, 2008; Love, Fong, & Irani, 2005; Nonaka & Takeuchi, 1995). In order to identify, share, apply, and create knowledge within the organization, this asset has to be properly managed; otherwise, valuable knowledge can be irretrievably lost. Knowledge management requires intensive efforts to improve how knowledge is created, delivered, and used (Davenport, Prusak, & Strong, 2008). The theory of organizational learning and knowledge management emphasizes the importance of knowledge as a key to gaining better performance and ultimately a competitive advantage (Argote, McEvily, & Reagans, 2003; Davenport & Prusak, 1998; Fiol & Lyles, 1985; Love, Irani, & Edwards, 2003; Nonaka & Takeuchi, 1995). To remain competitive and innovative, organizations must have the potential to learn, unlearn, or relearn based on their past behaviors (Fiol & Lyles, 1985).

Projects have been recognized as an important locus for organizational knowledge and innovation (Newell, Goussevskaia, Swan, Bresnen, & Obembe, 2008). In project-based organizations (PBOs), knowledge transfer is needed for both inter-project and intra-project activities (Baccarini, 1999; Bower & Walker, 2007; Kotnour, 1999; Schindler & Eppler, 2003;

Walker, Wilson, & Srikanathan, 2004). Intra-project learning is the creation and transfer of knowledge within a project, and inter-project learning is the creation and transfer of knowledge between projects. Successful knowledge transfer within and between projects avoids reinventions and saves time (Carrillo, 2005; Walker, 2004). However, PBOs simultaneously face serious knowledge needs in their projects. They tend to repeat the same mistakes because of a lack of effective knowledge transfer (Landaeta, 2008).

There are different mechanisms that facilitate knowledge transfer. Early initiatives in knowledge management focused on providing electronic databases, network systems, and software (Chow & Chan, 2008), but empirical findings have shown that these mechanisms were far from satisfactory. It was found that people prefer to turn to other people rather than documents for information (Pelz & Andrews, 1966; Mintzberg, 1973; Allen, 1977). Similarly, project environment social networks have been recognized as a very important tool for cross-project knowledge transfer. It has been found that knowledge transfer in projects is more effective when it depends heavily on social networks and informal dialogue rather than on IT (Newell, Bresnen, Edelman, Scarbrough, & Swan, 2006). Thus, researchers have argued that knowledge transfer is more about managing knowledge workers and cultivating relationships between them, rather than developing information and communication technologies for extracting and capturing their knowledge (Hansen, Nohria, & Tierney, 1999; Newell, Robertson, Scarbrough, & Swan, 2002). In addition, it was found that the interpersonal relationships are significantly correlated with knowledge transfer and individual performance. Empirical research has demonstrated that the quantity of contacts within other functional groups and in higher hierarchy is positively related to access to organizational information and individual performance (Cross & Cummings, 2004; Seibert, Kraimer, Liden, 2001). Mehra, Kilduff, and Brass (2001) found that employees who have greater numbers of informal socializing connections with peers have higher performance ratings than those with fewer numbers of such connections. As Emerson (1962) suggested, having more contacts creates more alternatives for obtaining valued resources and more ideas, and control over the use of those resources. However, it takes time and effort to initiate, develop, and maintain relationships. Employees have limited time and energy to interact with existing friends (Boissevain, 1974; Latour & Woolgar, 1979), and there will be a limit to the number of relationships that any given person can maintain (Mcfadyen & Cannella, 2004). Excessive contacts will consume much time and energy and consequently reduce the necessary time and energy devoted to knowledge absorption and creation. From the project management perspective, projects are often in remote locations and socializing is not always possible. There is also a need to consider the frequent mobility of people. In a project environment, people move from one project to the other, change positions, or leave the organization. It is hard to locate relevant people with the right knowledge in hand.

Regarding the two major means of knowledge transfer, face-to-face and IT-based tools, employees prefer the former to the latter. However, due to the project's remote location, frequent employee mobility and limited number of possible relationships, face-to-face is not always possible and recommended. Thus, PBOs are facing the challenge of how to leverage effectively the two means—face-to-face and IT tools—to facilitate knowledge transfer and enhance knowledge creation. This paper aims to explore a solution to this challenge by case studying a small to medium project-based enterprise.

The first part of this paper outlines knowledge transfer in PBOs, underlining the significance of intra- and inter-project knowledge networks, and provides some insights into different mechanisms used to transfer knowledge. It continues with a discussion on various

knowledge transfer techniques. The paper then presents the empirical study, which investigated knowledge transfer techniques used to transfer knowledge within and between projects. It extends the previous research on the relationships between and within teams by examining projects' internal and external knowledge transfer activities concurrently. Qualitative analysis on social networks, derived from the theory of social capital, was used to investigate the phenomenon of intra- and inter-project knowledge networks. The conclusions present recommendations on how to achieve better knowledge transfer within and across projects to utilize full project knowledge fully.

Intra- and Inter-Project Knowledge Transfer

The most important part of managing knowledge is its transfer to locations where it is needed and can be used (Alavi & Leidner, 2001). Knowledge transfer is one of the elements in the knowledge management process. Argote and Ingram (2000, p. 151) defined knowledge transfer as "the process through which one unit (e.g., group, department, or division) is affected by the experience of another." The transfer of organizational knowledge (i.e., routine or best practices) can be observed through changes in the knowledge or performance of recipient units. Transfer of knowledge occurs at various levels: between individuals, from individuals to explicit sources, from individuals to groups, between groups, across groups, and from the group to the organization.

Cross-field literature reviews on the area of social networks and project management have been conducted to investigate knowledge transfer within and between project teams. Existing research on project learning has recognized the need for knowledge transfer within and from projects (Baccarini, 1999; Bower & Walker, 2007; Kotnour, 1999; Schindler & Eppler, 2003; Walker, 2004). Nevertheless, in the field of social networks, most of the research is focused solely on the networks within groups or teams (Coleman 1988, 1990; Granovetter, 1985; Krackhardt, 1999; Portes & Sensenbrenner, 1993), and only some of the current research shifts the attention to the networks outside the teams (Oh, Chung, & Labianca, 2004; Reagans & Zuckerman, 2001; Sparrowe, Liden, Wayne, & Kraimer, 2001).

In the area of social networks, it was found that group members connected by strong relationship ties benefit from embedded and dense networks (Coleman, 1988, 1990). Tie strength is a social network concept ranging from weak ties at one extreme to strong ties at the other, characterizing the closeness and interaction frequency of a relationship between two parties (Levin & Cross, 2004) in this research between knowledge seeker and knowledge source. Network density is maximized when all team members communicate with each other frequently. Density describes the overall level of various kinds of interaction reported by network members. It is analogous to the mean number of ties per group member. The more ties each group member has with other group members, the greater the density of the network (Sparrowe et al., 2001). The denser the network the more the team members are connected to each other, and the stronger the connections between them. Dense groups usually have more bounded solidarity, and greater trust (Granovetter, 1985; Krackhardt, 1999; Portes & Sensenbrenner, 1993). It was also found that there are positive relationships between group closure and performance. Increases in network density indicate the enhanced capacity for a team to coordinate its actions, thereby enhancing performance (Reagans & Zuckerman, 2001). For example, Reagans and Zuckerman (2001) found that R&D teams that have more dense networks of interaction achieve a higher level of productivity than those with sparse networks. However, closed networks might also have unintended consequences on performance if they result in comfortable interactions, because they do not necessarily have the most relevant knowledge for the task at hand (Erickson, 1988; Mizruchi & Stearns, 2001). Furthermore,

people are willing to share information when they are similar to each other. On the other hand, members of closed networks tend to share information already known by members while they would gain much more from sharing knowledge with other teams (Mesmer-Magnus & DeChurch, 2009). Therefore, to enable and encourage organizational learning, cross-project communication is needed (Hobday, 2000).

In the field of social networks, it was found that groups that communicate more frequently with people outside of groups have greater access to outside resources (e.g., Hansen, 1999; Tsai, 2001). Groups whose members socialize outside the workplace with other diverse groups from within their organization will learn about developments in the organization faster, because the relationships in which their members are engaged are trusting. Those groups will be more likely to receive important tacit knowledge because their members spend more time with a diverse set of people (Oh et al., 2004). Furthermore, Granovetter (1973) demonstrated that people who develop ties with disconnected groups gain access to a broader array of ideas and opportunities than those who are restricted to a single group.

In the project management literature, it was found that knowledge from one project is valuable and can be reused in other projects (Baccarini, 1999; Bower & Walker, 2007; Kotnour, 1999; Schindler & Eppler, 2003; Walker, 2004). In addition, it was found that inter-project knowledge transfer is critical for PBOs: as each new project starts, there is a tendency to reinvent the process rather than learn from the experiences of previous projects (Prusak, 1997). Effective sharing of knowledge across projects avoids unnecessary reinventions that are costly and time consuming (Carrillo, 2005; Walker, 2004).

In summary, the current focus is mainly on internal teams and their networks, while networks with outside teams have been found to be significant for greater knowledge exchange. These findings have been revealed in the literature on social networks as well as in the project management field. Thus, there is a need for PBOs to maintain internal and external project networks to achieve better knowledge share that leads to better project performance, and consequently organization performance.

Knowledge Transfer Techniques

The transfer of organizational knowledge, such as best practices, can be hard to achieve (Argote & Ingram, 2000) because it is difficult to connect the right person with the source of knowledge he or she requires. According to Gupta and Govindarajan (2000), there are five elements of knowledge transfer: (1) perceived value of the source knowledge; (2) motivational disposition of the source—a willingness to share knowledge; (3) the existence and richness of transmission channels; (4) motivational disposition of the receiver—his willingness to acquire knowledge from the source; and (5) the absorptive capacity of the receiver—the ability to acquire and use the knowledge. The focus of this paper is on the element of existence and the richness of transmission channels, here referred to as knowledge channels. The channel is the medium used to transmit the signal from transmitter to receiver (Shannon, 2001). In this paper, the term “channels” is used to describe the conduits between knowledge seeker and receiver. The channels can be wireless and wired and can take many forms including face-to-face contacts, staff meetings, policy statements, memos, e-mails, telephone conversations, and other electronic tools. In other words, channels are the patterns of organizational knowledge flow representing potentially established conduits through which employees can send and receive knowledge (Bartol, Tein, Matthews, & Sharma, 2008). There are informal versus formal channels and personal versus impersonal channels (Alavi & Leidner, 2001). Informal channels are unscheduled meetings, informal seminars,

and coffee break conversations. These types of channels are effective in promoting socialization and are mainly suited for small organizations. Examples of formal channels are training sessions, plant tours, and scheduled meetings. Personal channels are more effective for distributing highly context-specific knowledge and tacit knowledge. Examples of personal channels are apprenticeship and personnel transfer. The benefit of personal channels is that there is no need to transfer tacit knowledge to explicit. Impersonal channels, on the other hand, facilitate the transfer of knowledge that can be generalized to other contexts, such as explicit knowledge. Computer networks create forums that facilitate contact between the person seeking knowledge and those who may have access to that knowledge. For example, this may be accomplished by posting a question in the form of "does anybody know" or "request for help" in the virtual discussion group. Corporate directories may enable individuals to locate rapidly the person with the knowledge that may help to solve a current problem (Alavi & Leidner, 2001).

On the project level, knowledge transfer occurs during team meetings held on regular basis through informal interaction, e-mail exchange, and the use of different electronic tools. Intra-project learning focuses on tasks within a single project and supports the delivery of a successful project by identifying problems and solving them (Kotnour, 2000). On the other hand, inter-project knowledge transfer occurs mainly by capturing and transferring lessons learned beyond the project, through cross-project meetings and the use of IT-based knowledge repositories.

Currently in the literature, there is a dispute on what type of techniques should be used to transfer knowledge: soft by using personal, formal, or informal channels; or hard by using impersonal formal or informal channels. Soft techniques of transferring knowledge are represented mostly by face-to-face communication. On the other hand, hard techniques are electronic or document knowledge exchange, IT databases, wikis, and so on. Document exchange is a highly effective and efficient mechanism for sharing codified knowledge. It is often highly inactive for transmitting tacit knowledge. In contrast, conversations and the transfer of people are relatively inefficient mechanisms for sharing codified knowledge, but for transferring tacit knowledge, they may be the only effective mechanisms (Jasimuddin, 2008). In the majority of the literature, it is suggested that IT plays a central role in the transfer of organizational knowledge (Alavi & Leidner, 2001). However, other authors described the soft techniques of transferring knowledge as more effective (Cook & Brown, 1999; Foos, Schum, & Rothenberg, 2006; Liebowitz, 2005; Newell, Bresnen, Edelman, Scarbrough, & Swan, 2006). Other authors propose a hybrid approach as the best for transferring knowledge (Bhatt, 2001; Jasimuddin, 2008), arguing that both tacit and explicit knowledge are linked together.

Empirical Study

The empirical study investigated knowledge transfer networks within and between projects. The concept of networks comes from social network analysis related to social capital theory. A social network is a pattern of friendship, knowledge, advice, communication, or support that exists among the members of a social system (Knoke & Kuklinski, 1982; Burt & Minor, 1983; Wellman, 1988; Scott, 1991). In other words, a social network is a social structure made of individual so-called "nodes," which are tied (connected) by one or more specific types of relations, in this case knowledge. In this paper, internal project knowledge network refers to the number of a project team's internal knowledge connections, while external project knowledge network is the number of a project team's external knowledge connections. It has to be noted here that the number of ties (connections) and the number of

channels does not mean the same. Channels represent the number of conduits between knowledge seeker and receiver, while the ties represent the number of direct relationships between nodes. This can be seen in Figure 1. The network represents two channels, but three ties. Nodes A and B seek knowledge from Node C, and Node C seeks knowledge from Node B.

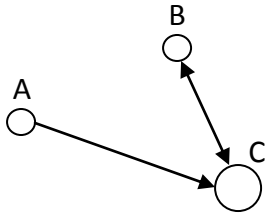

Figure 1. Knowledge Network

The case study was conducted in a small to medium project-based enterprise, known here as ITP. ITP designs and delivers intelligent transport systems projects. The study investigated knowledge transfer activities in ITP focusing on knowledge networks, and knowledge transfer techniques used to exchange three types of knowledge for the duration of four projects, namely A, C, E, and T. Most of the members from the four projects were co-located within the same building, and only some members were located in the adjacent building.

The data was collected from the members of the four projects (A, C, E, and T). The respondents' rate was 80%, which accounts for 57.5% of the overall number of ITP employees. Network analysis requires a high response rate of at least 80% (Wasserman & Faust, 1994); therefore, the findings could not be drawn based on the whole company, but only based on the four projects. The data was collected by asking ITP employees to "list the name of the person (inside or outside your project team) to whom you have turned for knowledge on work-related topics in the past three months, and to indicate the type of knowledge and the corresponding means to its transfer."

There are seven knowledge transfer techniques available for ITP employees as listed in Table 1. Among those techniques, Jira (Atlassian Pty. Ltd. [n.d.]) is the least known. Jira is a proprietary enterprise software product, commonly used for bug tracking, issue tracking, and project management .

Table 1. Knowledge Transfer Techniques in ITP

1	Face-to-face during formal meetings
2	Face-to-face during informal meetings
3	Telephone
4	E-mail
5	Wikis
6	Jira
7	Intranet
8	Printing documents

Based on knowledge typology proposed by Kasvi, Vartiainen, and Hailikari (2003), work-related knowledge in ITP was categorized into technical knowledge and procedural

knowledge. Procedural knowledge concerns how to produce and/or provide the product or service, and how to act in a project. Technical knowledge is knowledge about the product or service, its characteristics, attributes, parts, and/or technologies. A third knowledge type was added to this typology—knowledge about customer requirements, which was identified as important knowledge for ITP employees during preliminary interviews. The rationale behind this lies in the fact that projects are completed for clients; therefore, client requirements play an important role in product or service development. Knowledge about customer requirements includes documenting customer needs and understanding customer needs and expectations.

The number of knowledge transfer connections that occurred throughout the duration of the four projects was analyzed. The analysis also included the examination of the three knowledge types (technical, procedural, and about customer requirements) and the eight knowledge transfer techniques (face-to-face during formal meetings, face-to-face during informal meetings, telephone, e-mail, wikis, Jira, intranet, and printing documents).

Intra-Project Knowledge Transfer

Firstly, intra-project knowledge transfer was measured. Table 2 shows the number of knowledge transfer channels that are used to transfer the three types of knowledge in four projects. It has to be noted here that there was a high overlap in people working simultaneously on two or more projects at a time. It can be seen from Table 2 that members of all projects primarily used face-to-face informal interaction to acquire all three types of knowledge. They did not use wikis or the intranet. Printed documents were used only six times, primarily to transfer knowledge about customer requirements. Furthermore, project members sought for technical knowledge more than the other types of knowledge.

Table 2. Intra-Project Knowledge Transfer

Knowledge Transfer Techniques	Procedural Knowledge				Technical Knowledge				Knowledge About Customer Requirements			
	Project				Project				Project			
	A	C	E	T	A	C	E	T	A	C	E	T
Face-to-face formal	5	6	8	5	0	0	1	1	4	7	6	9
Face-to-face informal	**24**	**40**	**28**	**62**	**60**	**95**	**78**	**113**	**25**	**39**	**33**	**54**
Telephone	2	2	0	0	2	2	0	2	1	1	0	0
E-mail	2	2	4	1	3	3	9	4	5	6	9	4
Wikis	0	0	0	0	0	0	0	0	0	0	0	0
Jira	1	1	1	1	4	7	4	5	1	4	0	4
Intranet	0	0	0	0	0	0	0	0	0	0	0	0
Print documents	0	0	0	0	0	0	0	0	0	1	1	4
TOTAL	**34**	**51**	**41**	**69**	**69**	**107**	**83**	**125**	**36**	**58**	**49**	**75**

Figures 2a–2d, 3a–3d below represent technical knowledge transfer networks. Figures 2a–2d represent the face-to-face informal networks in projects A, C, E and T. Figures 3a–3d represent the e-mail networks in projects A, C, E, and T. A node in the network represents one employee, and a connection represents the tie between employees (nodes). Up-triangle nodes represent managers, and circle nodes represent non-managers. The degree of one node represents the number of ties connected to the focal node. The larger the node is the more people seek knowledge from that person. It is clearly seen that informal, face-to-face knowledge connections (Figures 2a–2d) are much denser in both cases compared to e-mail knowledge connections (Figures 3a–3d).

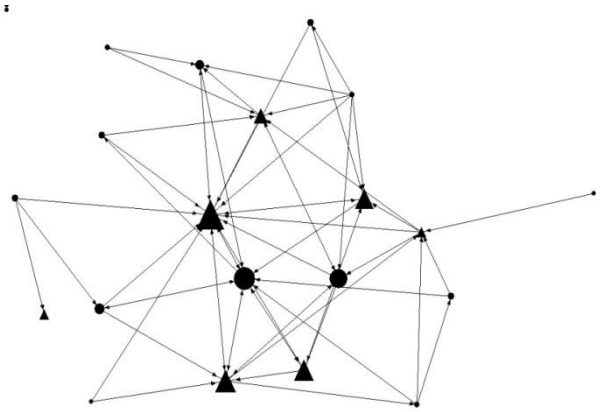

Figure 2a. Project A Technical Knowledge Transfer—Face-To-Face Informal Interaction

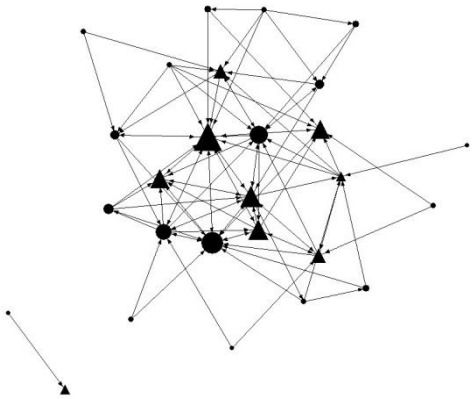

Figure 2b. Project C Technical Knowledge Transfer—Face-To-Face Informal Interaction

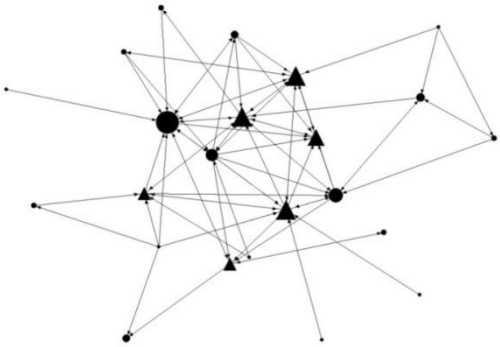

Figure 2c. Project E Technical Knowledge Transfer—Face-To-Face Informal Interaction

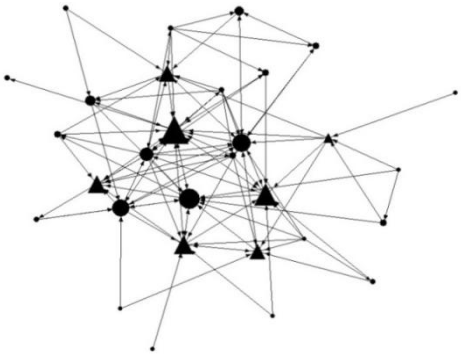

Figure 2d. Project T Technical Knowledge Transfer—Face-To-Face Informal Interaction

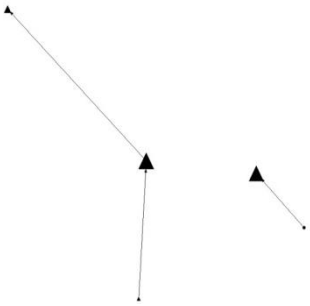

Figure 3a. Project A Technical Knowledge Transfer—E-Mail

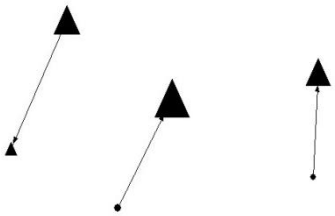

Figure 3b. Project C Technical Knowledge Transfer—E-Mail

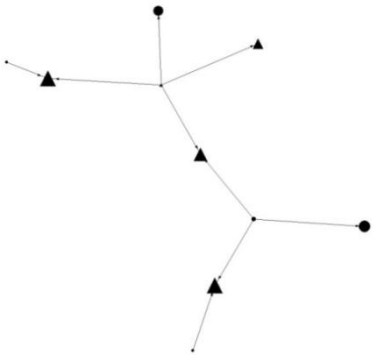

Figure 3c. Project E Technical Knowledge Transfer—E-Mail

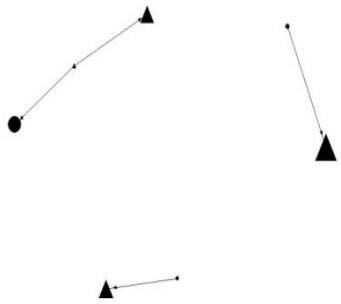

Figure 3d. Project T Technical Knowledge Transfer—E-Mail

Inter-Project Knowledge Transfer

It was a challenge to measure the inter-project knowledge transfer due to the substantial overlap in project members working simultaneously on two or more projects at the time. Therefore, only projects that had 50% or less overlapping employees were chosen for the analysis. As a result, only the knowledge transfer activities between projects T and E and projects T and A were analyzed. Figure 4 represents knowledge transfer networks within and between projects T and E, and representation of the data is listed in Table 3.

Table 3. Representation of the Figures 4 and 5

Network	Node Characteristic
Project T	Grey nodes
Project E	White nodes
Members working simultaneously on T and E	Black nodes
Managers	Up-triangle shapes
NON-Managers	Circle shapes

Black nodes represent overlapping employees who work simultaneously in projects E and T. The degree of the overlap is relatively high, which can be seen from black nodes that are, in most cases, larger than other nodes. This indicates that the overlapping employees play important roles in knowledge transfer activities. Furthermore, it can be seen that people largely seek knowledge from the managers (up-triangle shapes).

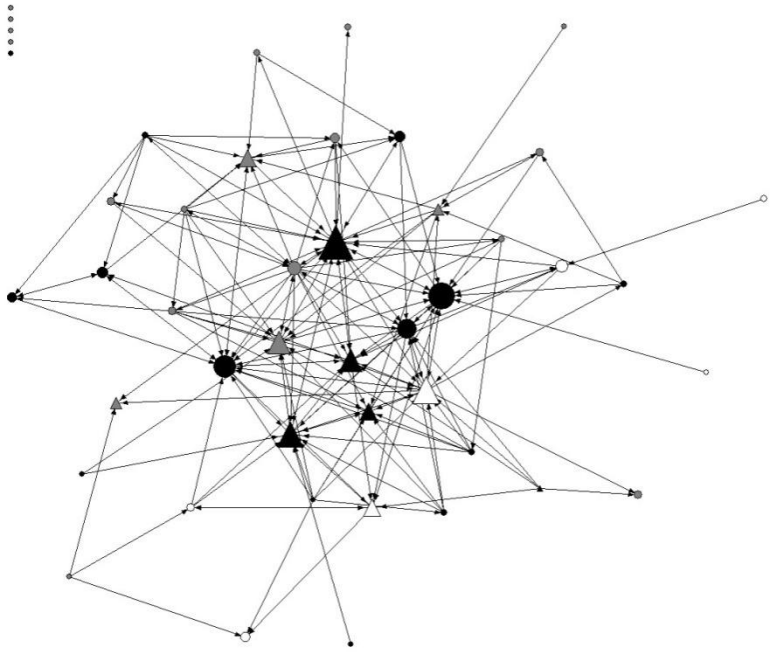

Figure 4. Knowledge Network Within and Between Projects T and E

Afterwards, people who worked simultaneously on projects T and E (black nodes) were removed from the network, and the inter-project knowledge transfer between remaining project members was examined. The results can be seen in Figure 5. Overall, 180 knowledge transfer connections within and between projects T and E were identified, among which only 6 were identified between project members that solely worked on either project E or T (the darker arrows). The remaining cross-project knowledge transfer occurred only between those members that worked on project T and E simultaneously.

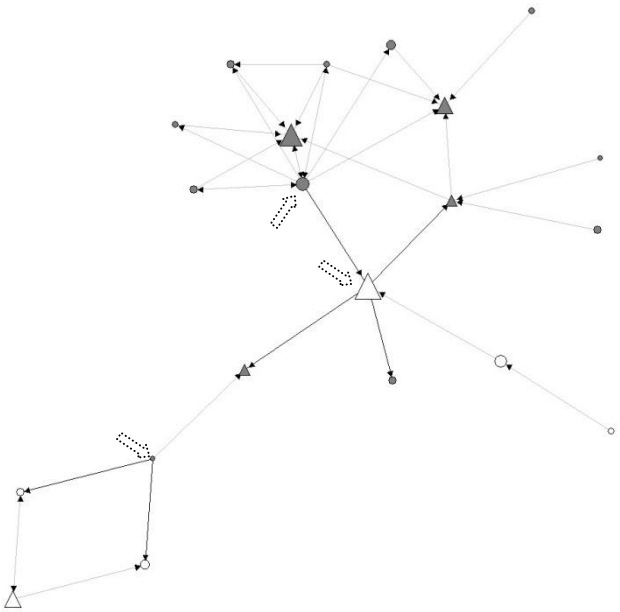

Figure 5: Knowledge Network Between Projects T and E, Excluding Overlapping Members

It is apparent from Figure 5 that only two members from project T (pointed gray nodes) sought knowledge from project E, and only one person from project E (pointed white

node) sought knowledge from project T. The remaining cross-project knowledge transfer occurred only between those members that worked on projects T and E simultaneously.

A similar situation occurred during knowledge transfer between projects A and T, which can be seen in Figures 6 and 7. Figure 6 shows knowledge transfer activities within and between projects A and T, and Figure 7 demonstrates the same network with overlapping employees removed. The representation of the figures is listed in Table 4.

Table 4. Representation of the Figures 6 and 7

Network	Node Characteristic
Project T	Grey nodes
Project A	White nodes
Members working simultaneously on A and T	Black nodes
Managers	Up-triangle shapes
NON-Managers	Circle shapes

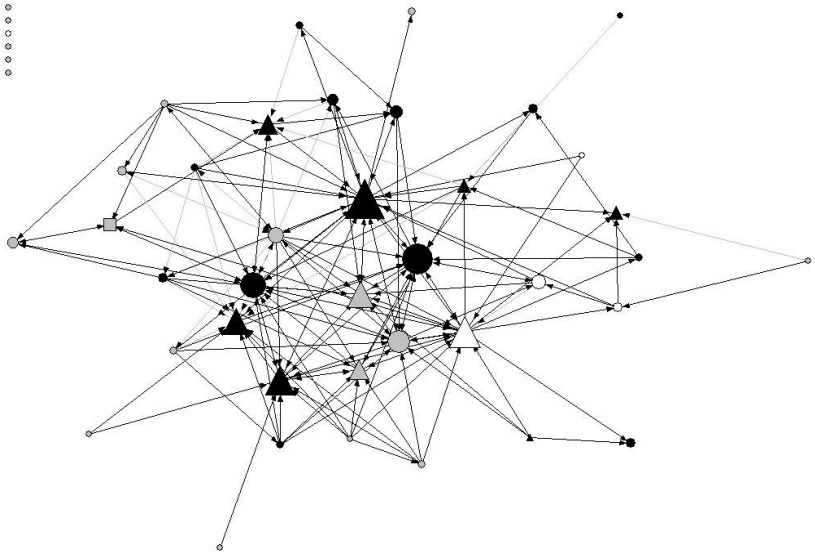

Figure 6. Knowledge Network Within and Between Projects A and T

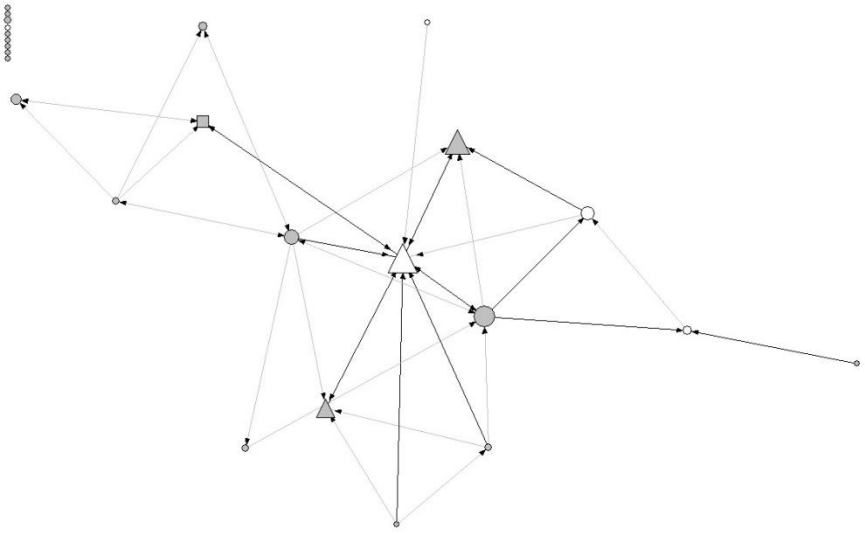

Figure 7. Knowledge Network Between Projects A and T, Excluding Overlapping Members

It can be seen that seven individuals took part in inter-project knowledge transfer: two individuals from project A (white nodes) and five from project T (gray nodes) sought knowledge outside the project.

As already mentioned, it was a challenge to examine inter-project knowledge transfer activities due to the high amount of overlapping employees. However, it is apparent from the two examples that overlapping employees play a significant role in inter-project knowledge transfer. To investigate that matter further, the paper examined an entire knowledge transfer network of the four projects excluding employees that worked on four and three projects at the time.

Figure 8 represents the knowledge network of all employees working on four projects. Circle nodes represent employees that worked on all four projects at the time; up-triangle represents those who worked on three projects; square those who worked on two projects; and down-triangle those who worked only on one project at the time. It can be seen from Figure 8 that the network is very dense, and knowledge transfer occurred frequently. However, when we exclude the employees who worked simultaneously on four projects (Figure 9) and further exclude those who worked on at least three projects at the time (Figure 10), it is apparent that the network became significantly sparser, and the knowledge transfer between remaining employees was only occasional.

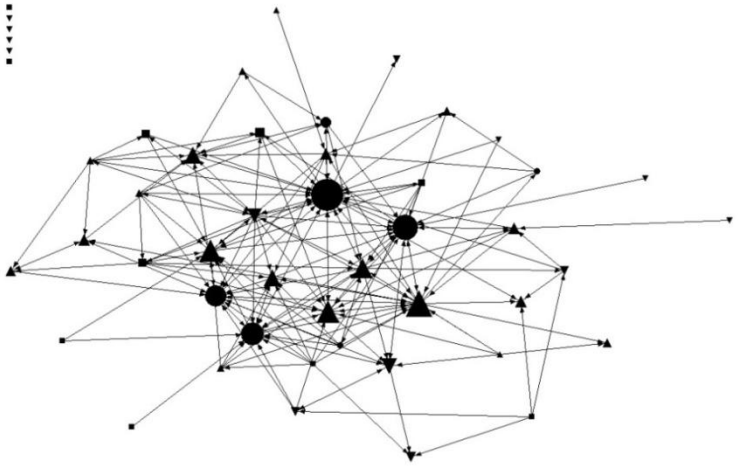

Figure 8. Knowledge Network Within and Between All Four Projects

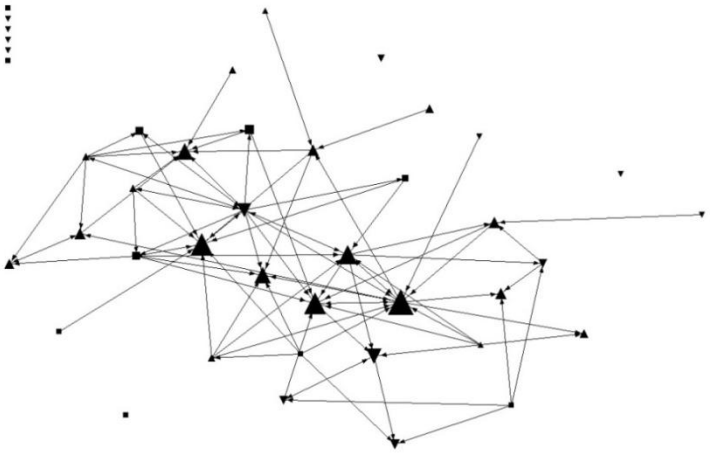

Figure 9. Knowledge Network Excluding People Who Worked on Four Projects Simultaneously

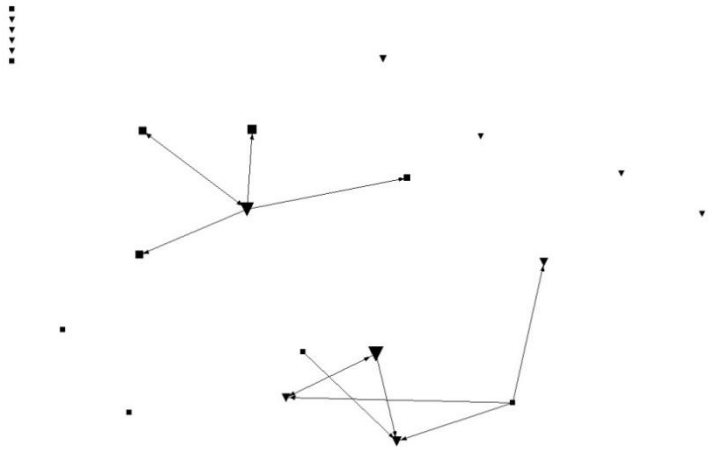

Figure 10. Knowledge Network Excluding People Who Worked on at Least Three Projects Simultaneously

Forty-nine nodes represent all employees working on four projects, among which 43 participated in knowledge transfer activities within and between projects. After excluding the people who worked on at least 3 projects at the time, 23 nodes remain, among which only 11 took part in knowledge transfer activities (as seen in Figure 10). Table 5 demonstrates the summary of these findings showing the number of remaining employees and their knowledge activities when the overlapping employees are gradually excluded from the network.

Table 5. Summary of Knowledge Transfer Networks Excluding Overlapping Employees

Knowledge Networks	Employees Remaining	Employees That Took Part In Knowledge Transfer Activities	Ties Remaining
Employees working on 4 projects	49	43	187
Excluding people working simultaneously on 4 projects	42	33	89
Excluding people working simultaneously on 3 projects	23	11	12

Face-To-Face Knowledge Transfer Does Not Always Occur Effectively

A case demonstrated that face-to-face communication is not always an effective technique for transferring knowledge. To solve the problem of setting up a server in ITP, one employee decided to find a relevant person to her help with the problem. Only a few people were able to solve the problem. However, when she contacted each of them, they were unavailable at the time. She stated that she spent five days seeking for knowledge from people to find out the solution. She claimed that if the information had been available on time she would have spent no more than two days solving the problem. In addition, this employee referred to wikis. However, the information she found was incomplete: "there was some info in wikis, but not all, and whatever was there was not organized." There is lack of standard guidelines on what and how to put information into wikis. "It is just a self-motivation," she claimed. As interactions between employees take time, people can be reluctant to engage in activities that are not recognized and rewarded by the organization, especially when he or she is busy doing other jobs that the organization recognizes and rewards (Cross & Prusak, 2002). From this example, it can be seen that face-to-face communication is not always the most effective and

efficient knowledge transfer technique. Therefore, other IT-based communication means can be complementary to face-to-face interactions; however, only if appropriately implemented.

Discussion

The results of the analysis show that while intra-project knowledge transfer networks are dense, the inter-project knowledge transfer networks are much sparser, especially when overlapping members were excluded. It appears that the overlapping members are the core of the inter-project knowledge transfer networks.

Additionally, it can be seen that project members mainly used face-to-face informal interaction to exchange knowledge. ITP facilitates such face-to-face informal communication because it is a small to medium business where all employees have easy access to each other. Furthermore, ITP facilitates such communication by establishing common areas in which employees can communicate and share their knowledge. This suggests that most knowledge is transferred within a short distance.

The interesting finding is that ITP employees' use of IT tools to transfer knowledge is minimal considering they are an IT company, as they are fluent in working with computerized technologies on a daily basis. This can be seen from the use of IT tools such as the intranet, Jira, and wikis, which was absent or minimal. This finding corresponds with the literature on project management and social networks, which indicates that people prefer to turn to other people for knowledge rather than to documents. Even those with ready access to the Internet and their firm's IT-based knowledge repository prefer social networks over documents and electronic knowledge exchange (Cross & Sproull, 2004). The limited use of IT-based strategies and the importance of social networks for cross-project knowledge transfer have also been identified by others (e.g., Keegan & Turner, 2001; Newell et al., 2006). The likely reason for this condition was due to the lack of integrated and user-friendly tools that enable collaboration, coordination, communication, as well as knowledge creation and sharing. Further study investigating the reason why ITP employees prefer to use face-to-face informal interaction instead of IT should be conducted.

It can be seen that all projects preferred to use face-to-face interactions while exchanging knowledge. However, use of face-to-face interaction is insufficient for effective knowledge transfer. In PBOs, there is a need for a balanced approach because face-to-face interaction is not always possible in a project environment. People involved in projects are not only functionally, but also geographically dispersed. Projects are time limited; often people change their location during a project. Sometimes it is difficult to find people who have been involved in a project from its beginning. Furthermore, the project's knowledge is dispersed, when the project ends people go back to their previous functions or start working on new projects. This results in organizational knowledge fragmentation and loss of organizational learning (Kasvi et al., 2003). Therefore, PBOs should facilitate access to integrated and user-friendly electronic tools and techniques, and consider that people do not want to be overwhelmed with the number of communication tools available. This can result in people's resistance to using them.

Conclusions

It can be concluded that in small to medium enterprises, where there is a potential for an overlap of members working simultaneously on two or more projects, inter-project knowledge transfer is facilitated. However, organizations should not rely solely on overlapping employees, but facilitate inter-project communication with employees from isolated areas by organizing informal gatherings, workshops, cross-project meetings, and

provide access to integrated knowledge base repositories, where people from different projects can seek knowledge and contribute to building organizational knowledge.

It was apparent that employees in ITP prefer to use face-to-face informal interaction to transfer the three types of knowledge. E-mail and face-to-face formal meetings were the second-most used techniques for knowledge and information exchange in the organization.

The least used knowledge techniques were wikis, printed documents, and the intranet. Employees primarily sought technical knowledge related to products or services and their characteristics, attributes, parts, and/or technologies. Some effort should be made to encourage employees to use and contribute to IT codified knowledge databases, mainly due to the projects remote locations and the mobility of project members. However, to encourage people to utilize IT tools they need to be easily accessed by all employees, as well as integrated and user friendly. People are not interested in searching for information in a pile of irrelevant documents, which can be tiresome and time consuming. An easy-to-use intelligible knowledge database, for example in the form of wikis, can ensure more frequent usage and contribution.

In summary, this study contributes to several streams of research. First, it adds to the project management and social network literatures by demonstrating a relationship between and within project teams in a small to medium enterprise. Second, it contributes to the area of knowledge management and organizational learning by examining preferences in knowledge transfer techniques used in small to medium project-based organizations, and replicating findings that people still prefer to look for knowledge using face-to-face, even in the companies where people are exposed to IT tools on a daily basis. Finally, this paper presents the shortcomings of face-to-face communications in knowledge transfer. Thus, there is a balance between the use of face-to-face communication and IT-base systems to facilitate knowledge transfer in PBOs.

Limitations

This study has several potential limitations. The first concerns the measure of knowledge transfer activities between projects due to the high level of overlapping employees. This can be a common problem within small to medium enterprises where there is a high overlapping of staff working simultaneously on two or more projects at a time. In addition, lack of sufficient data, mainly due to the large number of overlapping members working simultaneously on two or more projects at a time, allowed only for qualitative examination of the intra- and inter-project knowledge transfer activities. There is still lack of research that measures inter-project knowledge transfer where there is a high overlap between project teams. Future research can examine how inter-project knowledge transfer can be measured when there is a substantial overlap in projects members working simultaneously on two or more projects at a time.

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