TRANSACTION MEMORY IN WORK TEAMS:
KNOWLEDGE INTERDEPENDENCE AND HOW IT AFFECTS
PERFORMANCE SATISFACTION

A Thesis

Presented in Partial Fulfillment of the Requirements for

the Degree Master of Arts in the

Graduate School of The Ohio State University

By

Mary Jane Clark, B.S.

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The Ohio State University

2006

Master's Examination Committee:

Dr. Edward T. Palazzolo, Adviser

Dr. Samuel D. Bradley

Approved by

Edward T. Palazzolo

Adviser

Graduate Program in Communication
ABSTRACT

Transactive memory (TM) system development involves the encoding, storage and retrieval of information among team members. This study will specifically focus on the retrieval aspect, or the interdependent sharing of the team’s composite knowledge, and how the level of interdependent knowledge sharing impacts each member’s satisfaction with the team’s overall performance. It is argued that perceived interdependence and information retrieval are two important variables that may, ultimately, impact overall satisfaction with a team’s performance. Hypotheses are tested on data from intact, knowledge-based, work teams using an online questionnaire to obtain information from participants about: 1) their team’s knowledge interdependence, 2) level of information retrieval for specific areas of knowledge, and 3) level of performance satisfaction. Contrary to theoretical expectation, results indicate that members who retrieve information from more teammates are more satisfied with their teams’ performance.
VITA

February 11, 1967 ........................................ Born - Milwaukee, Wisconsin

1995 .................................................... B.S. Journalism, Ohio University

2004 - present ........................................ Graduate Teaching and Research Associate,
The Ohio State University

2003 - present ........................................ President, M.J. Clark Communications LLC

2000 - 2003 ............................................. Marketing Manager, Porter Wright Morris &
Arthur LLP

1998 - 2000 ............................................. Marketing Coordinator, Thompson Hine LLP

1996 - 1998 ............................................. Public Information Officer, Ohio Department of
Public Safety

FIELDS OF STUDY

Major Field: Communication
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CHAPTER 1

INTRODUCTION

Work teams are used throughout organizations to get work done. Transactive memory theory is a theory that is used to describe how people on teams learn information and learn who knows what other information that is necessary for their work. Transactive memory is a shared structure for encoding, storing, and retrieving information such that people in this type of relationship have a memory store that is greater than either individual possesses (Wegner, 1986; Wegner, Giuliano, & Hertel, 1985). A transactive memory (TM) system involves the sharing of expertise among team members, which allows the entire team to know more than its individual members (Wegner, 1987). The characteristics of TM systems have been studied using different, and evolving, participants and methods. Some researchers have studied how TM affects intimate couples (Fraidin, 2004; Hollingshead, 1998a, 1998d; Wegner, Erber, & Raymond, 1991). Other TM research involving couples has focused on subjects paired with strangers (Hollingshead, 2000; Fraidin, 2004). Several experiments designed to advance TM theory have focused on the performance of ad hoc groups of people asked to assemble an electronic device (Liang, Moreland, & Argote, 1995; Moreland & Myaskovsky, 2000; Lewis, 2003). More recently, TM researchers have studied actual work teams with a history of working together (Austin, 2003; Brandon & Hollingshead, 2004; Lewis, 2004;
Palazzolo, 2005). Studying intact work teams and how they share knowledge will produce a better understanding of team knowledge interdependence, and whether these previous findings, from studies involving very few team members, and the more recent studies involving actual work teams, are supported and to what extent.

TM system development involves the extent to which team members collaboratively encode, store, and retrieve information (Wegner, Erber, & Raymond, 1991). In a well-developed TM system, team members utilize one another’s expertise on specific topics and they equitably divide responsibility for remembering information the team may want to use in the future. In other words, team members expect one another to retain information and share it, as needed, with others on the team. If each person is responsible for information in their own area of expertise, then the burden of information storage can be shared, and experts utilized, to the benefit of the entire team.

Given the wide range of human interactions, not all TM systems are developed equally. Although TM development involves knowledge differentiation, team interdependence, and communication, this paper focuses on team knowledge interdependence and, therefore, defines a well-developed TM system as one in which the team members believe they are highly knowledge interdependent upon one another. That is, team members rely upon one another to a large extent to share knowledge in order to complete team tasks. If any member were missing, the team would be less likely to complete tasks effectively and efficiently. As an example, consider a corporate communication team. Each member of the team brings a unique set of experiences and expertise to the team. One person may be a graphic design specialist; another may have extensive knowledge about marketing; and still another might be a public relations
expert. To complete a comprehensive communication campaign, all members would be tapped for their individual expertise. No one of them alone could complete the campaign to the CEO's satisfaction, but as an interdependent team they share information and use the team's collective expertise to complete the required tasks effectively.

Interdependence is critical to a TM system because the importance of dividing or sharing "cognitive load" for the team's benefit is the driving force behind developing such a system. Cognitive load is the amount of information people must process and the amount of time in which they are allowed to do so (Hendy, Liao, & Milgram, 1997). When a team is given a new task to perform or a new piece of information to retain, decisions must be made as to who will do which part of the task or who will be responsible for storing the new information on behalf of the team. In many cases, the choice is clear because team members often have specialized knowledge. If a marketing-related newsletter is sent to the communication department, for instance, whoever receives it will likely forward it to the marketing expert, and she will be responsible for deciding whether it contains information the team may need in the future. If she determines it is, she is responsible for keeping the newsletter on behalf of the team and sharing the information contained within it when necessary. If she determines it does not contain information she believes may be needed in the future, she then makes the choice to discard the newsletter.

When members of a team possess differentiated knowledge, that is, each team member knows different things, they can become more interdependent, relying on one another to provide information as it is needed by others. A team may be best able to utilize each member's knowledge by actually assigning each member to an area of
expertise so that cognitive load, or how much information any one person must process for the team, is also divided (Stasser, Stewart, & Wittenbaum, 1995). Designating one team member to be responsible for a specific type of information frees the other team members to use their cognitive capacity to learn more, and different, information for the team’s use.

Without the division of cognitive load, each member’s cognitive capacity risks being overloaded by trying to redundantly remember all of the same information that is presented to the team (Tindale & Sheffey, 2002). If all team members remember all the information presented to them, so that they all have the same expertise, there is no advantage to working together, as any one person can complete team tasks alone. However, TM theory would suggest that team members possessing similar knowledge will not hold as much collective information as a team of people possessing differentiated knowledge. Think of the difference in total team knowledge that would be represented if you had one team of five advertising experts and one team consisting of one expert each in the areas of graphic design, public relations, advertising, marketing, and event planning. Obviously, several of the advertising experts would know the same things. They may belong to the same associations and have many of the same business contacts. Because much of their knowledge overlaps, their total store of knowledge on behalf of the team is less than the diverse knowledge held by the more diverse team of communication experts, each of whose knowledge is separate and distinct. When team members who have differentiated knowledge rely on one another for information, the cognitive workload is more efficiently shared among members, and the team also benefits by not losing any of the information it possesses as a whole (Tindale & Sheffey, 2002).
This thesis specifically considers the retrieval aspect of how teams share information. TM theory suggests that if people on a team have differentiated knowledge, they can interdependently rely on one another for specific information. Thus, they can utilize the experts on a team to efficiently retrieve information outside of their own area of expertise that is needed to complete a task. If team members know who to approach for information on a specific topic, they will be more likely to go directly to that person. If team members do not know who holds the information they need, they will waste more time approaching several others on the team in search of who has the information needed.

For example, if the public relations expert needs information about graphic design in order to complete a task, she would approach the graphic design specialist. The public relations expert does not need to approach others on the team for this information because she knows who retains graphic design information on behalf of the team. She can go directly to the best source of the information, the graphic design specialist, making the process of gathering the necessary information and completing the assigned task more efficient. If members of a team are aware of each of the other team members’ expertise, they will retrieve information from few others on any given topic, because they will know who the expert is, and they will ask that person for the information they need. They will not take time searching for the information by contacting multiple team members. On the other hand, if the expert on a certain topic is not very accessible or does not respond quickly to requests, team members may find that they have to approach others in search of someone who may know less than the expert but enough to help them complete the task at hand. Other literature suggests that face-to-face communication helps teams develop TM systems, but communication via other means does little to aid in TM system
development (Lewis, 2004). More work teams in the 21st century, especially virtual teams, use e-mail and Internet tools to communicate more frequently than face-to-face. This may hinder the effective development of a TM system. In addition, frequent ongoing communication, Lewis believes, may also be required until the team reaches a clear division of expertise responsibility.

In ideal conditions, where all team members are accessible and responsive, and there is a well-developed TM system in place (i.e., high perceptions of team knowledge interdependence), then their communication for information retrieval should be limited. That is, team members should know who knows what and, therefore, be able to directly retrieve information from the few who are experts in specific knowledge domains. This is critical in team communication, for if you know who holds the information and you can retrieve it from them quickly, presumably you will waste less time contacting several people. Based on the above, the first of four hypotheses is proposed as follows:

H1: Team members who feel that they are highly knowledge interdependent with other team members will retrieve information from fewer others on specific knowledge domains than team members who feel less interdependent with other team members.

If each member's knowledge of different topics yields positive results for the team, team members will continue learning new information in their respective areas of expertise (Hollingshead, 2001). As long as team members understand one another's areas of expertise, Hollingshead asserts that topic-specific information retrieval is beneficial to the entire team. The process of members learning what others on the team know is a critical component of the formation of a well-developed TM system (Wegner, Giuliano,
When teams have developed a TM system in which members share knowledge readily and effectively, team members are less likely to need external assistance or to spend time outside the team searching for answers, so they become more knowledge interdependent. Team members are then more efficient, and their performance increases (Austin, 2003). Moreover, Hollingshead and Brandon (2003) found that teams with a well-developed TM system in place perform more effectively than teams without such a system in place. Similarly, Rulke and Galaskiewicz (2000) found that team performance is contingent upon the distribution of knowledge within the team. Importantly, knowledge held by others is often discovered through communication. That is, communication helps team members better ascertain which teammates possess which expertise (Hollingshead and Brandon, 2003; Palazzolo, Serb, She, Su, & Contractor, 2006).

In an experiment involving radio assembly, Liang, Moreland, and Argote (1995) indicated that “group training improved group performance primarily by fostering the development of TM systems among group members,” (p. 384). The present study further examines Austin’s idea, along with Liang, Moreland, and Argote’s findings, by using actual work teams that have a history of working together. The teams in this study have had the potential to develop their TM system because they have worked together for a substantial period of time and intend to continue working together. Members of these teams have a vested interest in learning about the expertise of their fellow team members because their future success in the organization will likely depend upon being able to tap their coworkers’ knowledge. Team members who perceive that they have a well-developed TM system in place should report higher satisfaction with performance
outcomes than those whose team does not possess, or possesses less of, the elements that constitute a well-developed TM system. In light of this, the second hypothesis is offered.

H2: Team members who retrieve information from fewer others report greater performance satisfaction than those who retrieve information from a greater number of others.

Team members who are acutely aware of the expertise of other team members can more effectively share cognitive load, because they will be aware of which team members are responsible for what information. Knowledge integration occurs when individual information held by each team member is combined to form new team knowledge (Anand, Clark, & Zellmer-Bruhn, 2003). So after members of a team learn what each of the other members knows, they can combine this information to create new knowledge to benefit the whole team. Given that, team members need to know who to approach when they must retrieve information on a specific knowledge area. However, as Yoo and Kanawattanachai (2001) point out, simply knowing where the expertise lies is not enough. Team members must be able to utilize that knowledge to the fullest potential in performing tasks in order to positively impact team performance. Efficient information retrieval, resulting from a highly interdependent team, should lead the team to better overall performance, which is the motivation for the third hypothesis.

H3: Team members who feel they are highly knowledge interdependent with other team members will report greater performance satisfaction than team members who feel less interdependent with other team members.

Hypothesis 4 is based upon the combination of the previous three hypotheses. That is, team members who are highly interdependent and retrieve information from
fewer others will feel greater satisfaction with overall team performance than those who do not feel they are interdependent, do not retrieve information from fewer others, or both. Thus, hypothesis 4 is proposed as follows.

H4: Team members who feel they are highly interdependent with other team members and also retrieve information from fewer others report greater performance satisfaction than those who feel they are not highly interdependent with other team members and retrieve information from a greater number of others.

Because TM systems in intact work teams with some longevity of working together have only begun to be studied in recent years, and many of the studies that have been done previously focus on short-term work groups formed in a lab to address a task, it is important to further study actual work teams in organizations to see whether these earlier research findings translate into “real” workplace settings and whether more recent findings are further substantiated. It is worthwhile to study teams that consist of members who share knowledge on a regular basis, have worked together for a substantial period of time, and intend to continue working together in the future. This type of study will not only add to the body of knowledge in this area of research, but the findings may have applied benefits because providing feedback to the participating teams may help them better understand how they may improve knowledge sharing to positively affect the team’s satisfaction with what they produce in the workplace, leading to better team performance.
CHAPTER 2

METHOD

Participants

The participants for this research were solicited from intact work teams and included 112 individuals representing 10 teams ranging in size from 5 to 16 members each. The companies involved in this study include five non-profit organizations, two university offices, one state government agency, one Web site design company, and one utility company.

Of the 100 team members who identified their gender, 48 were males and 52 were females. The age range was 26 years to 66 years, and the average age of participants was 44 (SD = 11.71). The average company tenure was 7.99 years (SD = 8.58), and average job tenure was 3.33 years (SD = 4.39). Of the 99 who reported their education level, 24 people reported having a doctoral degree, 21 people reported having a master’s degree, and 25 people reported having a bachelor’s degree. The remaining 29 people had a high school diploma, some college, or an associate’s degree.

Instrumentation

This study is based upon several variables from a larger study designed to evaluate TM systems in organizational contexts. A contact person for each participating team was asked to complete an interview protocol to provide researchers with team
member information and a list of knowledge areas team members use the most in order to complete their daily tasks. Please see Appendix A for the interview protocol questions used in this study that a contact person for each team filled out prior to participation. The information provided in the interview protocol was used to tailor the online survey to each team so they when the survey was accessed, team members would see the names of their fellow team members and a list of the knowledge areas that pertain to their team. They would then answer questions about all team members and how they share information in each of the knowledge areas. The particular questions used in this study were designed to assess the following variables: Knowledge interdependence, communication to retrieve information, and performance satisfaction. The knowledge interdependence question asks team members to agree or disagree on a 5-point scale to 12 statements concerning how knowledge is utilized among their team’s members. The communication to retrieve information question asks respondents to choose from a list of fellow team members who they would retrieve information from on each of the knowledge areas listed if they, themselves, did not possess the information they needed in that knowledge area. The performance satisfaction question asks team members to agree or disagree using a 5-point scale to five statements concerning self-satisfaction and stakeholder satisfaction with the quality and quantity of the team’s finished products. See Appendix B for detailed information regarding these questions.

Knowledge interdependence. Interdependence is based on a 12-item scale designed to evaluate each member’s perceptions of knowledge interdependence with coworkers. Each item is rated on a five-point scale ranging from strongly disagree (1) to strongly agree (5). The 12 items are averaged together to create a single, composite
measure of knowledge interdependence (M = 3.43, SD = 0.36). Cronbach’s alpha was .46 indicating that these 12 items do not reliably measure the same underlying construct. Thus, a factor analysis was conducted post hoc to further understand the relationship among the 12 items in this variable (post hoc findings are discussed in the results section) and more importantly, to understand the relationship between interdependence and information retrieval.

*Communication to retrieve information.* Communication to retrieve information is measured as the percent of people on the team from whom team members choose to retrieve information on a specific topic. When filling out the initial protocol, each team in the study is required to identify five or more main areas of knowledge that are necessary for their team to complete its tasks. In the questionnaire itself, which is tailored to each team based upon the knowledge areas identified, the respondent is asked to choose from 0 to n-1 the number of others to whom they would seek information on the given knowledge area if they, themselves, did not possess that knowledge. That is, each member was asked to indicate from whom they would choose to retrieve information on each of the knowledge areas provided by the team (M = 2.60, SD = 2.47).

The network outdegree (the sum of people chosen for each topic) was calculated and then divided by the total number of other team members available (n-1) to determine from what percentage of team members each respondent would choose to retrieve information. The range for communication to retrieve information is 0% to 100%. Because the teams in this study differ in size from 5 to 16 members, using a percentage of those other team members with which each member communicates is a better indication of the amount of information retrieval present than raw numbers (M = 0.24, SD = 0.21).
For example, Bethany and Rob are on two different teams and both report retrieving information from three people. If Bethany is on a team of 5 members and Rob is on a team of 16 members, then Bethany is retrieving information from a greater percentage of overall team members than is Rob. Based on TM theory, Bethany is likely unsure who holds the expertise in the knowledge area for which she is retrieving information, but Rob probably has a very good idea which members of the team are experts in the given knowledge area.

Testing this variable involved focusing on one knowledge area per team. To keep the analysis uniform in light of the fact that each team identified a different number of knowledge areas, the one knowledge area with the lowest density (least amount of communication present) and highest indegree centralization (one team member is a focal point of communication) for each team was chosen for purposes of this analysis. This criteria was established because the knowledge area used is the one that is most differentiated of all those identified by the team, so it is the one most likely to show knowledge differentiation. That is, this knowledge area was identified by team member survey responses as the one in which most team members went to the least amount of others to retrieve information for that given topic. If significant findings were not produced by using this particular knowledge area, then significant findings were less likely for all remaining knowledge areas identified for each team.

*Performance satisfaction.* Performance satisfaction is measured on a 5-point scale ranging from strongly disagree (1) to strongly agree (5), in response to five statements concerning the participant’s satisfaction with performance and the participant’s perceived satisfaction of key stakeholders who receive the team’s final products. These five items
are based on prior team performance research in multiple areas including business problem solving with ad hoc teams (Mohammed & Angell, 2003), task significance (Patrashkova-Volzdoska, McComb, Green, & Compton 2003), meeting production objectives with intact work teams (Doolen, Hacker & VanAken, 2003), team member information sharing (Millitello, Kyne, Klein, Getchell & Thordsen, 1999), financial aspects of performance (Yeo, 2003), stakeholder performance ratings (Hirst & Mann, 2004), team member ability and cooperation (Senior, 1997), productivity, quality and stakeholder satisfaction (Cohen & Bailey, 1997), team efficiency (MacBryde & Mendibil, 2003), deadline perceptions (Waller, Conte, Gibson, & Carpenter, 2001), and social network theory (Yang & Tang, 2004). This prior research was used to inform the development of the five-item scale for performance satisfaction. That is, the work done by others were influential in the creation of the scale items in this study, but not in a one-to-one fashion. Cronbach’s alpha was .86, indicating that the scales had internal consistency. See Table 2.1 for supporting information.
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<th>Statements</th>
<th>Alpha</th>
<th>M</th>
<th>SD</th>
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<td>I am satisfied with the team's output quality.</td>
<td>3.99</td>
<td>0.77</td>
<td></td>
</tr>
<tr>
<td>Generally, management is happy with what the team produces.</td>
<td>4.08</td>
<td>0.77</td>
<td></td>
</tr>
<tr>
<td>I am satisfied with the team’s output quantity.</td>
<td>3.86</td>
<td>0.93</td>
<td></td>
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<tr>
<td>People who receive/ utilize the team's products are satisfied with this team's work.</td>
<td>4.17</td>
<td>0.66</td>
<td></td>
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<tr>
<td>I am satisfied with the overall performance of this team's work.</td>
<td>4.13</td>
<td>0.71</td>
<td></td>
</tr>
<tr>
<td>Overall Performance Satisfaction</td>
<td>0.86</td>
<td>4.00</td>
<td>0.62</td>
</tr>
</tbody>
</table>

Table 2.1: Descriptive information for performance satisfaction scale reliability

Data Analysis

Correlations will be calculated using pairwise exclusion for any missing values in the data to test hypotheses 1, 2, and 3. The number of valid responses for individual questions used for this study ranged from 79 to 112. Hypothesis 4 will be tested using a regression test with knowledge interdependence and information retrieval designated as independent variables and performance satisfaction as the dependent variable. Results from the correlation tests and regression test can be found in the results section that follows.

Hypothesis 1 speculated that team members who feel they are highly interdependent with other team members will retrieve information from fewer others than team members who report less knowledge interdependence. To test this hypothesis, a correlation test will be conducted between the composite interdependence measure and the degree of information retrieval. A negative significant finding would indicate that a
relationship exists between knowledge interdependence and retrieval such that those who feel they are highly interdependent with other team members will retrieve information from fewer others and, therefore, support the hypothesis. A positive, significant finding would suggest that a relationship exists between knowledge interdependence and retrieval such that those who feel they are highly interdependent with other team members will retrieve information from many others and, therefore, not support the hypothesis. A non-significant finding would indicate that no relationship exists between those team members who are highly interdependent and to what degree they retrieve information from others.

Hypothesis 2 posited that team members who retrieve information from fewer others will report greater performance satisfaction than those who retrieve information from a greater percentage of others. A correlation test will be performed between retrieving information and satisfaction. A negative, significant finding would indicate that the number of people chosen for information retrieval is negatively related to the overall satisfaction of team members. In other words, as the number of people chosen for retrieval decreases, the overall satisfaction of team members increases. This finding would support the hypothesis. A positive, significant finding would mean that the number of people chosen for information retrieval is positively related to the overall satisfaction of team members. In other words, as the number of people chosen for retrieval increases, so does the overall satisfaction of team members. A non-significant finding would mean that there is no linear relationship between the percentage of people from who team members retrieve and their level of satisfaction. See Appendix C for scatterplots showing the relationships between the variables studied.
Hypothesis 3 suggested that team members who feel they are highly interdependent with other team members will report greater performance satisfaction than team members who feel less interdependent with other team members. A correlation test will be run between the interdependence variable and the satisfaction variable. A positive significant finding would indicate that a feeling of strong knowledge interdependence among team members has a positive impact on the overall feelings of satisfaction with team performance. A negative significant finding would indicate that team members who feel they are highly interdependent with other team members will report less performance satisfaction. A non-significant finding would mean that the feeling of interdependence among team members does not relate linearly to whether or not team members are satisfied with their team’s overall performance.

Hypothesis 4 proposed that team members who feel they are highly interdependent with other team members and also retrieve information from fewer others will report greater performance satisfaction than those who feel they are not highly interdependent with other team members and retrieve information from a greater number of others. To test this hypothesis, a regression test will be run with the knowledge interdependence and information retrieval variables as predictor variables and performance satisfaction as the dependent variable. A significant finding would mean that strong feelings of team interdependence and being able to retrieve information from fewer others on the team is related to higher overall feelings of performance satisfaction. A non-significant finding would indicate that these feelings of knowledge interdependence and the ability to retrieve needed information from experts does not linearly relate to overall feelings of satisfaction with team performance.
CHAPTER 3
RESULTS

Hypothesis 1 posited that team members who feel they are highly interdependent with other team members will retrieve information from fewer others than team members who report less interdependence. A correlation test conducted between team knowledge interdependence and retrieving information shows that there is a low correlation that is significant, $r(78) = .25$ ($p < .05$). So, those team members who are highly interdependent do not retrieve information from fewer others when compared to those teams who are less interdependent. This finding is of great interest, because it is intuitive to think that if team members rely on one another to be experts in certain knowledge areas, then they would know exactly who to approach for information on each knowledge area. Thus, they would be expected to retrieve information from a fewer number of people because they would go directly to the one or two experts in that knowledge area. However, the positive direction of the correlation indicates that people who perceive higher interdependence are more likely to retrieve from more (not fewer, as hypothesized) others. Therefore, this finding does not support Hypothesis 1.

Hypothesis 2, which speculated that team members who retrieve information from fewer others will report greater performance satisfaction than those who retrieve information from a greater number of others, was not supported. The five
scale items in the performance satisfaction question were averaged into one satisfaction variable for the correlation tests with retrieving information and team knowledge interdependence in consideration of Hypotheses 2 and 3. Significance was found only on the correlation between performance satisfaction and retrieving information (Hypothesis 2), \( r(76) = .37 \) (\( p < .01 \)). This finding, while significant, is in the opposite direction than predicted. So, those team members who retrieve information from a greater number of other members report higher levels of performance satisfaction. This is an interesting finding in light of the fact that the correlation in Hypothesis 1 was also found to be in the opposite direction than would be expected by TM theory.

As mentioned above, Hypothesis 3 was not supported. A correlation between team interdependence and performance satisfaction showed no significance, \( r(76) = .001 \), \( p > .05 \). It was hypothesized that team members with a well-developed TM system, or high team knowledge interdependence, would report greater performance satisfaction than those who reported a less developed TM system, or less team interdependence. Collectively, these findings indicate that some other variables may be affecting performance satisfaction.

Hypothesis 4 suggested that team members who feel their team members are highly interdependent and who also retrieve information from fewer others will report greater performance satisfaction than those who feel they are not highly interdependent with other team members and retrieve information from a greater number of others. Although both predictor variables together produced a significant finding, \( F(2, 61) = 3.196, p < .05, R^2 = .098 \), knowledge interdependence was not a significant predictor. Information retrieval was a significant predictor, but in the opposition direction of the
suggested hypothesis, which is consistent with prior hypothesis tests. The regression showed that about 10% of performance satisfaction can be explained by the percent of communication retrieval such that those team members who retrieve from a greater number of others are more likely to report satisfaction with overall team performance.

Post Hoc Findings

To better understand the relationship between knowledge interdependence and satisfaction as well as retrieval of information, a factor analysis was conducted on the 12-item scale that was used to create the overall knowledge interdependence measure. Based on the analysis, two factors were significant: (a) expertise and (b) perceptions of expertise. The expertise factor, which included the statements: (a) Each member has unique knowledge, (b) I depend on others' expertise to do my job, and (c) I depend on expertise of others outside my team, loaded as 0.405, 0.825, and 0.561 respectively. The perception of expertise factor, which included the statements: (a) I know a lot about the expertise of team members, (b) Team members know a lot about my expertise, and (c) Team members know each others' expertise, loaded as 0.809, 0.816, and 0.849 respectively. Because the interdependence scale is at the heart of this study, each hypothesis was retested with each of these new interdependence measures; there were no significant findings.
CHAPTER 4
DISCUSSION

This study's findings are not consistent with results of previous TM research and lead to many questions about the implications of this research on TM theory, organizations, and team members. TM theory suggests that team members who feel they are highly interdependent with other team members should retrieve information from fewer others than team members who report less knowledge interdependence. A significant, but small, correlation found when testing Hypothesis 1 showed that team members who feel more knowledge interdependent do, to a small extent, retrieve information from a greater percentage of others on their team. Many reasons could explain this. The experts on a team may be inaccessible, which could include keeping their door closed, screening calls, being sick, or being on vacation. Sometimes certain people within a work team do not get along, so someone may retrieve information from a non-expert simply to avoid communicating with the expert. At times, a person may get an answer from one person that they do not trust as accurate, so they attempt to ask for the same information from other team members to be sure the information is reliable.

Perhaps the ideal situation that TM theory proposes, that an efficient team can simply go to the expert and get the necessary information, is not practical in every organization or in today's technologically-driven world. When the theory was developed in the mid-1980s, not everyone had access to a workplace computer and there were few
virtual teams. Those who participated in this study all work on computers daily and some work in virtual teams. Technological advances allow team members to e-mail several people simultaneously with the same question so they can get the information needed in the fastest way possible. Perhaps having adequate information quickly is more important in today’s world than having the most accurate information from the team’s expert. In addition, people use technology to communicate more often. Many work teams use instant messaging throughout the day to communicate quickly with coworkers. So there may be more communication going on in general among team members in today’s technologically-driven environment than when the theory was developed. In addition, in a 2004 study, frequent face-to-face communication was shown to lead to effective TM system development, but communication through other means was found to have no effect (Lewis, 2004). Thus, the evolution of the workplace into a more technologically driven environment may require a longer period of time in which to develop a TM system than in years past.

As a result of testing Hypothesis 2, findings were significant in the opposite direction of the prediction. The correlations showed that those team members who retrieve information from a greater number of other members report higher levels of performance satisfaction than those who retrieve information from fewer others. Perhaps team members feel that the camaraderie produced by interacting with many others to share information helps lead the team to the high performance outcomes they report. When people feel that they all get along well as a team, perhaps they are more likely to feel good about the work they produce together and try harder to not let the others on the team down when working collaboratively on a project.
Hypothesis 3 posited that team members with a well-developed TM system, or high knowledge interdependence, would report greater performance satisfaction than those who reported a less developed TM system, or less team interdependence. This hypothesis was not supported, and findings were not significant, so level of team knowledge interdependence appears not to affect performance satisfaction. In terms of TM theory, the current study may suggest that performance satisfaction is a product of other factors, not just sharing information effectively to achieve a team goal or complete a task. People in organizations may feel satisfaction both intrinsically and extrinsically. So although an efficient knowledge interdependent team may be enough for some workers to report a greater level of performance satisfaction, other factors such as poor team culture, destructive team politics, and other negative factors may affect a team member's perception of overall performance satisfaction.

The regression that tested Hypothesis 4 further confirmed that team members who retrieve information from a greater number of other members report higher levels of performance satisfaction than those who retrieve information from fewer others, but that knowledge interdependence does not appear to relate to reports of performance satisfaction.

*What This means for Organizations*

What this could mean to organizations is that because people seem to report that the more they communicate with others on their team, the better the satisfaction with team performance as a whole, it may be wise to organize brainstorming sessions, organize departmental retreats, and utilize other tools to help people communicate better in an effort to increase performance satisfaction. Additionally, it would seem as though
organizations should sanction communication or fraternization among employees and could assist by creating more common space for people to gather around such as mailrooms, cafeterias, or lounges.

What this Means for TM Theory

Again, these results appear contrary to previous TM theory research which stated that people do not need to communicate with many others if they are utilizing experts on their team. However, the fact that more communication is taking place may allow team members to better identify those experts. So, although it appears that people are using time inefficiently by retrieving information from several others, the act of going to multiple others may better help them determine where the expertise lies.

The goal of this study was to ascertain whether highly knowledge interdependent teams would, ultimately, be positively related with performance satisfaction ratings. Because this study of TM systems in work teams had only three significant findings of the four tests performed, the goal of the study may have better been served by incorporating more variables of the larger study’s data set into this project. Perhaps extracting only these three variables from the context of the larger study for which they were designed did not allow for a sufficient amount of information to be analyzed and considered. In hindsight, it may have proven useful to examine these three variables along with a fourth variable that looks at team coordination of efforts. The coordination question in the online survey is an eight-item scale that measures the extent to which team members coordinate their efforts to complete work projects. The participants responded to each item on a five-point, Likert-type scale ranging from strongly disagree (1) to strongly agree (5). As with the team interdependence question, the eight items for
this variable could be averaged together to create a single, composite measure of the members' perceptions of coordination. Perhaps this variable could have provided more insight given that retrieving information from others was the only variable that was significantly correlated with performance satisfaction. It may be the case that team members do not find it necessary to retrieve information from others because they coordinate their work so well that each person is utilizing his or her expertise to benefit the team by working on their own to accomplish their portion of the task and then bringing their finished product to the table at the end of the project along with the others who were working on their portions of the overall task.

There are three other questions in the data set that ask about (a) the team's communication and information exchange, (b) how team members work together, and (c) the participant's personal feelings about the team as a whole. These additional variables may have helped further explain what makes up a TM system and how those elements can affect performance satisfaction. As was mentioned previously, Hollingshead and Brandon (2003) found that communicating through team interaction helps team members better understand which of their coworkers possesses what knowledge. Perhaps these three additional questions may have helped this study better explain some of the findings, because some of the statements participants respond to include elements that would reveal whether the participant is positive about the team's goals, projects, and members. These questions also assess both motivation and frustration levels, which may give a clearer picture of what is happening in that particular individual's situation that may lead to answering questions in a certain way. These questions also give participants yet another chance to respond to statements pertaining to team members having clearly
defined roles and working closely together, which would be a good reliability indicator because the two statements that address these issues mirror statements found in the knowledge interdependence question studied.

Limitations

A clear limitation of this study is the fact that performance satisfaction of managers and key stakeholders were self-reported perceptions made by participants and not the actual report by these stakeholders themselves. Perhaps future research in this area could include input of actual stakeholders as well, so perceptions of satisfaction made by participants can be compared with actual reports given by stakeholders regarding performance. It would be interesting to see whether these two reports were similar. Perhaps just knowing actual stakeholders would be answering such a question would lead study participants to be a bit more discerning in what they report as the perceived satisfaction of the stakeholder.

Another limitation is that we ask respondents to think about from whom they retrieve information, and we rely on the sharpness of their memory to accurately report who they talk to about what topics. Because this is not a behavioral measure, we cannot attest to the accuracy of the information team members provide. If we observed the team and actually counted who talks to whom about what, we would have a more reliable picture of the actual communication that takes place on the team.

Future Research Directions

As was stated, many of the previous studies focus on short-term work teams formed in a lab to address a task, and certainly a look at work teams that have a greater longevity, such as was the case with this study, is a step in the right direction. For future
research, it would be advantageous to study whether the transactive memory of long-tenure teams, like those studied here with an average of 8 years of tenure, proves more efficient and effective than short-tenure teams and to see whether long-tenure teams utilize outside resources more frequently and effectively compared to short-tenure teams (Austin, 2003).

Several communication department teams participated in this study, and these team members are in a unique position of being able to improve internal communication company-wide based on what they might learn through the course of their participation. Comparing communication teams to other work teams in the study might prove interesting. Are team members from a communication department, for instance, more likely than team members from an accounting department, to engage in communication to retrieve information from more others, even given their knowledge of team member expertise, simply because they enjoy communicating with others? In addition, comparing virtual teams to non-virtual teams may reveal some differences that could affect the future direction of TM theory.

It may be also be helpful to study the actual characteristics of the members who make up the work teams, in addition to their TM system development. Are there clear leaders; are there clear followers; are there introverts and extraverts; do member characteristics affect the TM system in place? It seems intuitive that more charismatic or extraverted people may share knowledge more readily than introverted people. Perhaps considering team member characteristics would add an element to our understanding about knowledge sharing that would compliment what we know about how the development of a TM system affects a team’s performance.
LIST OF REFERENCES


APPENDIX A

INTERVIEW PROTOCOL QUESTIONS USED IN THE STUDY
Interview Protocol

Thank you for agreeing to participate in this research. We are interested in learning more about the team with which you are associated. To help us gain a better understanding of your team, we have questions in four categories: team membership demographics, team’s core competencies, team’s core tasks, and team’s information infrastructure. Please provide as much information as you can by expanding on the questions as you see fit, and feel free to contact us if you need further clarification about the question.

I. TEAM MEMBER INFORMATION

Company Name:

Team Name (if different):

Contact Person:

Contact Phone Number:

Please fill out the table below as completely as possible.

<table>
<thead>
<tr>
<th>First Name</th>
<th>Last Name</th>
<th>Title</th>
<th>Position/Level</th>
<th>Department</th>
<th>E-mail</th>
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II. CORE COMPETENCIES

Can you identify approximately five knowledge areas this team deals with on a daily/weekly basis that are used to support project development? In other words, what knowledge areas must project team members possess to get their work done?

Thank you for your time in answering these questions. Your responses will be very useful in our research and survey development. We will contact you if we have any further questions. Additionally, please feel free to contact us at any point if you have questions about this research.

Contact name: Dr. Edward Palazzolo
Phone number: 614-292-1909
Email: Palazzolo.3@osu.edu
APPENDIX B

SURVEY QUESTIONS
Q1. Knowledge Interdependence

The following items concern how knowledge is utilized among your team's members:

1. Most of my work is done independently.
2. Members of my team have a lot of overlapping knowledge.
3. Each member has unique knowledge that (s)he brings to our team.
4. I depend very much on the expertise of other members of my team in order to do my job.
5. I depend very much on the expertise of other people outside my team in order to do my job.
6. I work very closely with other team members.
7. I know a lot about the expertise of my team members.
8. My team members know a lot about my expertise.
9. My team members know a lot about one another's expertise.
10. My team coordinates knowledge well.
11. Each member of my team has a specialized role.
12. Members of my team have interchangeable roles.

The scale for responses is:

0 -- No Response
1 -- I Don't Know
2 -- Strongly Disagree
3 -- Disagree
4 -- Neither
5 -- Agree
6 -- Strongly Agree
Question 3 (of 47)

The following items concern how knowledge is utilized among your team's members.

<table>
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<tr>
<th>Statement</th>
<th>No Response</th>
<th>I Don't Know</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither</th>
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<td>Most of my work is done independently.</td>
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<td>Members of my team have a lot of overlapping knowledge.</td>
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<td>Each member has unique knowledge that contributes to our team.</td>
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<td>I depend very much on the expertise of other members of my team in order to do my job.</td>
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<td>I depend very much on the expertise of other people outside my team in order to do my job.</td>
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<td>I work very closely with other team members.</td>
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<td>I know a lot about the expertise of my team members.</td>
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<td>My team members know a lot about my expertise.</td>
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<td>My team coordinates knowledge well.</td>
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<td>Each member of my team has a specialized role.</td>
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<td>Members of my team have interchangeable roles.</td>
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Figure 1: Screen shot of sample for Knowledge Interdependence
Q2. Communication to Retrieve Information

Getting Information About "Technology" [Example Knowledge Area]

In your work, you may need information about Technology you do not possess. Using the adjacent screen, please indicate one or more person(s) from whom you are likely to retrieve information by clicking on their names.

Start with the name at the top and move clockwise around the circle so you do not miss anyone.

If you need to remove an entry, select the line just before the flat part of the arrow and press the delete key on your keyboard.

If you have further questions on how to answer these types of questions, please press and hold the "Ctrl" button and click on this tutorial link.

These instructions are applicable 5a-5e. When you are completing questions 5b-5e, if you need these instructions again you may return to this question by using the "<< Previous Question>>" button.

If you are NOT likely to retrieve information regarding Technology from any of your team members, <<Click Here>>.
Question 5a (of 47)

Getting Information About Technology

In your work, you may need information about Technology you do not possess.
Using the adjacent screen, please indicate one or more person(s) from whom you are likely to retrieve information by clicking on their names.

Start with the name at the top and move clockwise around the circle so you do not miss anyone.

If you need to remove an entry, select the line just before the flat part of the arrow and press the delete key on your keyboard.

If you have further questions on how to answer these types of questions, please press and hold the "Ctrl" button and click on the blue question link.

These instructions are applicable 5a-5e. When you are completing questions 5b-5e, if you need these instructions again, you may return to this question by using the "<< Previous Question" button.

If you are NOT likely to retrieve information regarding Technology from any of your team members, Click Here.

<< Previous Question
Next Question >>

Figure 2: Screen shot of sample for Communication to Retrieve Information
Q.3 Performance Satisfaction

The following questions concern your team’s finished products. Please indicate the extent to which you agree or disagree with each of the following statements.
1. I am satisfied with the team's output quality.
2. Generally, management is happy with what the team produces.
3. I am satisfied with the team's output quantity.
4. People who receive/utilize the team’s products are satisfied with this team’s work.
5. I am satisfied with the overall performance of this team's work.

The scale for responses is:

0 -- No Response
1 -- I Don't Know
2 -- Strongly Disagree
3 -- Disagree
4 -- Neither
5 -- Agree
6 -- Strongly Agree
**Question 37 (of 47)**

The following questions concern your team's finished products. Please indicate the extent to which you agree or disagree with each of the following statements.

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<th>Statement</th>
<th>No Response</th>
<th>Don't Know</th>
<th>(1) Strongly Disagree</th>
<th>(2) Disagree</th>
<th>(3) Neither</th>
<th>(4) Agree</th>
<th>(5) Strongly Agree</th>
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<td>I am satisfied with the team's output quality.</td>
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<td>Generally, management is happy with what the team produces.</td>
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<td>I am satisfied with the team's output quantity.</td>
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<td>People who receive/utilize the team's products are satisfied with this team's work.</td>
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<td>I am satisfied with the overall performance of this team's work.</td>
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Figure 3: Screen shot of sample for Performance Satisfaction

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APPENDIX C

CORRELATION SCATTER PLOT
APPENDIX C

CORRELATION SCATTERPLOTS
Figure 4: Scatterplot of H1 - Team members who feel that they are highly knowledge interdependent with other team members will retrieve information from fewer others on specific knowledge domains than team members who feel less interdependent with other team members.
Figure 5: Scatterplot of H2 - Team members who retrieve information from fewer others report greater performance satisfaction than those who retrieve information from a greater number of others.
Figure 6: Scatterplot of H3 - Team members who feel they are highly knowledge interdependent with other team members will report greater performance satisfaction than team members who feel less interdependent with other team members.