December 2002

DOES FIT MATTER? A LONGITUDINAL ASSESSMENT OF THE IMPACT OF TECHNOLOGY FIT ON TEAM PERFORMANCE IN ROUTINE TASKS

Robert Fuller
Indiana University

DOES FIT MATTER? A LONGITUDINAL ASSESSMENT OF THE IMPACT OF TECHNOLOGY FIT ON TEAM PERFORMANCE IN ROUTINE TASKS

Robert M. Fuller
Indiana University
rmfuller@indiana.edu

Extended Abstract

Team-based structures are used to perform activities to meet project, departmental, and organizational goals due to the anticipated improvements in performance and effectiveness that they promote (Ranney and Deck 1995). To take advantage of the benefits that teams provide, organizations are implementing technology to expand the membership and reach of teams across space and time constraints. Technology allows for newer organizational structures such as virtual teams to accomplish what was once done in traditional face-to-face interactions.

In addition organizations are faced with an ever-increasing number of collaborative technologies to choose from to facilitate team work. These tools provide many different features and characteristics to support different communication styles, information structuring and processing needs, and interaction and process structures (DeSanctis and Gallupe 1987).

Further complicating the identification of technology to support teams is the fact that over time, team interactions change. Teams will develop routines to improve performance predictability and reduce coordination and exchange costs (Gersick and Hackman 1990; McGrath and Hollingshead 1994). Routines are defined as complex patterns of social action (Pentland and Rueter 1994) that need not be fixed or automatic. Routines are pervasive in organizations; March and Simon (1958) note that the majority of behavior in organizations is governed by programs of performance, that is, routines. A task becomes routine when choices or patterns of behavior have been simplified as a fixed response to a stimulus. Given the lack of any major difference in input variables to the task or outcome requirements, team membership, or other contextual variables, the team will attempt to reapply old rules and patterns of behavior (Dennis and Valacich 1999; Postmes, Spears, and Lea 2000).

In summary, the first set of behaviors that a team will utilize to perform a task is expected to be markedly different from the ultimate routinized set of behaviors and activities the team utilizes to perform the task, given minimal changes in the context. These behavior changes are likely to be more pronounced with poor performance and lower levels of satisfaction with processes and outcomes. This change in behaviors over time obviously presents a problem for decision makers looking to select a technology to support team interactions and task processes. In effect, they are trying to hit a moving target. The identification of the right technology characteristics, based on task behavior requirements at earlier stages in the life of the team, could very well be the wrong technology characteristics for the team later when it has more experience with the task, technology, and team.

Research Questions

The purpose of this study is to better understand the influence of task and technology fit on team performance, specifically considering teams performing routine tasks and will attempt to identify how over time teams interact to generate performance, when there is a fit and not a fit. It is hoped that an understanding of the implications in the matching of technologies to task over time in predicting team performance will be uncovered and some prescriptions identified about the conditions when it might be better to consider an optimum fit between task and technology and when it is anticipated that team interactions can overcome lack of fit. The research questions to be addressed in this study are:

- Does fit matter?
- Can teams overcome poor technology fit to generate acceptable levels of performance and satisfaction?

Over the past two decades, much research has been performed examining the impact of technology on teams performing tasks. Overall, these studies have generated inconsistent findings as to whether teams using technology perform better, worse, or no different than their non-technology counterparts (Dennis et al. 2001; Fjermestad and Hiltz 1998). For researchers and practitioners alike, this result is disheartening as it suggests that technology may not have an appreciable impact on team performance. However, closer examination suggests that technology can influence team performance, given a particular context.

To date there have been no studies that have looked at team performance of teams working on a specific task repeatedly – that is, a routine task – with varying levels of technology that fit the task. Much of the research examines teams using technology in a single session, with an assumed level of task-technology fit based on the ultimate performance of the team. Studies examining teams across multiple sessions either performed functionally different tasks, or worked on an extended single task. Participants generally have not had the benefit of prior experience or feedback in this environment to learn about the task, the technology, the team, and how best interact in this environment (Fjermestad and Hiltz 1998; McGrath, Arrow, Gruenfeld, Hollingshead and O'Connor 1993) and therefore, our understanding of how these teams perform is limited to given points in time.

From a theoretical perspective, the proposed research builds on previous research in task-technology fit and team development and bridges the two to understand longitudinal performance in teams in regard to technology fit. From a practical perspective, the proposed research will provide practice with a better understanding of the implications of poor technology selection and its impact on team processes and team performance over time.

Theoretical Background

Three perspectives will be used to inform and derive the theoretical foundation for this research. Task-Technology Fit (TTF) provides a base to explain how performance comes about from the fit of technology to team and task requirements. Adaptive Structuration Theory (AST) provides a dynamic perspective on the changes that take place as teams interact with technology over time. Time, Interaction and Performance Theory (TIP) provides specific insights regarding team processes and performance improvement as teams interact and use technology over time.

TTF is defined as the degree to which features of a technology match the requirements of the task and the abilities of the individuals involved with the task (Goodhue 1995). It suggests that information systems will only have a positive impact on performance when their functionality is appropriately matched to user task requirements (Goodhue and Thompson, 1995). Antecedents of TTF are the interactions between the individual, the task, and the technology. Certain tasks are posited to require certain technology functionality to perform. As the match between the requirements to perform a task and the features of the technology becomes poorer, TTF reduces, as does expected performance. Likewise, better fit has been associated with better performance (Vessey 1991).

AST is a framework that describes organizational changes that occur from the social interaction between advanced technologies and individuals (DeSanctis and Poole 1994). It differs from TTF in that it focuses on the interplay of the structures that define and constrain the task, the team, and the individuals. It posits that the team, the technology, the task and team context all provide initial structures that are selectively enacted as the team interacts socially on the task, utilizing the technology. Over time, new structures are expected to develop from the social interaction between these structures, and performance derives form faithful appropriation of the technology provided to support the team.

TIP theory argues that teams are embedded into their surrounding social and organizational systems and engage in many overlapping projects to support the organization (McGrath 1991). It could be considered a more specific instantiation of AST, with emphasis on the interactions that occur in teams over time. Teams are social systems that engage in multiple, interdependent functions for multiple, concurrent projects, while existing within, and loosely connected to surrounding social systems. When working on tasks, teams can be performing in various "modes" consisting of inception, problem solving, conflict resolution, and execution. It suggests that there is no inherent order to the modes that teams must follow to complete tasks, except that all projects and tasks, at a minimum, move from an inception phase to execution – the default path. With added familiarity, and given little variance in the requirements of the task, teams will gradually adopt the default path to the task, to minimize coordination and task processing costs and improve performance (McGrath & Hollingshead 1994). Therefore, it suggests that the behaviors and

interactions that take place early in a teams' life will change over time and not necessarily be the same as the team develops, but will be those that help generate performance.

In conclusion, there is evidence to suggest that the proper match of task characteristics and technology characteristics should result in better performance at a given time and context. Over time, teams will change their patterns of behavior as they become familiar with the team, the task, and the technology. Likewise, teams working on routine tasks will attempt to minimize uncertainty and ambiguity and increase predictable performance and satisfaction by developing and maintaining norms and patterns of behavior. Therefore, initially identified levels of task-technology fit may be temporary as familiarity with the team, task and technology increases, impacting perceptions of fit, impacting team processes and performance outcomes.

Research Model and Hypotheses

The general research model to be employed in this study follows the Input Process-Output model that is commonly used in team research. Given the focus of this study on the impact of antecedents to performance outcomes over time, the I-P-O model is appropriate. Figure 1 provides the general research model to be utilized in this study.

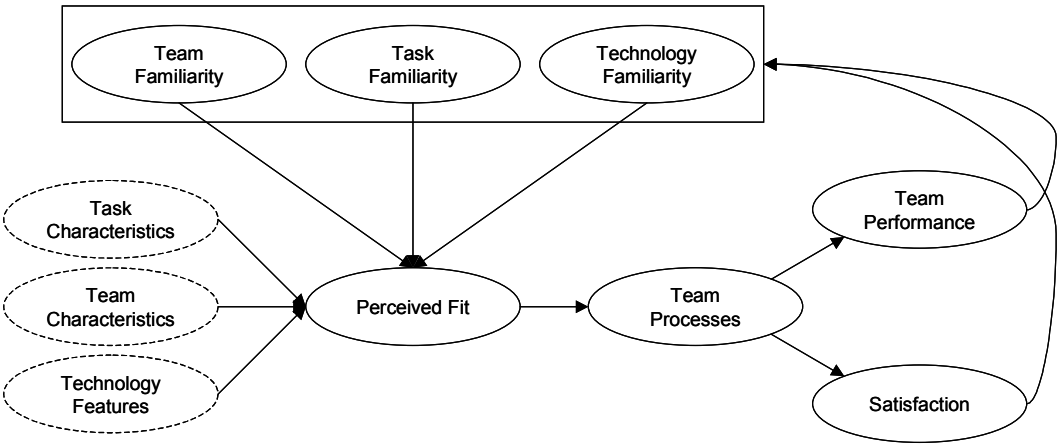

Figure 1. Research Design

"Fit teams" is defined as teams operating under the scenario where the characteristics of the technology support provided to them to perform a task are appropriately matched to the characteristics of the task. "No fit teams" is defined as teams operating under the scenario where the characteristics of the technology support provided to them to perform a task are not appropriately matched to the characteristics of the task. Initially, it is expected that teams utilizing a technology with a better fit to the task at hand will have a higher level of performance and satisfaction than teams working on the task using poorly fitting technology. Neither "fit teams" nor "no fit teams" will have a differential advantage due to task, team, or technology familiarity in this context, therefore, the initial degree of fit of technology to the task would predict the performance and satisfaction of fit and no fit teams.

H1: At T1, "fit teams" will generate higher performance than "no fit teams"

H2: At T1, "fit teams" will have higher satisfaction than "no fit teams"

Over time, the difference between initial levels in performance would be expected to diminish as teams gain familiarity with the technology, task, and team (Carlson and Zmud 1999). Given this change in familiarity, teams (particularly less satisfied and poor performing teams) would be expected to change their team processes with the intent to increase performance, based on feedback from prior instances of the task. At the time of final measure, it is expected that performance differences between teams due to initial differences in fit between technology and task will be minimal and not significant.

H3: At T4, there will be no difference in performance between "fit" and "no fit teams"

H4: At T4, there will be no difference in satisfaction between "fit" and "no fit teams"

As teams engage in routine use of the technology to perform the task, the degree to which they must appropriate the technology to generate desired outcomes will impact their subsequent performance on the task. Therefore, teams with good initial fit and acceptable outcomes will be less likely to significantly adjust their team processes, as they will perceive themselves performing adequately on the task. However, teams with poor fit and poor performance will feel inclined to adjust their team processes to improve performance. Therefore, it is expected that over time, with routine use:

H5: "Fit team" performance outcomes will not be significantly different between T1 and T4

H6: "Fit team" team processes will not be significantly different between T1 and T4

H7: "No fit team" performance outcomes will significantly improve between T1 and T4

H8: "No fit team" team processes will be significantly different between T1 and T4

Figure 2 graphically depicts Hypotheses H1-H5 and H7.

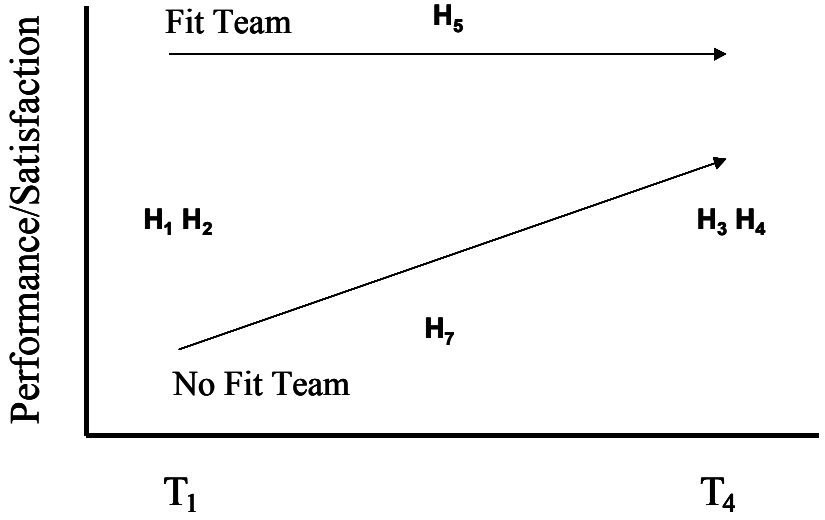

Figure 2. Hypotheses

Research Design

The study is a lab experiment with a repeated measures design. Approximately 160 participants will participate in 40 four-person teams. Participants will be randomly assigned to teams, and teams will be randomly and permanently assigned to one of two treatments, fit and no fit. The "fit teams" will utilize high-speed videoconferencing to support rich interactions; the "no fit teams" will use a lean synchronous messaging tool (Dennis & Valacich 1999). Both teams will be provided with comparable task support tools.

The task to be performed by the teams will be a decision-making task with a correct answer. The task is best categorized as a conjunctive hidden profile task in which successful outcomes can only be attained when team members work together since each member has unique information necessary for the successful completion of the task. No single member can complete the task alone (Lam 1997).

The task is a derivation of the student admissions task, where participants are to determine relevant criteria for student selection, and based on the criteria, select a student for admission. The task will be changed to require that the five candidates for admission must be ranked based on the criteria. Based on the selections, the teams will then receive feedback on their selections. The feedback will be an overall outcome from their selections to provide the participants with some information on the outcome from their selections. The information will allow the participants to rethink their approach to the problem. The participants will meet four times, two times per week, thereby performing the same task four times over a two-week period.

Independent variables to be measured include the participants' familiarity with the task, the technology, and the team. Dependent variables measured include perceived task-technology fit, team processes in terms of the types of interaction processes enacted during the communication (Dennis & Valacich 1999; Weick and Meader 1993), objective/subjective outcomes of performance and perceptual satisfaction measures. All variables will be captured during each of the interactions.

Familiarity variables will be measured using existing scales adapted to the current context. Perceived task-technology fit will be measured using items adapted from Goodhue's (1995) instrument for user evaluations of information systems. The questions will be reworded to fit the current context. A pilot test will be used to confirm the reliability and validity of using this scale to measure this construct.

Team processes will be measured from the interactions captured when the teams work on the task. The interactions will be coded to identify both the mode of activity (McGrath 1991) and type of interaction – conveyance and convergence (Dennis & Valacich 1999; Weick and Meader 1993).

Team performance will be assessed by comparing team results to the rankings generated by experts in student admissions. A differential score will be calculated assessing the difference between the team ranking and expert assessments. Satisfaction regarding the process and decision will be captured using existing scales, adjusted for the current context. Team size and task will be held constant across all teams.

Analysis

Confirmatory factor analysis and reliability analysis will be used to assess the validity and reliability of the scales developed or adapted in this study. The primary methods to be utilized to examine the data collected from the experiment are analysis of variance and Partial Least Squares. The analysis of variance analysis will be used to determine differences in the dependent variables due to changes (manipulations) of the independent variables. Partial Least Squares will be used to examine the research model to understand the relative impact of the different antecedents on team process and performance and satisfaction.

Contribution, Implications, and Limitations

The expected contribution of this study is twofold. First, it will provide a link between three theoretical perspectives on performance, TTF, AST, and TIP. This study will be the first to specifically address these two perspectives in the context of good and poor fit of technology to task, and to understand the ramifications of each in predicting performance and to understand the degree to which teams can compensate for poor task-technology fit to achieve acceptable performance. The second contribution of this study is that it looks at the impact of technology fit on performance of routine tasks.

This study will have important implications for theory. If H1 – H8 are supported, it would suggest that task-technology fit is important primarily in single use applications of technology. Therefore, in single use contexts, individuals delivering technology support must make sure of fit for performance. Over time with routine use, individuals will adapt their structures to compensate for poor fit to achieve performance. If H1-H8 are not supported, then it would depend on the nature of the results. If both performance outcomes were found to be stable over time, then task-technology fit would be paramount to achieving performance, not only initially, but sustained performance levels would be impacted. It would suggest that individuals would either be unable to adapt to poor fitting technology, or that there existed a ceiling effect in the experimental design of the task.

Two primary limitations exist in the study: (1) Ascertaining that the best fit for one of the technologies has occurred. The task is of paramount importance to ensure that one treatment has good fit (face validity of good fit) and the other treatment has poor task-technology fit and (2) the time confound. Many studies in this domain do not examine use of time or attempt to justify how time is similarly allocated across teams to provide an apples-to-apples comparison of outcomes. This study will compensate for this discrepancy by suggesting that teams will have *ample* time to complete the tasks.

Conclusion

In conclusion, this study will examine team performance over time, given varying degrees of fit between technology and the task. Using the theoretical perspectives provided by Task-Technology Fit, Adaptive Structuration Theory, and Time Interaction and

Performance Theory, this study will attempt to bridge very different streams of research on team performance and technology to determine the predictive strengths of the underlying assumptions of each theory, as well as to suggest how the theories together provide a better explanation of team performance, particularly in the context of a task that is repeated, or routine. Given the nature of teams and their development over time, it is anticipated that teams will initially benefit from a better fit between task and technology. However, over time, this differential improvement should diminish.

References

Carlson, J. R. and Zmud, R. W. "Channel Expansion Theory and the Experiential Nature of Media Richness Perceptions," *Academy of Management Journal*, (42:2), 1999, pp. 153-170.

Dennis, A. R. and Valacich, J. S. "Rethinking Media Richness: Towards a Theory of Media Synchronicity," *Proceedings of the 32nd Hawaii International Conference on System Sciences*), 1999, pp. 1-10.

Dennis, A.R. Wixom, B.H, and Vandenberg, R.J. "Understanding Fit and Appropriation Effects In Group Support Systems Via Meta-Analysis," MIS Quarterly, (25:2) 2001, pp. 167-193.

DeSanctis, G. and Gallupe, R. B. "A Foundation for the Study of Group Decision Support Systems," *Management Science*, (33:5), 1987, pp. 589-609.

DeSanctis, G. and Poole, M. S. "Capturing the Complexity in Advanced Technology Use - Adaptive Structuration Theory," *Organization Science*, (5:2), 1994, pp. 121-147.

Fjermestad, J. and Hiltz, S. R. "An Assessment of Group Support Systems Experiment Research: Methodology and Results," *Journal of Management Information Systems*, (15:3), 1998, pp. 7-149.

Gersick, C. J. G. and Hackman, J. R. "Habitual Routines in Task-Performing Groups," *Organizational Behavior and Human Decision Processes*, (47:1), 1990, pp. 65-97.

Goodhue, D. L. "Understanding User Evaluations of Information Systems," *Management Science*, (41:12), 1995, pp. 1827-1844.

Goodhue, D. L. and Thompson, R. L. "Task-Technology Fit and Individual-Performance," *MIS Quarterly*, (19:2), 1995, pp. 213-236.

Lam, S. "The Effects Of Group Decision Support Systems And Task Structures On Group Communication And Decision Quality," Journal of Management Information Systems, (13:4), 1997, pp. 193-215.

March, J. and Simon, H.A., *Organizations*, John Wiley and Sons, New York, 1958.

McGrath, J. E. "Time, Interaction, and Performance (TIP) - a Theory of Groups," *Small Group Research*, (22:2), 1991, pp. 147-174.

McGrath, J. E., Arrow, H., Gruenfeld, D. H., Hollingshead, A. B., and Oconnor, K. M. "Groups, Tasks, and Technology - the Effects of Experience and Change," *Small Group Research*, (24:3), 1993, pp. 406-420.

McGrath, J. E., and Hollingshead, A.B. *Groups Interacting with Technology,* Sage Publications, Thousand Oaks , 1994.

Pentland, B. T. and Rueter, H. H. "Organizational Routines as Grammars of Action," *Administrative Science Quarterly*, (39:3), 1994, pp. 484-510.

Postmes, T., Spears, R., and Lea, M. "The Formation of Group Norms in Computer-Mediated Communication," *Human Communication Research*, (26:3), 2000, pp. 341-371.

Ranney, J. and Deck, M. "Making Teams Work: Lessons from the Leaders in New Product Development," *Planning Review*, (23:4), 1995, pp. 6-12.

Vessey, I. "Cognitive Fit: A Theory-Based Analysis of the Graphs vs. Tables Literature," *Decision Sciences*, (22:2), 1991, pp. 219-240.

Weick, K.E., and Meader, D.K. "Sensemaking and Group Support Systems," in *Group Support Systems: New Perspectives*, L.M. Jessup and J.S. Valacich (eds.), Macmillan, New York, 1993, pp. 230-252.