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System Usage: A Shared Mental Model Perspective

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ABSTRACT

The failure rate of Information Systems (IS) projects is high and has been high for many years. Failed IS projects leave organizations with systems that have very low usage and a negative rate of return on their investment. System use is a key measure of IS success. User participation and involvement (UPI) during application development and configuration are key factors that influence system use. However, empirical studies have shown mixed results for the influence of UPI on system use.

This study explores the extent to which shared mental model (SMM) of a project team influences the impact of UPI on system use. Drawing on theoretical frameworks from UPI and SMM body of research, this study introduces SMM as a variable to better explain how and why UPI effects system use outcomes.

The findings are based on multiple case studies conducted over many months and reviewed eight IS projects by different teams within an organization. The findings illustrate effects of UPI on system use outcomes is moderated by SMM, such that a) higher levels of SMM positively influences the effects of UPI on system use outcome and b) lower levels of SMM negatively influences the effects of UPI on system use outcomes. The wide ranging implications of these findings for IS research and practitioners are discussed.

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1. INTRODUCTION

Analysts at a Gartner (leading research and advisory company) session predicted the worldwide information technology (IT) spend in 2018 would surpass 3.7 trillion dollars (Press Release, 2018). SelectUSA, a U.S. government program led by the Department of Commerce, claimed that the U.S. alone accounts for one fourth of this market, which is about $1.14 trillion of U.S. value-added GDP, accounting for 10.5 million direct and indirect jobs (Software Information Technology Spotlight, 2018). With numbers so large, success of information systems (IS) becomes a crucial and critical factor. Even a small change in the rate of use, adoption, or project success can generate great value. However, Standish Group's 2015 Chaos Report claimed that 19% of all software development projects fail and 52% of the projects are in a challenged state, leaving just 29% of all projects as being considered successful. The group's analysis of data for large projects ($10 million or more in labor costs) found that the performance of these large projects was even lower. The U.S. Office of Management and Budget issued a report in 2008, stating that it and other federal agencies identified approximately 413 IT projects that were either poorly managed, poorly performing, or both. These projects cost the U.S government approximately $25.2 billion for the financial year 2008 (Powner, 2008). The High-Risk Series report released by the U.S. Government Accountability Office in 2015 also highlighted many failed projects. These lackluster reports underscore the difficult nature of building usable systems. It also highlights our limited understanding of what makes a user use a system.

1.1. Statement of Research Issue

Organizations invest millions of dollars in IS to improve organizational productivity and efficiency. To achieve established goals and realize the value of these investments, people must use these systems. Organizations have employed strategies like mandatory use to overcome system usability and adoption problems. However, research has shown that mandatory rollouts of applications are successful at first, but over time they lose their luster and become less effective (Venkatesh & Davis, 2000) (Sauter, 2008). Training appears to be the only strategy that has been successful in increasing application use. Empirical research clearly shows that training improves application use by influencing the view of the user about the task at hand and by enhancing the user's computer self-efficacy (Bedard, Jackson, Johnstone, & Ettredge, 2003).

IS research over the years, has identified many constructs like system quality, user satisfaction, perceived ease of use, and system use that impact IS success (DeLone & McLean, 1992) (Seddon, 1997) (Rai, Lang, & Welker, 2002). These constructs have provided great insights into our understanding of IS success. System use is one of the key constructs that has been studied for many decades and is the focus of this study. IS researchers have identified many constructs that impact system use, namely, top management support, facilitating conditions, user experience, user training, user attitude, user participation, user involvement, system quality, perceived usefulness, and user satisfaction (Sabherwal, Jayaraj, & Chowa, 2006). System performance and availability are prerequisites for any successful application in the digital world, but for an application to be used, it must be intuitive (Rakowski, 2014). IS designers have always tried to build software that are intuitive, but they have struggled in making them intuitive from a user's perspective (McKay, 2010). When an application does not work for the user, designers

are quick to point out that “the application is working as the user requested,” or they respond with, “it is a training issue.” The user somehow seems to not understand the designer’s perspective and vice versa. Researchers and practitioners have viewed UPI as a key factor in increasing user satisfaction and acceptance of information systems (Subramanyam, Weisstein, & Krishnan, 2010). However, empirical studies have found mixed results on the impact of UPI on system use and even less is known about why and how UPI increases user satisfaction and acceptance.

This study is an attempt to add to the body of knowledge a better understanding of UPI and its impact on system use. The researcher proposes that sharing of mental models among project team members that includes users creates a Shared Mental Model (SMM), which then helps improve the system use among users. A mental model in this instance is defined as the process by which the human mind reviews a given task or action. Mental models affect all aspects of an individual’s day-to-day life, including technology use, and are based on knowledge, past experience, events, and environment. Mental models form the basis of a user’s view of how the world works and how one should interact with the world. Communication helps improve mental model similarities among individuals (Denzau & North, 1994) but it may not be the only way to align SMM. Communication between the users and the various stakeholders of an IS project is recognized as a critical component of user participation (Hartwick & Barki, 2001). To make software intuitive, a designer’s mental model must align with the user’s mental model, (Norman, 1988) i.e. they need to have shared mental models (SMM). This study investigates how and why UPI impacts system use.

1.2. Gap in Literature

System use is an important variable in IS success research. Scholars have argued that it is very difficult to estimate the actual use of a system during application development or deployment (Mathieson, 1991). IS research has relied on "Intension to Use" variable as a good predictor of actual use (Sheppard, Hartwick, & Warshaw, 1988). Over the years, empirical researchers found "Intension to Use" not to be a reliable predictor of actual use, as the empirical evidence was mixed (Straub, Limayem, & Karahana-Evaristo, 1995). It was also noted that self-reported use estimates and intension to use does not accurately predict actual use of a system over time (Szajna, 1996) (Sauter, 2008). Another variable identified by research that could be an antecedent to system use was UPI (Hartwick & Barki, 2001). Empirical research on UPI found confounding evidence on its ability to estimate actual use.

The increase in the adoption of technology devices to perform everyday activities is evident (Jiang, 2018) and four in ten Americans credit technology for improving life (Stauss, 2017). Then why do many systems encounter low system usage and why are organizations unable to capitalize on their investments? The relationship between UPI and system use requires further investigation. Researchers need to develop a better understanding of how and why UPI impacts system use.

1.3. Research Purpose and Questions

The purpose of this study is to develop and test a theory-based model that will provide greater understanding on how UPI influences system use and how shared mental model impact this relationship. This researcher developed a model based on the theoretical framework proposed by Hartwik and Barki (2001) on UPI and Mathieu et al.

(2000) on the shared metal model and tested its prediction using a multiple case study approach. The context of this study is application development and system usage. The model infers from the theoretical frameworks and proposes the following: Teams with higher mental model share-ness have better system use outcomes. This research aims to enhance our understanding of the following broad question.

1. **Does SMM impact system use?**

The remainder of this paper is structured in the following manner: In section 2: Literature Review, the researcher reviews various constructs that form the basis of this study. In section 3: Research Model, based on the constructs discussed, the researcher develops the hypotheses and the research model. In section 4: Methodology, the researcher describes a multiple case study approach to test the hypotheses and the research model. In section 5: Implications, the researcher presents the theoretical and practical contributions of this study. And in the final section 6: Limitations, the researcher discusses some known limitations of this study.

2. LITERATURE REVIEW

2.1. IS Success and System Use

IS success and the factors that influence it is an important area of IS research. With investments in IS increasing to over a trillion dollars, this topic is very relevant today as it was thirty years ago. It may even be more important as IS projects are not delivering the promised objective. The 2015 Standish Group reports on large IS projects show 41% of projects in a failed state, 24% of projects in a challenged state, and just 8% of projects in a successful state (Standish Group, 2015). A 2010 study conducted by the BT Centre for Major Program Management at Oxford University and McKinsey & Company evaluated 5,400 information technology projects on cost and schedule overruns, and valued the predicted benefit shortfall and cost overruns at $66 billion (Bloch, Blumberg, & Laatz, 2012). The “High-Risk Series” report released by the U.S. Government Accountability Office in 2015 highlighted projects like the U.S. Air Force Expeditionary Combat Support System, which was cancelled in December 2012 after spending more than $1 billion and failing to deploy within 5 years of initially obligating funds, and the Department of Homeland Security’s Secure Border Initiative Network, which was cancelled in January 2011 after spending $1 billion because it did not meet cost-effectiveness and viability standards (Dodaro, 2015).

An extensive survey of the IS literature for over four decades shows various models and constructs that attempt to explain IS success. This section reviews the major models and constructs that influence IS success.

DeLone and McLean (1992) proposed a model for IS success that identified six constructs: system quality, information quality, system use, user satisfaction, individual impact, and organizational impact. Seddon (1997) enhanced this model further by adding perceived usefulness and qualified system use as a behavior and as an action that leads to impact (individual or organization). Rai el al. (2002) added constructs like ease of use and system dependency. The quest for identifying new constructs continue to this day. Business value (Sabherwal & Jeyaraj, 2017) and lean/rich use (Burton-Jones & Straub, 2006), (Zhang X. , 2017) were added in the last 5 years.

System use is an important antecedent for IS success, for users must use the application to realize its value. Most empirical studies have examined technology acceptance/use problems immediately after the deployment of an application, and few researchers have studied these issues over time. These studies have assisted in the formulation of many theories and models to explain the phenomenon of application use, such as the technology acceptance model (Davis, 1989), the theory of planned behavior (Taylor & Todd, 1995), the social cognitive theory (Compeau, Higgins, & Huff, 1999), and the unified theory of acceptance and use of technology (Venkatesh, Morris, Davis, & Davis, 2003), to name a few.

Empirical studies in IS indicate that subjective norms, perceived ease of use, perceived usefulness, perceived behavioral controls, self-efficacy, anxiety, social influence, performance expectations, and facilitating conditions (Venkatesh, Morris, Davis, & Davis, 2003) top management support. User experience, training, attitude, participation, involvement, satisfaction, and system quality (Sabherwal, Jayaraj, & Chowa, 2006) all impact system use. The technology acceptance model, the most popular

and tested model, has identified the following two key antecedents that best explain technology use: perceived ease of use and perceived usefulness. IS researchers adopted from behavioral studies “intention to use” as the best indicator of the “actual use” of an application, with the assumption that an individual’s intention to use an application (intention to perform a behavior) predicts the actual use (predicts the actual behavior). In essence, the research suggests that intention to use the software is a good predictor of the actual use of the software (Sheppard, Hartwick, & Warshaw, 1988). However, other studies have found that this predictor of actual use was not very reliable, and the results were mixed. Empirical evidence also demonstrates that actual usage is significantly less than self-reported use (Straub, Limayem, & Karahana-Evaristo, 1995) (Szajna, 1996) and that intention to use an application does not accurately predict the actual use of the application (Sauter, 2008).

2.2. Application Development Team

Application development is a complex process that involves various individuals who perform discrete tasks and who offer domain knowledge. The members of the application development team who influence the overall application design and development can be placed into the following roles:

- Sponsors: A project sponsor is an upper management team member who has budgetary control and is a representative of senior leadership. The project sponsor is the highest-ranking officer on the project and is the final decision-maker on risks associated with the project. The project sponsor ultimately is responsible for ensuring that the project’s scope is delivered.

- Users: A user of an application is someone for whom the application is built. As a project team member, the user is the individual or group of individuals who would use a particular technology to fulfill a business or personal task. The user is responsible for providing the proper guidance on current gaps in a process or technology to help other members of the team understand the challenges.
- Business analysts: The business analyst on a project is responsible for understanding and recording the business needs of a project. The business analyst interacts with the users to develop requirements. Some business analysts also participate in business process reengineering.
- User interface designers: The user interface designer on a project team works very closely with the business analyst to develop the functional design that includes the user interfaces. User interface designers ultimately are responsible for the overall user experience.
- Developer(s): Developers on a project team have a variety of skill sets and can be classified as team leads, architects, database administrators, server administrators, and programmers. A developer's primary role is to develop a working code that can be maintained over time.
- Testers: The tester on a project is responsible for developing the comprehensive test plan/script for the project and then test the product to ensure the project followed all the established standards and functions per the expectation established in the business requirement.

- Project managers: The project manager is responsible for the overall project, including the budget, timeframe, and scope of the project. The project manager manages risks associated with the project and communicates the health of the project to senior leadership.
- Technical writers: These individuals create documents that help users understand the application's capabilities and how to use the applications.

All these roles are essential for success and, depending on the budget allocated for the project and specific skill sets of team members, an individual may satisfy more than one role or multiple individuals may satisfy a specific role.

Participation by users during system development is critical for success IS projects (Powers & Dickson, 1973). They engage during various phases of the system development project (Caveye, 1995) (Sabherwal, Jayaraj, & Chowa, 2006) to perform specific functions like approving the budget, develop requirements, user testing of the system, etc. User participation can be defined as a set of activities performed by the user during the system development project. Participation has different attributes such as types (all users or representative of users), degree (advisory, sign-off responsibility, team member), extent (project definition or scope, define requirements, testing) and content (design) (Caveye, 1995).

2.3. User Participation and Involvement (UPI)

The effect of UPI on system use has been widely studied in the field of IS success research (See Table 1 below). User participation is an important antecedent to application use, wherein user participation is viewed at the following three levels: overall responsibility, user-IS relationship, and hands-on activity (Hartwick & Barki, 1994).

Meaningful participation during the application development process is considered to have an impact on a user's attitude toward the new application (Hunton & Price, 1997), which in turn affects application use. User participation is positively related to user satisfaction and the more the users participate the more they are satisfied (McKeen & Guimaraes, 1997). A study of user participation in software development examined the impact of this participation on the users and the development team. The findings suggest that a moderate level of participation by the user in an application development project improves the user's perception of the project, whereas extremely high or low levels of participation lead to very unrealistic expectations with the project, which negatively affects a user's perception toward the application (Subramanyam, Weisstein, & Krishnan, 2010).

User participation does not automatically deliver IS success, but it does enhance the overall IS quality (Butler & Fitzgerald, 1997). He and King (2008) conduct meta-analysis of IS literature on user participation and further qualify this idea of participation. The authors found that different strategies need to be deployed along with user participation. For example, to achieve user acceptance one will have to involve the user at the psychological level. To improve productivity, one will have to involve the user to provide extensive domain knowledge to the developer (He & King, 2008). Research also found user involvement to enhance system use and user satisfaction (Kappelman & McLean, 1991). The more a user is satisfied the more he or she use the system (Baroudi, Olsen, & Ives, 1986). In system implementation projects user participation at various levels of the project is found to improve implementation outcomes. Forbes technology council, a group of leading technology leaders, identified user error as one of nine major

cyber security threats that we face today (Forbes, 2019). However, research found that user participation improves security controls (Spears & Barki, 2010).

Research is this space continues. Tang et al. (2018) found that user involvement in healthcare IT, a highly sensitive and regulated field where users (nurses and physicians) are constrained for time, enhances the overall quality of the system and increases the use of even non-mandatory systems (Tang, Lim, Mansfield, McLachlan, & Quan, 2018). Abelein et al. (2013) found both user participation and involvement to improve user satisfaction and system use (Abelein, Sharp, & Paech, 2013). Although there is empirical evidence that suggests UPI is a good predictor of system use, it is still inconclusive, and the jury is still out. Review of IS studies by Ives and Olson in 1984 found mixed evidence (Ives & Olson, 1984). A meta-analysis of MIS studies conducted by Sabherwal et al. in 2006 found no support for user participation and system use. The authors justified this finding as a mediating effect of perceived usefulness and by the dependence on top management support (Sabherwal, Jayaraj, & Chowa, 2006). Due to this confounding evidence more research is needed to help better understand the relationship between UPI and system use.

Table 1: Summary of Literature on the Effect of UPI on System Use

Author(s)	Comments/Notes
User Participation and its impact on System Use	
Baroundi, Olson & Ives (1986)	User involvement in development of IS positively related to system usage and user satisfaction and user satisfaction will lead to more system use.
Kappelman & McLean (1991)	User involvement is strongly related to user satisfaction
Hartwick & Barki (1994)	Participation leads to involvement and involvement mediates participation and use.
McKeen & Guimaraes (1997)	User participation is positively related to user satisfaction. The more user participates the more they are satisfied.

Fitzgerald (1997)	User involvement did not ensure IS Success, but it improved overall quality.
Delone & McLean (2003)	No relation between user participation and system use.
Amoak-gyampah & Salam (2004)	User participation at various level of implementation helps improve the outcomes.
Sabherwal et al (2006)	Found no support of user participation, and attributed it to mediating effect of other variables.
He & King (2008)	User participation alone is not enough to improve IS outcomes, different strategies need to be deployed: For user acceptance, involve the user at the psychological level. For productivity, involve users to provide domain expertise.
Spears & Barki (2010)	User participation improved security controls.
Abelein et al (2013)	user participation and involvement positively impact user satisfaction and system use.
Tang et al (2018)	User involvement enhances the overall quality and increases IS use on non-mandatory systems.

2.4. Mental Models

Mental models are the mechanism by which people describe a system's purpose and its functions, observe current state, and predict future state (Rouse & Morris, 1986). In the late 20th century, Norman (1998) developed a model to explain the complex relationship among the user, the application, and the designer. The author proposed following must take place for the successful operation of any device:

- The user must have a good conceptual model, which requires the user to be observant and consistent in actions and the visible parts of the device must reflect the current state of the device.
- The designer must develop a model that is appropriate for the user and that captures the operations of the device in a manner that is understood by the user.

- The designer must communicate with the user through the system or product; therefore, the system image is critical. The system image in this instance is defined as all the information conveyed to the user by the physical or software product, like buttons, gears, handles, icon, etc. The presence of objects provides users with necessary information to operate the product.

In this model a designer must ensure that every aspect of the conceptual model is in alignment with the system image since the user acquires all knowledge of the system from the system image. The ideal goal of a designer, according to the author, is to ensure that the user model and the designer model are equivalent. Research in human computer interfaces also concluded that applications built to a consistent model simplifies training to merely presenting the model to the user (Carroll & Olson, 1987). Therefore, if the user's model and the designer's model are identical, the system will be accepted and will not require any training. To achieve this state, Norman (1998) suggests:

> The designer must start with a model that is functional, learnable and usable, then he/she must ensure that this model is revealed to the user through the system image, which is the only way the user can acquire knowledge about the system. User's model of the system is developed based on the interactions with the system (pp. 189-190).

Alignment between the user's model and the system image also can occur with time (Kellogg & Breen, 1987). This is illustrated by users who have experience with an application finding it to be easy to use, whereas a user new to the same application finds the application difficult to use. The notion that the user's model is based solely on the user's interaction with the system, as previously expressed by Norman, may no longer be entirely accurate. Over the years there has been an extensive proliferation of technology

and digitization in our everyday life (Dan Wang, 2014) (Bröhl C., 2018). Users today have predefined notions on how technology should function, much before their actual exposure to the new technology. Users develop this notion or model based on applications they use in their daily lives. This argument is based on empirical evidence suggesting that mental models are constantly modified based on environmental and experience (Zhang & Xu, 2011) and that mental models help individuals predict application behavior or interaction (Rouse & Morris, 1986) (Yehezkel, Mordechai, & Dreyfus, 2005).

Communication and training improve mental model similarities among individuals (Denzau & North, 1994) (Smith-Jentsch, Campbell, Milanovich, & Reynolds, 2001). Communication among application development team members, including users, helps to improve the success of application implementations (Amoako-gyampah & Salam, 2004). Training can be viewed as a communication channel. After training, participants have developed similar mental models associated with the application, which is an essential factor for application acceptance and use. Before we go further let us try and understand the concept of mental models (See Table 2).

Table 2: Summary of Literature on the Impact of Mental Models on System Use

Author(s)	Comments/Notes
Mental Models and its impact	
Mead (1934)	Complex cooperative activities can occur when everyone involved can direct their behavior to a shared notion.
Rouse & Morris (1986), Mathieu et al (2000), Yehezkel et al (2005)	Mental models help users to explain, predict behavior of any systems, predict events in our environment.
Carol & Olson (1987)	Application built with similar models will simplify training.
Kellogg & Breen (1987)	Alignment of Mental model will happen with time.

Norman (1988)	When designer model and user model are identical, one will require very limited or no training for system use.
Cannon-Bowers (1993)	Shared Mental Model helps coordinate action and adapt behavior to meet the demands of a task.
Denzau & North (1994)	Communication positively influences shared mental models
Vandenbosch & Higgins (1996)	Mental model influences an individual's world view and ability to learn and train.
Smith-Jentsch et al (2001)	Communication and training improve mental model similarities among individuals.
Amoak-gyampah & Salam (2004)	Communication between application developers and users improves system success.
Zhang & Xu (2011)	There is an inherent inertial towards mental model maintenance.

The mental model is one of the factors that enhances and influences an individual's worldview, learning, and ability to be trained (Vandenbosch & Higgins, 1996), helping the individual describe, explain, and predict application behavior/interaction (Rouse & Morris, 1986). Mental models also enable users understand, describe, and predict events in their environments (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000). For example, as users interact with multiple applications, their mental model changes and affects how they interact with new or existing applications. A user might develop a mental model in which help pages are launched upon pressing the F1 key on the keyboard after using applications that access a help menu when F1 is pressed.

Mental models can be classified into the following two distinct frameworks: the mental model maintenance framework and the mental model building framework (Zhang & Xu, 2011). When individuals use known mental models to solve problems or predict behavior, the mental model is categorized under the maintenance framework, and every successful use of the model reinforces the behavior and the model. The mental model

maintenance framework is played out every day. It is the reason why a user can use a newer version of software with minimal or no training. If the user has mastered an older version of a software program and if the operations of the newer version of the software have not changed much, then adapting to the new software is easy. On the contrary, when a problem is not resolved or the predicted behavior is not exhibited based on user knowledge and experience, then the individual is forced to solve the problem in a new way, using the mental model building framework. In this framework, since the existing mental model of an individual did not achieve the expected result, the mental model is restructured, and a new model is created to be used again. For all activities an individual's inertia is always toward mental model maintenance (Zhang & Xu, 2011). An individual's mental model affects application use because the behavior of the application is predicted on the basis of the individual's mental model maintenance framework (Yehezkel, Mordechai, & Dreyfus, 2005). When the outcome is not as expected, the user experiences frustration because the user now must learn a new pattern and engage in mental model building to figure out the new system.

Similarly, a designer's mental model is influenced by experiences and interactions with applications. Sometimes they are not aligned with the user mental model. An example of incongruity between user and designer mental models was the backlash by the user community against Microsoft Corporation after the release of MS Office 2007, when the company introduced the concept of ribbons within the Office suite. The ribbons are a multilayered approach to the menus, which before this version were simple dropdowns. Whereas most users now recognize the usability of the ribbons, they did not easily adapt to them because the change was dramatic, and it was a departure from the

original mental model. The user community had to engage in the mental model building exercise for this new version, which caused frustration among the users. Application designers need to harness the power of the users' mental model or recognize the application adoption challenges among users that will be created by not doing so.

Consider a more contemporary scenario with touch screen devices. A user of this type of technology was introduced to an Android phone with a unique "double-tap" feature that turns the device off or on depending on its current mode when the user taps the screen twice in quick succession. This user was also an avid user of another touch screen device, Apple's iPad, and had used the iPad for a number of years, becoming very familiar with the workings of the product. However, within a few weeks of using and becoming familiar with the new Android device, the user would double tap the iPad's screen, expecting the same result that this action produces for the Android (that is, turning the device on or off). After a few anxious seconds of waiting for the iPad to respond to this action, the user would realize that the iPad does not respond this command, and the user would then take the appropriate action to turn on or off the device. The user involuntarily repeats this erroneous action at different times, having to consciously remember the specific actions necessary to turn on or off each device becomes a challenge. One could argue that this repetitive, yet erroneous behavior is a result of the devices being too similar; however, the Android had very few similarities with the iPad in shape, size, and look. Therefore, this behavior may be more of a result of the user's mental model of touch devices being modified by the introduction of the Android and that the new experience had overwritten the previous mental model.

The effects of the user's mental model go much beyond just user interfaces; they affect learning, decision making, and, ultimately, satisfaction with a product. Mental models are unique for each individual, and they evolve based on an individual's life experiences. No two individuals have identical mental models (Denzau & North, 1994). However, research in the field of cognitive psychology has identified the concept of shared mental models, which are mental models that are shared among individuals who have a relationship of some sort, such as coworkers, family, team members, or those affiliated by some common cause or goal.

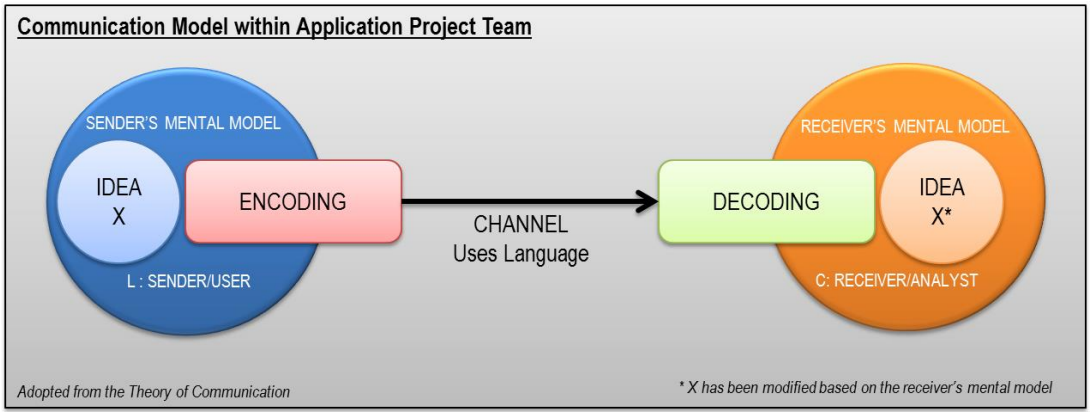
2.5. Shared Mental Model and Communication

The shared mental model is an extension of the mental model concept. It appeared in various forms in the early 20th century research literature. Mead (1934) suggested the idea that a "complex cooperative" activity can occur only if everyone involved can direct their behavior according to the shared notion of the task. Some of the other labels used to describe shared mental models are team mind, transactive memory, group think, and team memory. For the purpose of this study, the shared mental model is defined as the knowledge structures held by members of a team that allow them to provide an accurate explanation and expectation for a task (Cannon-Bowers, Salas, & Converse, 1993). The shared mental model helps them to coordinate their actions and adapt their behavior to the meet the demands of the task and the other team members (Cannon-Bowers, Salas, & Converse, 1993).

Communication is an essential component that helps facilitate the exchange of design ideas, business processes, and assumptions within the team. Effective

communication enables team members to better support each other and complete assigned tasks in a faster and more accurate manner than teams without effective communication. Communication is recognized as the fourth dimension of user participation (Hartwick & Barki, 2001). Figure 1, adopted from the theory of communication between two agents as described by Denzau & North (1994), illustrates a simple exchange between a user and an analyst.

Figure 1: Communication model within application project team



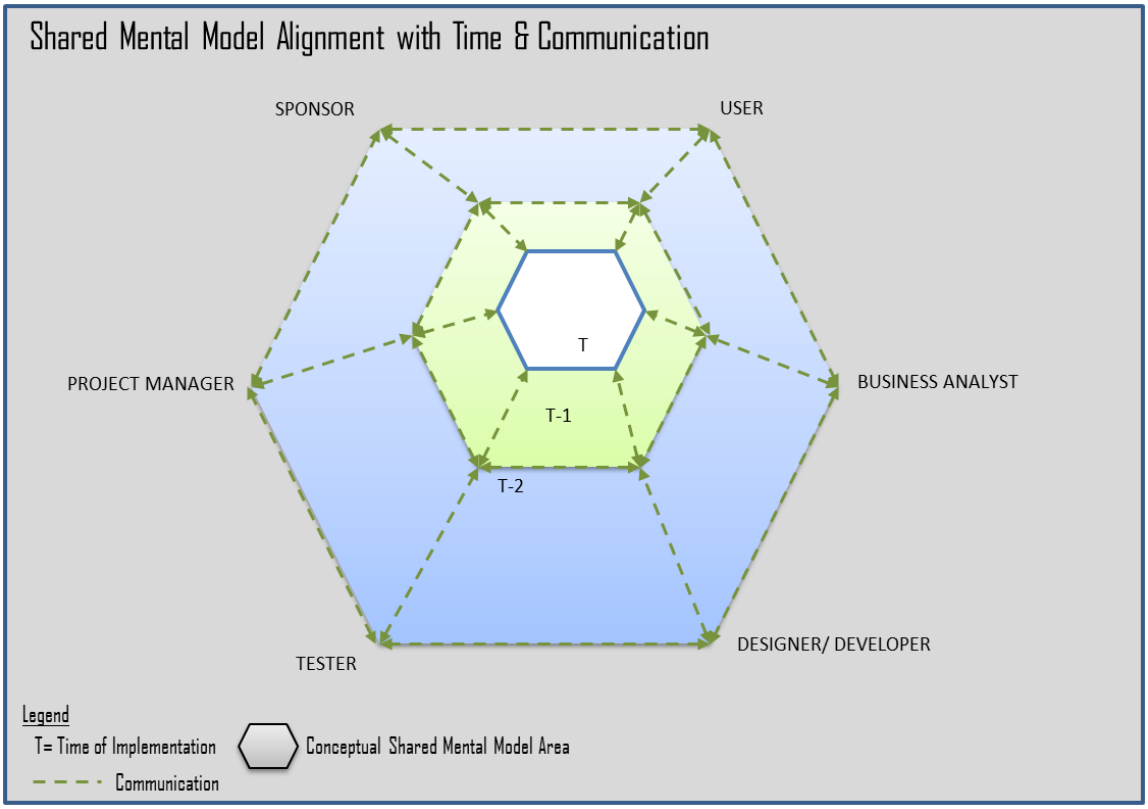
The sender (L) is the user, and the receiver (C) is the analyst. The encoding of an idea or requirement (X) by the user (L) is influenced by the user's mental model. The requirement (X) is then encoded using language and transmitted imperfectly (with noise) via some communication channel, which then is received and decoded and interpreted by the analyst (C). The interpretation of X also is influenced by C's mental model, which would be different from the mental model of L, unless C and L is the same individual.

The conceptualization (encoding) and interpretation (decoding) of an idea are influenced by the mental models of the individuals involved in the exchange. Members of a team use various modes of communication to exchange thoughts, ideas, and domain

knowledge. Communication among team members is an essential process that facilitates mental model alignment and the success of the team. Effective communication enhances mental model alignment (Denzau & North, 1994). This alignment creates a shared mental model within a team, which has been identified by researchers as a main factor that influences team performance (Cannon & Edmondson, 2001) (Espevik, Johnsen, & Eid, 2011).

The shared mental model also helps different individuals who share or have similar mental models to communicate better and share their learning. This communication then reinforces the mental model shared among them. When individuals with a shared mental model discuss an idea, their mental models are reinforced and become more similar than the mental models of random individuals (Denzau & North, 1994). Figure 2 illustrates that with passage of time and good communication, the mental models shared among team members become more aligned. They understand each other better, and their focus on the problem sharpens as concepts become more refined with time. There is limited variability in their understanding of the goals and objectives, and ultimately this enhances team performance (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000).

Figure 2: Shared Mental Model Alignment with Time and Communication



Researchers have identified that experience (that is, working with a single team for long periods) facilitates the convergence of mental models within the team. Expectations become aligned as team members work together (Cannon & Edmondson, 2001). Teams with shared mental models are demonstrated to have a higher level of performance and effective communication patterns (Espevik, Johnsen, & Eid, 2011) (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000). The main benefit of shared mental models in a team is that they lead to similar expectations for tasks among the members of the team. It is safe to say that the shared expectations generated by the shared mental models leads to the alignment of mental models within a team, and alignment of mental models is what makes a team perform at a superior level compared

with teams without shared mental models. Shared mental models can by grouped in to two major categories: Task related mental models and team related mental models. For complex tasks a team may share multiple mental models (Cannon-Bowers, Salas, & Converse, 1993). Researchers often have argued that for a team to perform at a superior level it not only must perform a task-related function well, but also must work well as a team. Team members share the following two distinct types of knowledge: (See Table 3)

- Task-related shared knowledge: Research has found that sharing task-related knowledge helps team performance because it reduces communication needs and helps team members devote more mental energy on tasks at hand (Langan-Fox, Anglim, & Wilson, 2004). The task-related knowledge are steps associated with completion of a task that require both technology or equipment knowledge and process knowledge. (Cannon-Bowers, Salas, & Converse, 1993) In application development this could be equated to development tasks, business process tasks, testing task, project management tasks, etc.
- Team-related shared knowledge: This refers to the general knowledge about team tasks and objectives or the knowledge of tasks related to the roles and responsibilities within the team. It also includes skills, behavior, and attitude that will help promote team performance. (Cannon-Bowers, Salas, & Converse, 1993)

Table 3: Types of Shared Mental Model
Adapted from (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000)

Type of Knowledge	Knowledge Content	Comments

Technology/Equipment	Equipment functioning Operating procedures System Failures & Limitations	Likely to be the most stable model
Job/Task	Task procedure Task strategy Contingencies Scenarios Environmental Constraints Task Component Relationships	For high procedural tasks, there will be more mental model alignment. When tasks are unpredictable, the value of mental model is high.
Team Interactions	Roles and responsibilities Interaction patterns Communication channels Role interdependencies Information flow	Shared knowledge about interactions drives how team members behave and sets expectations.
Team Behavior	Teammates: Knowledge Skill Attitudes Tendencies Preferences	Shared knowledge help team members to tailor their behavior.

Sharedness in shared mental model: The concept of shared-ness does not always mean common. The term "Shared" could mean overlapping, identical, complementary or distributed. This is very easily noticeable in a team performing complex tasks, such as medical teams performing surgery. In this scenario the knowledge of the surgeon and the nurse is not common. For certain tasks they may have overlapping or complementary, but not identical, mental models. In teams performing complex tasks each member is

specialized to perform certain tasks, and it is not possible of one individual to know every aspect of all tasks. This idea is true to most system development projects. The knowledge held by various team member performing similar tasks could be overlapping or identical, like two programmers working on the user interface. At the same time the knowledge possessed between the user and business analyst might be overlapping. The user might know more about the business needs and the analyst might know about some tool or technology limitations. The knowledge possessed by a business process lead and the programmer might be complimentary as one creates efficient processes to improve speed, the programmer creates efficient code to improve process power of the system. Lastly, the knowledge held between the project manager and the architect might be distributed. They are specialists in their fields tied by a common goal. Shared-ness of mental models helps us to understand the knowledge similarities that help set common view of what is happening, what might happen next, and why it happens within members of the team (Mohammed, Ferzandi, & Hamilton, 2010).

Family-of-Application and Task – Related Shared Mental Models

In recent years, an extensive proliferation of technology has taken place in an individual's day-to-day activities. A user's knowledge about a system may not necessarily be acquired from the system images alone, as expressed by Norman (1998) (Norman, 1988). Rather, a user's mental models are influenced by all the applications and actions in which the user engages to perform day-to-day, routine activities. These applications and actions may be as simple as conducting a search on the Google, placing an online order for pizza, making a payment using ApplePay, using the GPS on a handheld device, using social media, or e-mail software. We shall term these applications

that an individual (user) uses to conduct their day to day activities as the "family-of-applications" for that individual (user). A user's mental model is influenced and modified by new patterns in technologies and is constantly being constructed or re-constructed due to the user's interactions with these evolving technologies.

It is easy to understand the impact of family of application on user experience, however SMM is also associated with processes. The shopping cart model is an example of one such SMM that is found in many applications. Many order processing systems and websites emulate variations of the shopping cart process model within them.

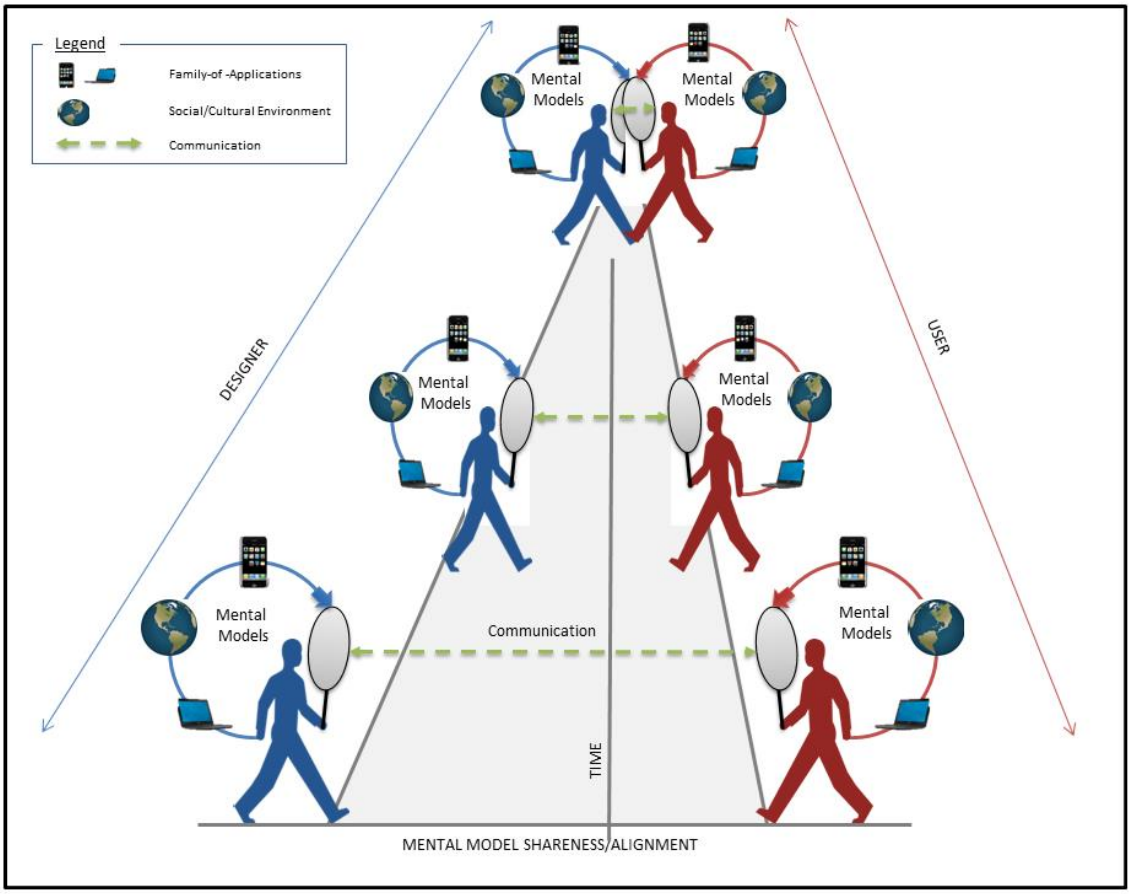
The shopping cart model is a multi-step process that has a selection step followed by a summary of selections, which is followed by a payment/registration step and finally ends with a confirmation step which includes an option to send the confirmation to a device of the user's choice. This multi-step process is not limited to online retail stores, one can find this process in service industries like reservations for airline tickets, hotel rooms, events tickets, etc. One can find this model in subscription (Journal or technology) or library systems and even is technologies used with organizations like ServiceNow. None of these above mentioned business models have traditionally used shopping carts, yet designers find it advantageous to leverage the shopping cart SMM within the applications that support these business processes.

Another process SMMs that designers use in systems is the notification models from social media. System allow users to be notified of messages and requests for approval via notifications. The SMM easily transferred from social media to system. User were understood the need to monitor their notification as it may contain important

information about their daily functions. There are many other process SMM that designers leverage to maximize mental model maintenance.

Prior research on task related shared mental model indicate that shared mental model helps reduces communication demands during task performance (Langan-Fox, Anglim, & Wilson, 2004). Designers will benefit greatly by having a good understanding of the family-of-applications for the application's user community. The use of the family-of-applications should have created a shared task related mental models and therefore can be leveraged to enhance usability of a new application, by designing using similar patterns. When interacting with new applications, users may draw on familiar family-of-applications as a frame of reference or lens to evaluate and understand the new application. Figure 3 illustrates hypothetical interactions between the user and the designer, and it could represent any two vertices from Figure 2. As the interactions increase with time, the mental model alignment grows closer. Note that the designer can only get close to the mental model of the user; their mental models can never become identical due to varied life experiences.

Figure 3: User-Designer Interaction



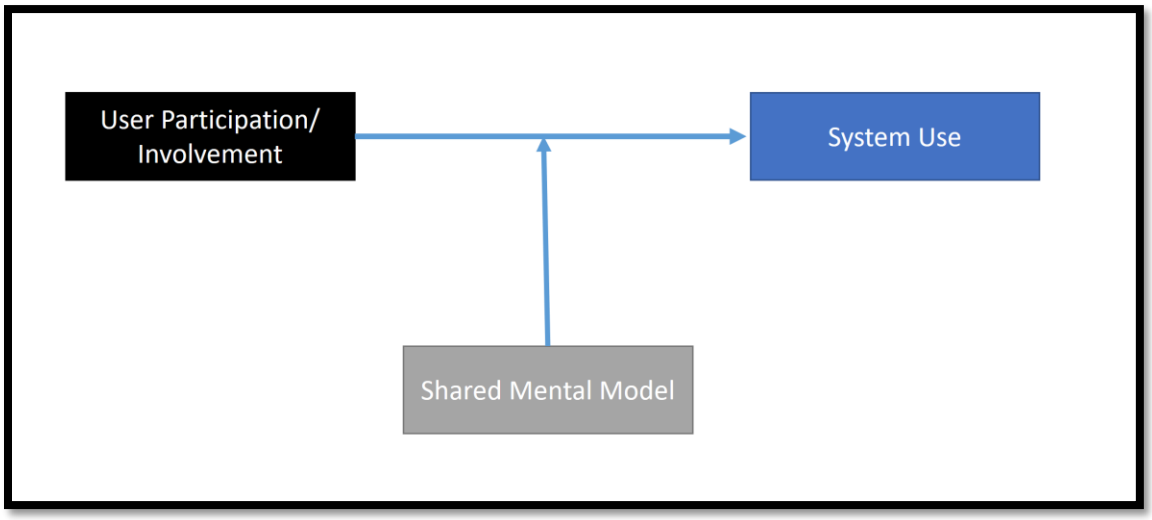
System development is process that occurs over a period of time, and user – designer relationship will not remain static during this period (Caveye, 1995). Figure 3 demonstrates a subtle tilt, or greater movement, of the designer toward the user. Ultimately the goal is for the mental model of the designer and all other members of the application development team to become more aligned with the user's mental model and not the other way around, although there is no mechanism to prevent the influence of the designer's mental model on the user. This is an important distinction made in this study and is a departure from the current view of user participation. User participation provides designers with an avenue to better understand the mental model of the user. It helps develop a shared mental model within the application development team, so designers

can develop applications that are more aligned with a user's mental model. This study attempts to add more specificity to the role of user participation and involvement in IS use, and how Share Mental Model impacts the relationship between User participation and IS use.

3. RESEARCH MODEL

The high-level research model proposed in this study is an attempt to further understand the impact of the shared mental model on the causal relationship of user participation/ involvement on system use. Based on the discussion in the previous section, this researcher proposes a model where the causal relationship between user participation/ involvement (UPI) and system use is not constant, but is moderated by the shared mental model such that, when the shared mental model of a team is high, the impact of UPI on system use is more positive and when the shared mental model of team is low, the impact of user participation/ involvement on system use is negative. (Figure 4)

Figure 4: Broad Research Model



3.1. System use, UPI, and shared mental models

The dependent variable "system use" is conceptualized in different ways within IS literature. It has been viewed as both an objective and a subjective variable (Sykes, Venkatesh, & Gosain, 2009) (Szajna, 1996) (Davis, 1989) (Straub, Limayem, & Karahana-Evaristo, 1995) (Venkatesh, Morris, Davis, & Davis, 2003). Due to multiple interpretations of system use, it is recommended that the researcher pick the measure of system use that will be best suited for their research (Burton-Jones & Straub, 2006). For this study, the researcher assesses system use from frequency perspectives (Devaraj & Kohli, 2003) (Venkatesh, Brown, Maruping, & Bala, 2008).

This researcher considers the user as an integral part of the application development team. Empirical evidence suggests engaging users at a psychological level improves system acceptance (He & King, 2008). User participation and involvement in application development process increases user satisfaction (Kappelman & McLean, 1991) (McKeen & Guimaraes, 1997). User participation provides better requirements, it helps overcome user resistance, it helps in validation of designed features and it helps in development of systems that is more likely to be used by users. User participation does provide means for developer to better understand the users, their work environment which helps them to create better experience for the user (Caveye, 1995). User participation, involvement and user satisfaction leads to positive system use outcomes (Amoako-gyampah & Salam, 2004) (Hartwick & Barki, 1994) (DeLone & McLean, 1992) (Abelein, Sharp, & Paech, 2013). This leads to the hypothesis:

H1: UPI will have a positive effect on system use.

Meaningful participation during application development has a positive impact on the user's attitude towards the new system (Hunton & Price, 1997). User involvement in IS development is positively related to system usage (Baroudi, Olsen, & Ives, 1986). The key factor that helps achieve meaningful participation and involvement is communication. Communication was termed as the fourth dimension of participation, it helps with the exchange of ideas and facts among various members of the application develop team (Hartwick & Barki, 2001). Communication enhances mental model alignment and helps in the development of shared mental model among team members (Denzau & North, 1994). The shared mental model of a team impacts the task they must complete. If members of a team can communicate often and freely, share mental model will not have a significant impact. Members can discuss each decision freely and at length to arrive at an optimal solution that is shared among all. Members of a team do not have this opportunity due to workload, time constraints or other environmental condition, and they must rely on shared mental models. Teams with shared mental models develop similar expectations about equipment function, tasks, roles and team members which allows them to operate at a superior level than teams without a shared mental model (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000). Equipment and task-related mental models help team members to develop similar expectations about functions, procedures, limitations of the system or business process. A shared mental model about task helps team members develop shared expectations about task strategies, contingencies, environmental constraints, and task component interdependencies. These are essential factors that make user participation more effective. This leads to the following two hypotheses:

H2a: Technology Task shared mental model (TT-SMM) of the team influences the effect of UPI on system use, such that the effect of UPI on system use is positive when TT-SMM of the team is higher and the effect of UPI on system use is negative when the TT-SMM of the team is lower.

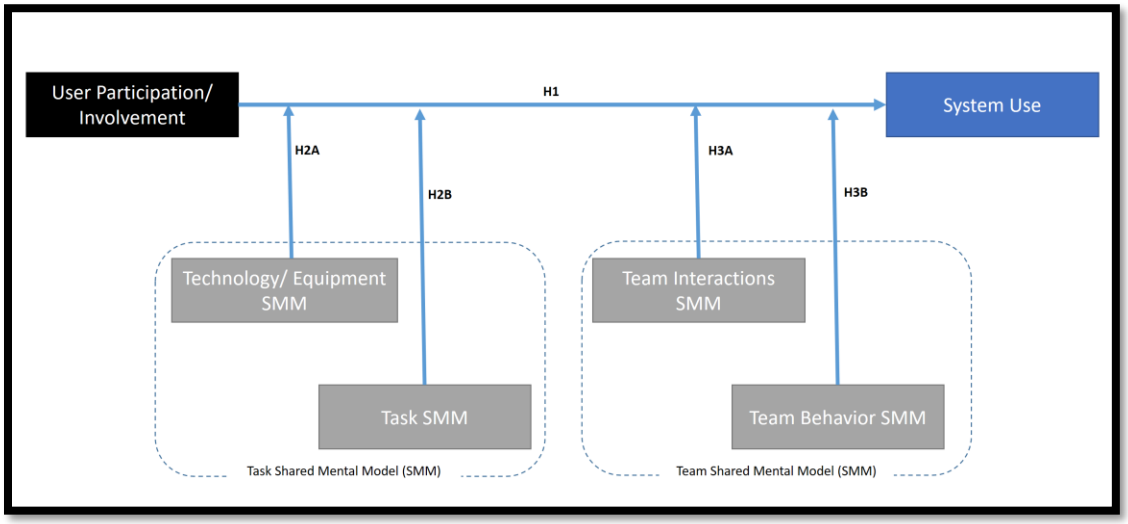
H2b: Job task shared mental model (JT-SMM) of the team influences the effect of UPI on system use, such that the effect of UPI on system use is positive when JT-SMM of the team is higher and the effect of UPI on system use is negative when the JT-SMM of the team is lower.

Application development is a team effort. In order for a team to be effective members must not only perform task-related functions well, they must also work together as a team (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000). Team interaction-related shared mental models help team members develop shared expectations about roles, responsibilities and role interdependencies within the team. Team behavior-related shared mental models help team members to understand other members of the team better. Teams develop a shared understanding about other teammates' skills, knowledge, attitudes and preferences (Cannon-Bowers, Salas, & Converse, 1993) (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000). Existence of a shared mental model provides great benefit to team performance (Mohammed, Ferzandi, & Hamilton, 2010). These factors create the necessary environment to facilitate meaningful exchanges within a team and help team members to interact efficiently and progress towards team goals (Saltz & Hackman, 2018). This leads to the final two hypotheses:

H3a: Team Interaction shared mental model (TI-SMM) of the team influences the effect of UPI on system use, such that the effect of UPI on system use is positive when TI-SMM of the team is higher and the effect of UPI on system use is negative when the TI-SMM of the team is lower.

H3b: Team behavior shared mental model (TB-SMM) of the team influences the effect of UPI on system use, such that the effect of UPI on system use is positive when TB-SMM of the team is higher and the effect of UPI on system use is negative when the TB-SMM of the team is lower.

Figure 5: Detail Research Model



4. METHODOLOGY

This study employs a positivist qualitative multiple case study approach, where each case will be an independent "Whole" case study. The approach will compare and contrast archival and interview data between case studies.

4.1. Qualitative Method

Case studies are best suited to answer the questions of "how" and "why" (Yin, 1984). They are also an appropriate method for developing a good understanding of an area that inherently is a complex subject (Stuart, McCutcheon, Handfield, McLachlin, & Samson, 2002). Both apply to this study. The concept of the shared mental model in application development and system use is extremely complex and new to IS research.

To develop a more comprehensive understanding of the influence of an application development team's shared mental model and its influence on application use, the researcher developed a theory driven, multiple case study approach. The unit of analysis for the study is an application development project. A project comprises of various members or roles, such as sponsor, project manager, developer, analyst, user, etc. The members and roles within each project vary based on the type, category and size of the project (See Table 4). For completeness, every attempt was made to interview all roles who actively participated in the project.

A semi-structured interview guide was created to measure the key variables in this study. User participation and involvement measures were based on the survey instrument developed by Hartwick and Barki (2001). System Use, the dependent variable in this study, measures were based on a survey instrument developed by Hartwick and Barki (1997 and 2001). The constructs of the shared mental model were based of the theoretical model proposed by Mathieu et al. (2000). There were four constructs, namely: a) Technology Task Shared Mental Model (TT-SMM), b) Job Task Shared Mental Model (JT-SMM), c) Team Interaction Shared Mental Model (TI-SMM) d) Team Behavior Shared Mental Model (TB-SMM). The actual measures captured for each of these constructs were based on the survey instrument developed by Johnson et al. (2007). See details in Appendix A for the interview protocol (Bayeri, Lauche, & Axtell, 2016) (Dyer & Nobeoka, 2000).

Rigor in case study research is often challenged (Akkermans & Helden, 2002). Therefore, this researcher has taken sufficient safeguards to ensure that the validity and reliability of the study was not compromised.

Construct validity was supported by employing multiple data collections. Project documents and other documented artifacts were made available for the study. Construct validity was also maintained by using multiple sources. Interviews were conducted with all possible members of the project. Finally, construct validity was supported by obtaining feedback on the draft of the report from key informants.

Internal validity in explanatory case study research helps strengthen the causal relationship between the independent variables and the dependent variable. In case study research the internal validity is established during the data analysis phase by explanation building and pattern matching.

External validity is the ability of a study to generalize across settings, people and time. In a quantitative survey this established by random sampling. External validity in case study research is established by using theory and replication in multiple case study. Note, case study generalization is to theoretical proposition or analytical generalization and not to population.

Reliability is a critical factor for a case study. It ensures that operations within the study, such as data collection can be replicated by other studies to achieve the same result. In case study research this is accomplished by developing a case study protocol. (Yin, 1984)

A case study protocol has four components that are designed to ensure reliability of the study. The four components are: a) an overview of the case, b) the procedures and

rule that should be followed during the case study, c) the actual instrument or interview guide used and lastly, d) the outline of the case study report.

The overview section of the protocol contains the background information, issues surrounding the project, hypothesis examined, etc. For all purposes, the overview should communicate the objective and setting of the case study.

Procedure and rules section of the protocol focuses on the logistics associated with data collection. Unlike other research methods the case study relies on interviews with subjects in real environment, where the researcher has very little control over the environment and the behavior of the subject. The procedure of the case study should help researcher focus on the key task of data collection. The procedure should outline tasks like gaining access to organizational artifacts (people and documents), developing a clear schedule of tasks and anticipate unplanned interruptions. In many instances this would require permission from high ranking organizational leaders.

The interview instrument or questions are primarily used by the investigator as a reminder of the information that needs to be collected. It may also serve as a prompt and help the investigator to keep the interview on track. The questions could be accompanied by other supporting evidence from documents, memos, etc. This crosswalk between questions and evidence is very useful during the interview and helps the investigator establish data source triangulation.

The case study report, the final section in the protocol, discusses to the extent possible the outline of the case study report. Unlike other research methods, such as experiments that must follow a linear, chronological sequence, a case study can follow a random order. Many positivist case study researchers still follow a chronological

sequence. A case study also generates large volume of data from various resources that are made available to the researchers. Documenting and creating a data library of the evidence collected is critical for easy retrieval during the report development.

4.2. The Case Study Protocol

This multi-case research study is designed help us better understand whether user involvement during application development enhances application usage among users, and how the shared mental models of the team moderates this relationship.

The eight cases selected were technology development projects that enhanced the operational effectiveness of different business units. There is debate among researchers about the applicability of system use as a dependent variable when the use of the system is mandatory (DeLone & McLean, 1992). Although, some research suggests that, even in mandatory conditions, the user still has control of the level and extend of use (Hartwick & Barki, 1994). Table 4 provides the details about each case used in this study. The description column lists the name of the project/case followed by an alphabet key in parenthesis. This key is used in charts and in the cross-case analysis section of the study. The user column lists the potential number of users who will be using this application. The "Type" column identifies the type of project, i.e. in-house development or off-the-shelf/SaaS solution. This variation has significant importance, as shared mental model also influences the use of configurable systems. The "Age" column represents the age of the application. And lastly, the "Category" column informs us if the project was a new feature within an existing application or an entirely new application.

Table 4: Case Selection

			Case Details		
#	**Description**	**User**	**Type**	**Age**	**Category**
1	Interaction Accounts Sharing [A]	< 100	In house development	9 Years	New Feature
2	Worker Onboarding [B]	< 14K	Vendor	3 Years	New Feature
3	Academic Learning Management [C]	< 17K	Vendor	New	New Application
4	COIPAT [D]	< 4K	Vendor	New	New Application
5	Asset Tracker [E]	< 14K	Vendor	3 Years	New Feature
6	Financial Need Reporting [F]	< 25	In house development	3 Years	New Feature
7	Advancement Reports [G]	< 30	In house development	9 Years	New Feature
8	RAD [H]	< 200	In house development	New	New Feature

4.3. Measures

The selection of IS success constructs and measures for a study should be based on the research context (Rai, Lang, & Welker, 2002). For this purpose of this research, frequency of actual use of an application/technology to perform a task will be used as an objective measure of system use. To categorize use as high, medium or low, this researcher will compare the frequency of use against the overall recorded task. If the system was used to record or process over 66% of all transactions, then system use will be categorized as high. If the system was used to record or process less than 66% of the total transaction, but it was higher than 33% of the total transactions, then the system use will be categorized as medium. And it the system was used to record or process less than 33% of the total transactions, then the system use will be categorized as low.

Prior research suggests the use of direct and indirect measures to evaluate similarities of mental models. Researchers in the past have measured mental models in terms of shared expectation, with the assumption that if mental models are similar or

compatible then the expectation developed for them should be similar (Cannon-Bowers, Salas, & Converse, 1993). This researcher is using shared expectations as a measure of the shared mental model. Other direct references in the case study of similarity of ideas and expectations among members of the team are used as a measure of shared-ness of mental models. Expectations, similarity of ideas among team members, were derived from the transcribed interviews. The degree of shared-ness among the team is measured based on the number of shared expectations among the various team members.

The degree of user participation and involvement (High or Low) is measured for the factors of: a) overall responsibility, b) user – analyst relationship, and c) hands on activity (Hartwick & Barki, 2001) (Hartwick & Barki, 1994). In this study, this researcher evaluates measures mentioned in Table 5 to assess UPI. The assessment of high or low participation is based on the frequency engagement by the user for each of these activities.

Table 5: UPI measures

	Overall Responsibility	**User - Analyst Relationship**	**Hands on Activity**
High	-Involved in product selection -Involved in funding request -Participation in product design or implementation	- Participate in RFP and Pilots - Advisory groups - User groups - Approval - Participate in pilots	- Participate in requirement - Participate in testing - Participate in documentation/Training
Low	-Limited or no evidence of activities	-Limited or no evidence of activities	-Limited or no evidence of activities

4.4. Data Collection and Analysis

The organization stored all documentations associated with projects in two main repositories, namely Jira and Confluence. Jira contained the tasks assigned to various developers. Confluence was the document repository for all other documentation, such as

the project charter, business requirements, test plans, etc. Access to these repositories was provided to the researcher. Meeting invitations and other user engagement activities were stored on Office 365.

Each project, depending on the size, was staffed with four or more resources, playing various project related roles like sponsor, developer, project manager, business analyst, etc. Interviews with various project team members were schedule in advance. The interviews were scheduled for a duration of one hour and were conducted at the interviewee's office location or via phone. The interviewer reviewed project document prior to the scheduled interview to help facilitate the cross walk between questions and other evidence. All interviews were conducted by one researcher who then developed the case studies. Hence training on the case study protocol was not deemed essential.

Outline of the case study report: All interviews conducted were digitally recorded and transcribed. The transcribed script was then shared with the interviewee to ensure accuracy. All project related artifacts collected from the organization were cataloged in a database for easy access. The transcribed interview data was then coded and tabulated for inference that support or refute the hypothesis proposed in the earlier sections of this paper. A case study report was generated for each of the eight cases. An explanation building for cross case study inference was developed to support analytical generalization.

Data Analysis Stages (Smith, 2014): After the interviews were conducted, they were transcribed, and the transcriptions were shared with the interviewee. Transcribed data was then processed in four stages as described in Table 6 to find support for the stated hypotheses. Inferences were drawn for each case based on the findings. Then the

findings for each case were reviewed in a cross-case analysis to achieve generalizability of the findings.

Table 6: Data Analysis Stages

Stage	Activity
Transcribe interview to generate initial overall insights	1. Transcribe interview 2. Share transcription with interviewee for reliability and comprehensiveness
Identify key themes in each case	1. Identify key items related to task or team based shared mental models 2. Code items 3. Cluster based on literature 4. Return to raw data to confirm all instances 5. Identify language that indicate system use and impact
Aggregate each case over multiple items	1. Create table by each case with responses about each item 2. Aggregate coded data to prove hypothesis
Use data from cases and literature to draw inferences	1. Triangulate data from cases and archival data to support hypothesis and draw inferences

4.5. Research Setting

The interviews were conducted at a large non-profit organization located in the mid-west region of the United States. The organization has a large information technology team serving various operational business units, such as Human Resources, Finance, etc. The case studies selected for this study were projects completed for different business units. The application development services were provided from the same central information technology team. This control was essential as: a) different departments within the information technology team followed different methodologies, and b) leadership in different departments create different subcultures. This approach

allowed this researcher to study multiple projects in one department and compare cases within the same context, thus minimizing extraneous variables (Eisenhardt, 1989)

5. CASE STUDIES

5.1 Interaction Accounts Sharing [A]

Background

Omega is a large not for profit institution in the mid-west region of the United States. The primary mission of the institution can be classified in to three distinct pillars, teaching, research and patient care. Omega has an operating budget of over two billion dollars. And as a not-for-profit organization, a good portion of major initiatives at Omega are funded by major gifts from donors or by interest returns from endowment funds. The advancement office is responsible for raising funds. They do this by running capital campaigns, cultivating donors and managing donor relationships, maintaining alumni relationships, and running numerous other fundraising programs. Fundraising is an activity that many not-for-profit organizations engage in. Good fundraising staff are hard to find and not-for-profit organizations are always on the lookout to get the best people in to their teams, i.e. fundraisers are always in high demand and thus the fundraising team, in most organizations, is plagued with high turnover rates for fundraising staff. Omega was no exception to this rule. Over the years the turnover rates within the advancement office had reached over twenty percent, which created different challenges for the organization. Most advancement offices are busy fundraising and soliciting visits to potential donors. At Omega, this function was running at an excessive rate because Omega was near the end of a major fundraising campaign and the goal established by leadership seemed to be achievable. And the whole team was motivated to not only achieve the goal but to surpass it by a huge margin. This caused the advancement office and all its subunits to be overextended for a long period of time.

The advancement organization at Omega can be grouped in to three main units – the major gifts team, the annual giving team and the administrative support team. The major gifts team focuses their attention on individuals with high net worth and who could potentially give Omega a large sum of money for specific program or initiative. It is also believed that the number of individuals in this category is far less than the general alumni population, and these relationships require special attention. Omega's leadership pays special attention to these relationships which are nurtured over many years. The annual giving team manages all other donors and alumni. They initiate and cultivate relationships with fresh graduates, parents and relatives of freshmen students, and other friends of the organization. Relationships and engagements take time to mature, and the sooner the organization engages these constituents the better it is for the organization. The administrative team supports all functions for the advancement office. They record and maintain data about donors. They record all gifts received by Omega, and they provide reporting for executive leadership.

Technology plays a major role in fundraising activities. It helps the fundraisers identify new donors. It helps the fundraising team classify donors, capture donor interactions, record gift and transactions, manage fundraising events, and report out progress on various activities that help leadership within the advancement office make tactical and strategic decisions and measure progress. Technology has successfully penetrated the market and plays a major role in the success of fundraising activities. There are commercial applications in this space that support all functions of a fundraising/advancement organization. At Omega, the technology support needed for the advancement office is provided by the central IT team. For all the services provided by

the technology team the advancement office is charged with an internal tax. These taxes help pay for staff salaries within IT, hardware, software, and other technology related services like technology upgrades, network usage, application development, and a customer support desk. All technology projects that support advancement functions are initiated by the administrative team of the advancement office. They meet regularly with the IT team lead who supports the advancement office to ensure optimal service is delivered, discuss upcoming projects, and provide status updates on on-going projects. The administrative team also plays the role of user representative on many IT projects as direct access to fundraisers is not possible due to their busy travel schedule. The IT team that supports the advancement office from the central IT comprises of six to eight individuals. Additional support, if needed, is hired on a contract bases for a limited period of time.

Project context

This case study is centered around an IT project that was initiated by senior leadership within the advancement office. The project was called "Interaction Accounts Routing", renamed to keep the anonymity of the individuals and organizations. The project entailed modifying an application and enhancing its features to meet the new rules established by department leadership. The advancement office at Omega conducted most of its administrative functions within an application that was developed and maintained by the central IT team. The application, which was web-based, was initially rolled out in 2009. Over the years, it has undergone multiple module and feature enhancements. This application captures and stores all donor demographic, relationship, and contact information. It also includes a gift processing module that allows users to record gifts and

donations given to Omega. The application is used to identify the geographic region a fundraiser is assigned along with all the donors in that region. Visits by fundraising staff to various donors are captured within this application via interaction accounts. When a fundraising staff enters accounts about visits that they concluded, the information is routed to various individuals within the advancement office. Based on how a particular donor is classified within the application the interaction account could be routed anywhere from ten to fifty individuals or more. The selection of individuals, to whom the interaction account will be routed, is based on a predetermined algorithm that looks at multiple data points. The fundraising staff who is entering the account does have the ability to add or remove individuals from the automatic suggestions. This routing feature was one of the original features developed within the application.

In recent years, leadership within advancement office noticed that certain high profile donor interactions were been routed to a larger population. Although much of the information within the interaction report is mundane, they feared at times it could potentially contain sensitive data that the donor would have preferred to be kept private. And fundraising staff who are entering this account may not be sensitive to the information and accidently chose the default setting, inadvertently sending private conversation to over fifty individuals with the department.

Privacy of donor data is extremely important for advancement officers. They were more sensitive about the privacy of certain selective donors. These donors were mostly high net worth individuals or families, but not always, some individuals on this list had political context for Omega and there were others who were planning estate giving, etc. The administrative team wanted to have control over who will get added to this selective

donor list and they wanted to ensure no additional burden was placed on fundraising staff during this high stress period for the department. The high turnover and limited pool of good fundraising talent re-enforced the strategy that no additional burden will be placed on the fundraising staff. The advancement office leadership decided to modify the application such that for certain select donors the algorithm will produce no selections This would force the fundraising staff to specifically select individuals with whom they wanted to share this data. This functionality was designed to mitigate the risk of a fundraiser accidently sending sensitive information to multiple individuals. It also helped the management team with their messaging, as they would not have to implement any audit or punitive measure against a fundraiser who did not follow a management directive. From the technology standpoint this was a critical decision as well. The application was about nine years old and was fragile due to the technical debt it had accumulated over the years. For over a year the organization was performing minimal to no changes to the application to prevent any potential disruption due to changes introduced by a new code base. The decision to make this change was approved by the senior most executive of advancement at Omega. The high visibility and critical timing of the implementation demanded key resources to provide a dedicated focus on the project.

Within Case Analysis

This section presents details of this researcher's case analysis that merge the theoretical constructs of the mental model shared-ness with the data collected to explain

how and why the mental model shared-ness moderates the relationship between user participation/involvement and systems use.

System Use

The project met the scope and expectation of the requested department and the technology organization. This opinion was independently expressed by all members of the project team. The project was scoped to mitigate a major risk to the organization, and it was successful in meeting that objective. The developed feature is in use across the department as evident from the usage report. Interaction account-related changes were implemented for all existing critical donors and system use was clearly 100% for the existing data. To further support the argument of high use, when new critical donors were added to the application, this feature was utilized. It was developed to mitigate a risk and no risk has materialized over the year of its use. Based on the above stated evidence, this researcher concludes the system use was high.

User participation

User participation on this project was channeled through the user representative on the project. The project team engaged this individual multiple time over the course of the project. The business analyst was new to the organization and was eager to ensure the success of the effort.

"…It was my first project and wanted to sure it was successful…I may have not had a deliverable in a certain aspect of the project, most definitely kind of wanted to

make sure I was involved some point in the oversight of it, to make sure that the project was successful."

The BA engaged the user representative at various points over the course of the project. There were wire frames and mock designs that were shared during the requirements gathering and design phases. User approval on the design was acquired prior to the development effort. User training and documentation were developed to ensure members of the larger user community will have the necessary training to successfully use the new feature.

"...Three in terms of elicitation (Requirements) and then obviously more meeting followed when the requirement was in the initial draft ... and then we started to refine the actual document, so there were multiple meetings post the first three meeting."

The user representative was deeply engaged in the project and ensured that the requirements were complete and covered most business scenarios.

"...Looking at the requirements, just making sure whether or not anything was missed, because we recognize that application is so complicated in so many different, um, different projects over the years has made it complicated as it is."

There are three distinct dimensions of UPI: overall responsibility, user-IS relationship and hand-on activity (Hartwick & Barki, 1994). In this case, users were engaged in hands-on activities such as testing, development of documentation, ensuring all business scenarios were covered, etc. The users also took overall responsibility of the project by approving the wire-frame designs. The user-IS relationship was high. The users were engaged by the business analyst and the technology lead at various stages of

the project. Based on the engagement of the users across all stages of the project, the project scored high on all factors associated with UPI.

The H1 hypothesis states that UPI will have a positive effect on system use, and the findings in this case clearly illustrate high UPI and high system use. Therefore, this hypothesis is supported.

Listed below in table 7-1 are measures of Shared Mental Models extracted from the transcribed interviews. The ID and time stamps references to the transcribed text and original recorded interviews.

Table 7-1 Illustrative Evidence from Case: Interaction Account Sharing (TT & JT SMM)

ID	Time	Technology Task - Shared Mental Model
CRU	16:45	***"We did a good job coming up with the design in term of the solution… I wonder, if we would have had a little bit more time weren't rushed we could've come up the a more efficient way"***
CRU	18:00	"There were limitation as to, um , how we responded to user events, um, because of the platform, um, that goes back to saying that it was somewhat outdates in term of what is state of the art now"
CRU	19:21	"… There was a specific path that you had to take with in the application from screen to screen or button to button to implement, um, for a user to implement the functionality"
RMO	15:17	"...Yes, there (users) experience changed because one of the things that we were asked to.."
SUL	11:53	***"...it (feature) was similar to current application in the context where user would see information display in a similar way in seeing options when they were filling out.."***
		Job Task – Share Mental Model
CRU	22:51	"...Is this a common practice? ... This particular task is not, um, this one's a niche case"
CRU	24:20	"… not been able to get more of a user's perspective"
RMO	18:03	"..it is not standard within the application and I don't see how it could be standard within the industry."
SUL	13:18	".. We added an additional options on something that they were already filling out."

Note: Bold and italics rows were referred in the case as examples.

Shared Technology and Job Task Mental Model

The technology and task capabilities of the new feature that was developed were very similar to the current application. The users were familiar to the current process, hence would have engaged in mental model maintenance.

"...it(feature) was similar to current application in the context where user would see information display in a similar way in seeing options when they were filling out the interaction account."

The designer was aware of the limitations within the application and engineered the new feature to support the current user experience model. The design may seem to be more antiquated compared to the modern application, but it was in line with what the users of this application have been used to.

The task automated as part of the project was unique and not an industry standard. While the overall objective of protecting sensitive information could be considered an industry practice, it was not the approach taken on this project. This could be attributed to the limitation of the application.

"...it is not standard within the application and I don't see how it could be standard within the industry."

All information about the task and user experience was filtered through the user representative. This would create a challenge in understanding and aligning to the larger user mental model, especially if the automated task was not an industry standard. In this case the designer mimicked the current functionality and extended the feature.

SMM Effect: The project team designed the new feature to align with the existing processes and user experience. This deliberate attempt to stay true to legacy design and user experience was essential for the overall consistency within the application. The users' familiarity with the application would enable them to adopt this new feature as it was similar to other application functions. This was in alignment with the empirical evidence found by Zhang and Xu in their study of mental model maintenance. Multiple members of the team expressed this theme of similarity in design and consistency with current applications.

The team unanimously agreed that the feature developed was not common to the industry, however the task was just an additional step among other tasks that the user was performing. It was not a major departure their current tasks, as one interviewee expressed *"…We added additional options on something that they were already filling out."*

Although, the job task was unique and new, since it was just an additional option for the users, they would not have experienced a major shift in the task they performed. Based on these findings and the fact that these ideas were echoed by many members of the team, we can clearly state strong support for H2A and H2B.

Listed below in table 7-2 are measures of Shared Mental Models extracted from the transcribed interviews. The ID and time stamps references to the transcribed text and original recorded interviews.

Table 7-2 Illustrative Evidence from Case: Interaction Account Sharing (TI & TB SMM)

ID	Time	Team Interaction - Shared Mental Model
CRU	26:41	"…communicate well with other members of the team? Eventually…"
CRU	27:49	***"…well there was jargon…. Business used certain vocabulary and it's not common to us ... Again because I was new"***

CRU	30:50	"…rest of the individuals on the project team had a pretty good working relationship from the past"
RMO	18:48	"Our jargon is common"
RMO	20:50	***"…roles and responsibility understood very well? Absolutely. And I think that's probably why things work well. Everybody knew what their part was."***
RMO		***…Problem solving? … through various communication meetings, whether it's through email or phone conversation.."***
SUL	16:56	***"...common vocabulary when you talk? I would say in the beginning of the project, probably not. But by the end of the project, yes.***
SUL	20:10	..towards the end when we had the team together, I thought that went well."
SUL	20:43	"…Some of the team members were brought in later, for example those who are testing were brought in a lot later in the process, um, knowing whether or not they truly understand all the different components. Um, you know, them" may have some input at the, you know, eleventh hour of the ways things might work and may not realize that we may have already had all these conversations. And so, I don't know to what extent that might have impacted trust, but, um, I think us not all being on the same page until the very end may have impacted them."
		Team Behavior - Shared Mental Model
CRU	35:22	"… ability to complete tasks? …. We had senior tech lead, I did my part, uh, the business was forthcoming…"
CRU	38:01	".. I think about how tech lead and I related and that project there was a real energy in going back and forth in term of, hey, could you have written this better?... Just checking each other to make sure we are bringing the best out of each other."
CRU	39:29	"…it was a really good brain storming with the team"
SUL	25:03	"..our lead liaison for IT team did, I think help towards the end, kind of gather everybody on the same page and that was helpful"

Note: Bold and italics rows were referred in the case as examples.

Shared Team Interaction and Behavior Mental Model

With new members in the group, team communication was ineffective at the beginning of the project, but it improved over time. The use of business jargons could have contributed to this challenge especially for the new members.

"...well there was jargon…. Business used certain vocabulary and it's not common to us ... Again because I was new"

"...common vocabulary when you talk? I would say in the beginning of the project, probably not. But by the end of the project, yes."

Roles and responsibilities were understood within the team. Many members had a long-term working relationship with other members on the project. Theory supports the idea that members of a team improve their mental model alignment with time (Denzau & North, 1994).

"...roles and responsibility understood very well? Absolutely. And I think that's probably why things work well. Everybody knew what their part was."

Collaboration between team members also improved over time. Problem solving was an inclusive activity within the team, with constant feedback loops to those who were not present in meetings. The team encouraged other members to perform at a higher standard to achieve favorable task outcomes.

".. I think about how tech lead and I related and that project there was a real energy in going back and forth in terms of, hey, could you have written this better?... Just checking each other to make sure we are bringing the best out of each other."

"…Problem solving? … through various communication meetings, whether it's through email or phone conversation."

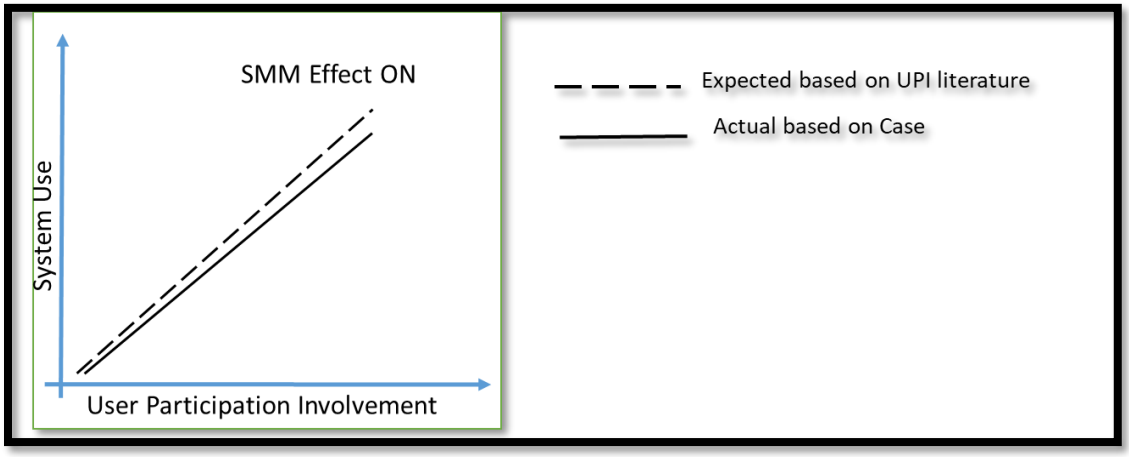
SMM Effect: The project team comprised of new and old members. The interactions during the initial phase of the project were weak, but over time became strong. This was consistent with the mental model theory which states that mental models among

individuals align over time with communication. Team members enjoyed problem solving and engaged in improving the overall quality of the product. Roles and responsibilities within the team were clearly understood and the team over the course of the project developed operational synergy. These feelings were expressed by various individuals within the team. Based on these findings we can clearly state strong support for H3A and H3B.

Discussion

Consistent with the theory, the findings in this case suggest the shared mental model factors positively impacted user participation and involvement leading to a positive system use outcome. Technology and task-related mental models were further enhanced when the design implemented was very similar to the existing application design. This approach minimized the mental model building activities for the user (Zhang & Xu, 2011). The lack of mental model building activities increases ease-of-use and further enhances the shared mental model among the user community. The quality of communication improved over time with activities like brain storming sessions, which further enhanced the mental model alignment (Denzau & North, 1994). The team interaction and behavior-related factors were expressed more positively by interviewees, hinting at the influence of team related mental model on the user participation and system-user relationship. Figure 6-1 below clearly shows the expected system use with high UPI and SMM. The findings from this case clearly align with the expectation of the UPI literature. The positive effect of the shared mental model further supports system use outcomes.

Figure 6-1: Impact of SMM in case - Interaction Accounts Sharing



Alternate explanation

Another explanation for the success of the developed application feature could be attributed to the top management support. Top management support on a project is a factor that influences system use. This project was requested from the top tier of the institution. Senior leadership had identified a risk that the department was trying to mitigate. Users were sensitive to the risk and wanted to abide by the requests made by management, so they decided to implement and use the feature. The training and documentation provided to the user community helped to further reinforce the need for using this feature appropriately. While this explanation could be valid considering the highly-sought-after user community this application serves, it was very unlikely that they were using the developed feature due to pressure from management to use the system.

5.2 Worker Onboarding [B]

Background

Omega is a large not-for-profit institution in the Midwest region of the United States. The primary mission of the institution can be classified into three distinct pillars: teaching, research and patient care. There are various schools and departments that support the mission. Together they form the institution. Omega has an operating budget of over two billion dollars. For operational efficiency and scale, the administrative functions of the institution are serviced from a central unit under the leadership of a chief operating office. Information Technology (IT) is one such function within the central unit. It is headed by the chief information officer, who reports to the chief operating officer. IT at Omega is both centralized and decentralized. Although Omega has a central IT department, most IT operators are embedded with the various schools and departments. Over the years, Omega had tried to minimize cost within the administrative areas by using technology and automation. As IT costs ballooned across the institution, the CIO shifted the IT department's approach to a service-based model. The intent was to move the institution towards centralization of many common or commodity services like infrastructure, identity and access management, IT security, help desk, email services, etc. to gain economies of scale. Schools and departments were expected to get similar or better service at the same cost. The many resources from across the units would now move into the central IT to support these services at scale across the campus.

This was a major shift for the institution. There was relinquishing of agility and power to achieve standardization and scale of commodity services. It also provided an opportunity for various IT resources to grow within the IT department, a career path that

they never had before. The institution was set to move from a relationship-based model of operations to a service-based model. In the old paradigm, if the staff had an issue with technology they called the IT representative in their unit, someone they likely knew and had a working relationship for years. In the new paradigm, they called a help desk hotline or entered a service ticket on a website. To provide services at scale, the institution decided to invest in tools that would help deliver IT services. ServiceNow, a market leader in software that helps IT organizations transform to a service-based operating model, was introduced into the IT department at Omega. It is important to note here that an instance of ServiceNow was already in operations at Omega, but not in the IT space. The IT department had to work within the constraints imposed by the existence of another department within the tool. They had purchased ServiceNow to manage their operations and over the years had customized to tool to meet their specific needs. The flexibility of the software provided the necessary assurances to IT leadership that they will be able to use the software to support the new approach. The program to centralize the common services started and soon the complexities of standardization emerged. Each department and unit had operational freedom and continued to operate independently to meet unique operational and service level needs and specific business expectations. Aligning expectations, establishing uniform service-level agreements across all units, and providing a single-entry point for all common services proved to be a daunting challenge. To further complicate the model, the IT staff had to be educated in the ITIL Service Delivery model and trained to operate under those guidelines. The case discussed in the following section is about a project that was initiated in this background to help support the standardization effort.

Project context

As an institution, Omega hired approximately one thousand new staff members every year. The process of onboarding a new staff member into a department or unit required a series of tasks and approvals that needed to be accomplish by various departments. These tasks could range from simple human resources functions like completing legal paperwork to technology functions like acquiring a computer for the new staff member to setting up access to certain buildings or technology software. The sooner an employee had these barriers removed the sooner they could be fully productive. Technology teams played a major role in this space, not just from getting a computer ready with the necessary software, but also in providing the individual with the necessary access to be successful in his or her job. Omega had over fourteen thousand employees who were distributed among various departments and units. What was required for a recruit was highly decentralized and could only be accurately predicted by their unit manager.

How could a manager successfully communicate with IT to determine what was needed? The manager could pick up the phone, call the helpdesk number, and communicate the issue via the help desk operator. This would likely bring about challenges associated with terminology and translation. Another approach would warrant the use of a paper or online form that the manager could submit to make the necessary request. The form was designed to route the tasks and approvals to the appropriate members within the IT team. This is important because the person actually performing the work would be a specialist and not the person who picked up the call. Such triage mechanisms were essential to generate specialization and scale within the teams. Paper

forms were quite popular among the various departments. Some departments had upgraded to an online SharePoint form to overcome the administrative burden of a paper-based process. The IT department at Omega decided to develop an online form within ServiceNow. This approach served two purposes. Users could directly submit a form with data and special instructions. Based on the form, ServiceNow could automatically send approval requests to managers who could then approve the request within ServiceNow, leaving an audit trail for authorization. Another advantage for using ServiceNow was that all technology services at Omega were delivered via ServiceNow and the IT teams were constantly monitoring requests throughout the day as part of their daily work to maintain the agreed-upon SLA. So, when a ticket or task was assigned within ServiceNow for the IT team, they were prepared to work on it.

Each department within Omega had their own onboarding procedures. While some departmental procedures were more sophisticated than others, they all had similarities and variations among them. As these departments started using the central IT for common functions, such as provisioning an email account for new employees, requesting access to drives and applications, provisioning a computer for the new employee, etc. The need for standardizing processes became essential. ServiceNow was the chosen platform to capture and record IT services, and a new form was requested by the central IT services team.

The initial objective of the project was to develop a form that would meet the needs of all departments and yet remain generic. Another item on the wish list was to ensure the tasks associated with each request would automatically be created and assigned to the appropriate IT team within the central IT department. This would ensure

the email provisioning team received the necessary information about the new employee via the assigned task, and would be able to successfully create the requested email account and complete the task within the agreed-upon SLA.

The worker onboarding project was a major supporting project initiative for a multi-million-dollar program that was consolidating local IT services from various departments and schools in to a shared IT services environment that would be managed by the central IT team. Onboarding new and transferred workers is a major issue for many organizations. This was true in Omega's case as well. Various departments and schools have their own applications, devices, drives preferences, etc. which are difficult to catalog and scale. The onboarding project was an attempt to help catalog and help with the administration of these tools. This was a critical project for the central IT team to scale and meet the needs to the schools and department. Many departments that central IT was incorporating into the shared services program had their own local IT team to support the departments and schools. Each school and department had their own form that could be filled and faxed or emailed or submitted to SharePoint, and many still relied on phone calls. The objective was consolidation and standardization to facilitate scale. However, they failed to recognize the lack of standardization and the diversity in the services provided or the processes deployed within these units. It was a "white gloved" approach to commodity services. IT soon realized that such diversities could not be accommodated in a model designed for scale and they will have to put forward a simplified onboarding application.

Within Case Analysis

This section presents details of this researcher's case analysis that merge the theoretical constructs of the mental model shared-ness with the data collected to explain how and why the mental model shared-ness moderates the relationship between user participation/involvement and systems use.

System Use

The system that was put in place to request and process on-boarding of new or transferred employees had over five hundred recorded instances of use in one year. The scope of the project was elusive from the beginning, as expressed by many members of the project team.

"...The scope was changing. Um, so if we're talking to the onboarding, there was definitely a rolling scope, started out, very detailed, so we do not meet that scope. Um, and then it, was reduced mainly by our customers over time."

"...initially we had to cut down some of the tasks because they had a task shooting off for every single thing that you fill out. And to me that just be over saturation of, of items. So, evidently we trimmed it down to one. "

"...No. Okay. And that was a decision that we made because of time. Um, we decided instead of actually fully fleshing out the requirements that we were just going to reproduce the word document that people currently feel out as a form in service now. "

The actual function of the on-boarding form required a user to fill out data about the new or transferring employee. Based on the data that was entered, the form would create necessary tasks for the central IT service delivery team to fulfill. It could include setting up email accounts, creating employee access ID (keys), etc. On average, Omega

hires approximately a thousand employees every year. If over five hundred on-boarding requests were made using this form, it would account for about fifty percent of the overall on-boarding requests. Based on the criteria established, it would easily place the utilization of the feature in the medium system-use range (33% - 66%). The project manager was pleasantly surprised with the usage statistics, not anticipating this level of usage for the feature. This was expected, due to the varying scope of the project.

User participation and involvement

This project was unique in many aspects. It was a sub-project under a massive shared services program effort. There were two kinds of users, the department user, who used the form to on-board staff, and the Central IT shared services staff, who fulfilled the tasks created from the on-boarding request form. There was heavy scrutiny of the project team from IT leaders. Since the health of the shared services program was poor, it could not suffer another missed milestone or failed sub-project that could have given the program some scale.

The user participation involved meeting with the central IT team engaged in the shared services program multiple times a week.

"...primarily keeping things on time for our very aggressive schedule. Um, coordinating to bring everybody together. I think we were meeting two to three times a week."

The business analyst played an active role in capturing requirements, mocking the design using wire-framing techniques. Due to the aggressive schedule time was a critical factor. The shared services IT team was consulted during the period of testing many of the changes were incorporated. They were also involved in the approval process.

Unfortunately, the primary user of the form, the department users were only engaged for a very brief period to create a word document that was a consolidation of the services they offered today. For the remained of the project it was the second type of user, the Central IT shared service team, who were engaged as users.

"...user participation standpoint, I worked with the, the SME kind of where the people who are onboarding sets. So they understood the different onboarding forms from the different areas and they kind of kind of tried to combine them into something that would work for all of them, realizing that we can't make everybody happy. So they had put together this word document, um, and that was what all of them were currently using and they kind of felt like it was a step back. So how can we get this into service now in a way that's, that's helpful. I, um, we did have conversations about how can we make this better? But then we had to have that, um, that kind of negotiation of if you do want this, it's not going to be done in time. Is this more time bound or is this more, let's make sure we've got the right functionality? And so it turned out to just be, it's time bound "

"...There was two, um, after they created the forms, we still looked at the forms and see if there's anything else that they need to add or see, see how the tasks would have generated, if they're doing what they're supposed to do or how they want us, to approach that. "

Based on the discussion above, it is very difficult to say if any of the three distinct dimension of UPI, overall responsibility, user-IS relationship and hand-on activity were met (Hartwick & Barki, 1994). In this case, the primary users of the feature, the department managers, were completely neglected. The ongoing training did actively

focus on the feature, as clearly stated by an interviewee *"...So then I asked the person that's doing the training, she says we don't go over that. "*

However, the team did manage to make necessary changes suggested by one group of the users. Based on the above discussion of the case, this researcher concluded that there was low user participation and involvement.

The H1 hypothesis states UPI will have a positive effect on system use, and the findings in this case clearly illustrate low UPI and medium system use. This hypothesis is not supported

Listed below are measures of Shared Mental Models extracted from the transcribed interviews. The ID and time stamps references to the transcribed text and original recorded interviews.

Table 7-3 Illustrative Evidence from Case: Worker Onboarding (TT & JT SMM)

ID	TIME	Technology Task - Shared Mental Model
JST	8:57	***"...Was the user experience similar to other tools that you use at home or other places? Uh, are the tool itself? I would say it's, yeah, it was similar to what was in that tool at the time. And we tried to avoid any thing that was really off the rails as far as."***
BSC	9:49	***"...it was a form. So we already had a kind of onboarding form, those kind of generic also, this is just a little more specific to what we would like to see as far as what we needed to do to do our job. "***
BSC	11:36	No CMDB is a limitation
BSC	19:50	"...So then I asked the person that's doing the training, she says we don't go over that. "
CMA	9:57	***"...I would say it's similar to other websites where you would fill out a request for sure."***

CMA	10:10	"...because of our customizations, not so much that it prevented us from really getting the goal accomplished, but from some of those extra features such as like making sure or something scrolls with you as you were checking out or making sure that like a field name makes sense because it's so service now. Some of their field names make sense if you're in IT but if you're a customer it doesn't. And so we can't really go in and change those because of that piece. "
		Job Task - Shared Mental Model
JST	7:47	"...I think there's some folks that liked it, but I think there's been a change in the attitude now that there's a realization that hey, maybe we need to know what we want to do before we create a form to basically direct us to do it."
JST	9:55	"...what are the business processes, um, you know, when the user's going to be. Um, and I, uh, what I call a real design phase. Um, and I think that being absent is a failure. "
JST	10:56	"...so starting that out there, we're going to be I think six or seven different tasks associated to unknown processes. In the end, I think that got reduced to maybe as low as two or three because they realize it was the same people doing all of these things. "
JST	10:56	"...within our organization I would say it's not very standard. We've seen a lot of variants…"
JST	11:54	"...discussed the processes of the tasks in detail? Um, we did, um, with the end users, again, a lot of that was kind of put into their court because we don't know what they do and what they want. Um, and I think what happened is as they started to try and go into detail, they realized they didn't have the detail and that's how we kind of went back."
BSC	12:51	"...discuss these processes in detail? I don't think they did. "
BSC	20:59	"...I don't think it is meeting expectations of the users or of us. So we did, every time we on-board a new department that's what they're biggest question is, how do we do new users? So I have several meetings with the local departments. Alright, here's the report, here's what we are going to do and kind of go over what each field does and how that applies to what they're doing. And once you do that does the adoption seem? Seems to go well. "
BSC	18:53	"...So I think that's the biggest drawback right now is the overall user training. And this goes with this form, pretty much all our forms and service now is they created them, they leave the finished product and then go somewhere else and work on something else. And a lot of that, I think a successful implementation of something is follow up to make sure that what you have to path laid out there, and that the people that are utilizing that project or that product are trained on how to use that product, where that product is and all that other stuff."

CMA	11:20	"...I would say ours is a very simplified version of a standard. Um, I think it could absolutely be more complex than it is based on our needs and our maturity level. "
CMA	11:55	***"...Yes. So we talked about what was involved in each task to make sure that we could put a actual like instructions in there so that if it's a new person coming on and they're taking on this, they actually have step by step instructions on what to do. "***
CMA	13:06	"...one was that we had to, at first it was we need to make everybody happy. So all these different teams that were onboarding, we need to make them happy. But we kind of went back and said, well, okay, but you're going to onboard more and how do we kind of work with that? Um, what's the bare minimum, you know, what is the minimum requirements for this?"
CMA	13:06	"..., time was, it was a problem. It's always, um, because this was supposed to be part of a larger group of, of forms. Yeah. And so finally we just said, we've run out of time. We just need this done. So time was a big part of it as well."

Note: Bold and italics rows were referred in the case as examples.

Shared Technology and Job Task Mental Model

The feature that was implemented to support on-boarding was an additional form to the services catalog. The designer was very careful to not waiver too far from the existing design constructs with the tool. Users were familiar with other form that were in use. The use of a web form was also very similar to other applications or websites that people use in the daily activities. This was a critical consideration as it kept the new feature with in a familiar mental model. There was constant discussion on how the user would like to use a feature of this type. Step by step instructions were provided to help those who were new to the form and help understand the objective of the various fields. Communication with the users helped align the mental model between the users and the project team. Technology and task-related mental model helped users and project team set similar expectations on functions, procedure and limitation.

“I would say it's, yeah, it was similar to what was in that tool at the time. And we tried to avoid any thing that was really off the rails as far as."

"...it was a form. So we already had a kind of onboarding form, those kind of generic also, this is just a little more specific to what we would like to see as far as what we needed to do to do our job. "

"...I would say it's similar to other websites where you would fill out a request for sure."

"...Yes. So we talked about what was involved in each task to make sure that we could put an actual like instructions in there so that if it's a new person coming on and they're taking on this, they actually have step by step instructions on what to do. "

"...one was that we had to, at first it was we need to make everybody happy. So all these different teams that were onboarding, we need to make them happy. But we kind of went back and said, well, okay, but you're going to onboard more and how do we kind of work with that? Um, what's the bare minimum, you know, what is the minimum requirements for this?"

SMM effect: Based on the above discussions and highlighted extracts from the case it is quite evident that there were frequent contacts made with one of the user groups responsible for fulfilling the request. For the second user group, the user submitting the request, the designers developed wire frames and modelled experiences of an online customer or any user over the web using commercial sites. The designer in doing so was deliberately attempting to leverage the users’ technology SMM. The designer deliberately

placed multiple guides or instruction on how to use the form on the page as well. Based on these findings we can clearly state a strong support for H2A and H2B.

Listed below are measures of Shared Mental Models extracted from the transcribed interviews. The ID and time stamps references to the transcribed text and original recorded interviews.

Table 7-4 Illustrative Evidence from Case: Worker Onboarding (TI & TB SMM)

ID	TIME	Team Interaction – Shared Mental Model
JST	14:21	"...there was definitely hesitation from folks because we basically doing something that kind of goes against, hey, this isn't right. You know, sometimes you have to do what you're told. Um, there was some issue around that."
JST		**"...it's the most, I've seen customers interact on something and this is there, because of the high level of management involvement. I think that was a big part. "**
JST		"...We had constant communication. I moved that we have made that a little better or, but if it was a sort of thing where it wasn't in one of those sessions or somebody who could make a decision and then when I tried to do is regularly taking notes after this, we were documenting everything that went out within those sessions. It was great. But if anything was ever allowed to go outside of that it was lost. "
JST		"...I think it actually, uh, improved trust with the exercise. Started off with less trust then improved yes, there was skepticism."
BSC	15:13	"...Outside of her actual role was supposed to be in that. I think she was the designer but she was also doing the training on it. So I wasn't sure what her role was. "
BSC	15:13	***"...actually a lot of the decision making happened before came to us they were open to hear, we want to change, we're willing to do it."***
BSC	15:13	***"...difference in opinion encouraged? I think so, actually they were looking for that difference in opinion. "***
CMA	14:51	"...So our internal EA team I think did a really good job trying to reach out to the customer at this case was IT, so it was kind of Sharon's team and um, the depo and kind of all these little pieces I'm getting feedback from them was hard. I feel like it is very bad at being IT's own customer or being a customer in general. Um, but I think we tried really hard to reach out. We just didn't get a whole lot back."

CMA	15:29	"...No. Okay. Um, I think it could have been done better. Yes. I think it could have been done better. I think, um, the involvement from not only like, cause we just had so many different people involved that it was hard to get it kind of everybody on board having CRM involved was great, but they like us, we're saying they, they were, they kind of, um, limited us to what they thought would work."
CMA	16:11	"...On from a customer standpoint of who actually gets to sign off on this, who should be giving us information, it was difficult."
CMA	17:21	"...Was decision making primarily done during meetings? I would say it, it was happened in meetings, but a lot of times too, we would push something out there and get an email."
		<u>Team Behavior – Shared Mental Model</u>
JST	17:30	"...shared goals of the project. There was some decent originally, and again, I think a lot of that comes back to be, you know, oh no, we need to develop this thing properly. The, I think again, the overriding thing was do something quick, get it out, get somebody off my back."
JST	18:50	"...I would say pride with disclaimers. Um, I, I think yes, but I think that hesitation mainly came from, you know, this we could have gone a lot farther, but then it's remind yourself that, well, the customers aren't even ready for that, so. Okay. "
BSC	17:37	***"...they're actually, really open in accepting the feedback that we had so we'd, we'd made some larger changes and they're willing to do that. So that was nice. Uh, honestly a lot of the changes that we did request were made and there a couple things a big that they couldn't meet for us and they just told us why. We understood and decided to work our processes around that. Uh, but overall they did a good job in fulfilling what the form was for what we wanted it to be. "***
CMA	17:48	***"...Absolutely. One of the big things that kept happening was kind of pushed back and go, okay, well let's, let's rethink this and kind of go from there. We did a lot of different, like we were saying, wire framing. Yeah. Trying it again."***
CMA	18:23	"...Did the team know and agree on the shared goals? they changed. So I think it's hard because our original goal was to wrap this all into have, um, have this form be a bigger part of multiple forms. So it would, it would also spin you into the next form, which would be filling out what computer they get and then setting up an email and then those kinds of things. Um, which totally changed by the time we got to it. So I would say that it's changed. Yes. But it changed so much that it's hard to keep up."
CMA	19:12	"…So I came on, I guess I kind of half way through this project"

CMA	19:48	"...Yes, they, they helped they helped each other out a lot, um, to say like, this would work, but what if you did it this way instead trying to get out of the hard coding, trying to get out of customization pieces and just say kind of the kind of helped each other out through the, throughout that stuff."
CMA	20:57	***"...Um, as far as like user experience, it was rough, but I think we really tried to think about it from an end user as me going in and that whole idea of like, what does this look like when I'm at home? It was brought up a lot more in this project than any of the ones I've, I've heard of since. So, yeah."***

Note: Bold and italics rows were referred in the case as examples.

Shared Team Interaction and Behavior Mental Model

The team was small, but they were quick and agile. There was constant communication, and efforts were made to keep everyone in the loop. There was lack of trust initially, but trust was gained over time. There was some role confusion as project team members played multiple roles. The team still manage to be flexible and were able to accommodate many changes during the testing phase of the project. The criticality of the project created heavy top management oversight and support. Even with the top management oversight, decision making was a challenge.

"...it's the most, I've seen customers interact on something and this is there, because of the high level of management involvement. I think that was a big part. "

"...they're actually, really open in accepting the feedback that we had so we'd, we'd made some larger changes and they're willing to do that. So that was nice. Uh, honestly a lot of the changes that we did request were made and there a couple things a big that they couldn't meet for us and they just told us why. We understood and decided to work our processes around that. Uh, but overall they did a good job in fulfilling what the form was for what we wanted it to be. "

"...actually a lot of the decision making happened before came to us they were open to hear, we want to change, we're willing to do it."

"...difference in opinion encouraged? I think so, actually they were looking for that difference in opinion. "

"...Absolutely. One of the big things that kept happening was kind of pushed back and go, okay, well let's, let's rethink this and kind of go from there. We did a lot of different, like we were saying, wire framing. Yeah. Trying it again."

"...Um, as far as like user experience, it was rough, but I think we really tried to think about it from an end user as me going in and that whole idea of like, what does this look like when I'm at home? It was brought up a lot more in this project than any of the ones I've, I've heard of since. So, yeah."

"...On from a customer standpoint of who actually gets to sign off on this, who should be giving us information, it was difficult."

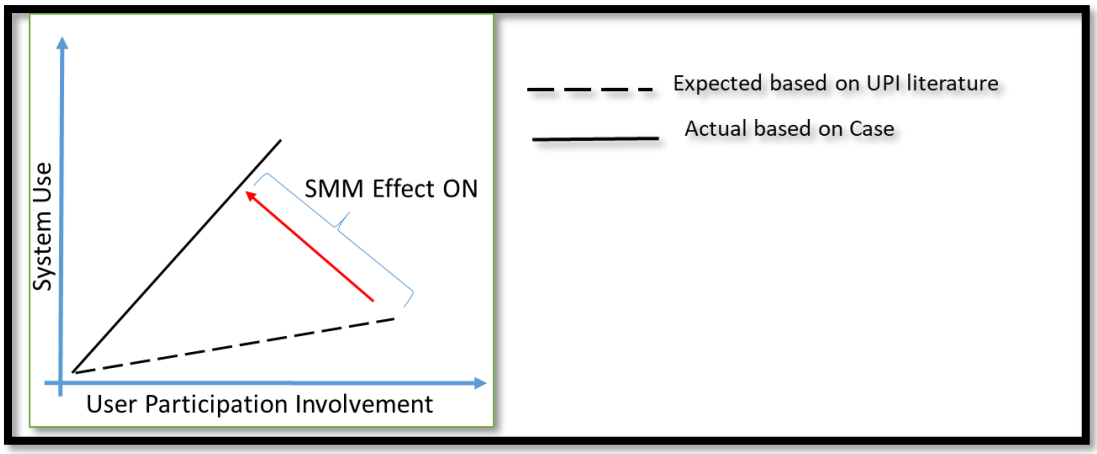
"...Yes, they, they helped they helped each other out a lot, um, to say like, this would work, but what if you did it this way instead trying to get out of the hard coding, trying to get out of customization pieces and just say kind of the kind of helped each other out through the, throughout that stuff."

SMM Effect: The team developed trust and shared understanding of different skills that members of the team had and created an environment to successfully operate in a stressful environment. The team accommodated other team members. These ideas were expressed by many members of the team. Therefore, it is clear that the team's overall

shared-ness of the team interaction and behavior mental model was high. These findings clearly state a strong support for H3A and H3B.

Discussion

Figure 6-2: Impact of SMM in case - Worker Onboarding



In this case, this researcher's findings indicate that user participation and involvement were low, as the confusion about "who the actual user is?" persisted throughout the project. Findings also indicate that the user community was split into two. Community 1 submitted the request online and Community 2 fulfilled those requests. This team engaged frequently with Community 2, and as for Community 1, they followed design pattern that were in common among users performing those tasks. Although, engagement with the user happened during the initial phase and then later on during the testing phase, there was strong shared mental model. There was alignment on the overall expectations from the project. There were relatively higher technology and task-shared mental models within the team. The team emulated the "family-of-Application" construct and was able leverage the existing mental model of the user. This is a possible explanation to why even at lower levels of user participation and involvement one finds

moderate system use. As seen in the figure 6-2 above, the UPI by itself cannot explain the finding. With low UPI the theory would predict low system use, however by adding moderating effect of SMM in to the mix one can clearly see how at high levels of SMM the team is able to achieve moderate system use at low UPI and explain the findings.

5.3 Academic Learning Management [C]

Background

Omega is a large not for profit institution that is engage in the business of educating young minds from all over the world. As a premier institution, educators and individual interested in higher education and research are drawn to it. Omega has about fifteen thousand students who are enrolled in various programs at any point in time. The campus is divided into seven schools and has multiple programs that cater to a variety of learners. The organization has two learning management tools. All schools except one uses Blackboard, the market leader in this field of academic learning management software. Blackboard has been in this space for many years and over time has managed to acquire many competitors and complementary functions to support and meet the needs of various institutions. For Omega, Blackboard was rolled out for all users in 2013. It had interfaces built to other administrative applications that support enrollment and other resources.

Blackboard was a large system. Because it supported complex pedagogical needs of a variety of institutions, it appeared clunky, complex, and difficult to use. The other tool, Canvas, was new to the market compared to Blackboard but quickly gaining market share due to its intuitive, easy-to-use interface. It did not have a rich portfolio of features, but rarely did a single organization have the need to use all features. So, one school within Omega decided to break the pattern and purchase Canvas as its learning management tool. The program managed with this tool was small having a limited number of students. Canvas never gained traction among faculty in other programs, although some were experimenting with it.

The challenge with the incumbent tool was its non-user friendly interface and non-intuitive set up of features. Blackboard recognized this problem and began developing a new and improved version of their flagship product. Unfortunately, the user community started feeling the effects of the market pressure and found Blackboard to be unresponsive to problems with the product itself. Service levels degraded and the new product that was launched failed to make an impression. Blackboard's installation at Omega was over five plus years old. The initial setup was plagued with numerous conservative configuration decisions that prevented users from easily adoption of modern pedagogical techniques. The service for the product was shared by two very small teams. One had the responsibilities of providing pedagogical support to instructors and some user interface training. The other was the central IT department, which managed the infrastructure and performed maintenance and upgrades to Blackboard. This lean pedagogical team lost resources that were never replaced. Hence, the overall service quality of the product degraded. The technology team that supported the product took on the burden of training instructors to maintain service levels. They were given additional non-Blackboard related responsibilities, which shifted their focus. Users could feel a degradation in service across the campus. To compensate for this problem, some schools deployed their own technology team members to support their faculty. This approach worked well for those schools and managed to stabilize the overall environment.

By the middle of the decade, technology was creating an unequivocal disruption in the teaching and learning space with online classes for over a thousand students, pedagogical patterns of flipped class rooms emerging, etc. Certain schools at Omega, feeling the need to engage in this paradigm shift, hired new staff members who could

better focus on these trends and create an environment for the institution to participate in this shift. This change in focus provided the necessary catalyst required to start a conversation about the need for a modern learning management tool.

Project context

Leadership within certain school and departments of Omega developed a strategic plan to engage in the technology revolution that was influencing the teaching and learning domain. The way instruction was delivered to learners shifted dramatically with the advent of new and improved technology. At Omega, certain schools desired to tap the potential of this paradigm shift to change the way they delivered classes. The incumbent tool, Blackboard, was neither capable nor configured to play a major role in this new paradigm. To make the situation worse for the incumbent, the results of a faculty survey showed that overall adoption numbers for Blackboard came to less than 40%. Canvas on the other hand was leading the charge on this seismic shift. Canvas had a presence on Omega as one school was already using the tool and certain faculty members from other schools were running the trial versions. The modern look and feel and intuitive design made using Canvas a breeze, so the bar for entry was set very low. To select a tool, Omega created a small committee of leaders from various cross sections of the schools and IT. After a few brief demos of two competing products, a pilot project was initiated. The pilot ran for about 4 to 6 months, and classes from select faculty were offered on these two product platforms. After the allotted time for the pilot, various user community members submitted their evaluation scorecards. The committee summarized the findings and Canvas was declared a clear winner. The committee then recommended Canvas as the choice to Omega leadership. The recommendation of the evaluation committee was accepted by senior leaders. The new learning management system project

was conceived. The overall charge given to the project team was to rollout a single platform for learning management systems to be used across the institution. The project would have two phases and would span a period of two years. The first phase was voluntary, allowing any instructors to adopt the tool. The second phase started in early 2019 would transfer all courses from Blackboard to Canvas by July of that year. This case study will examine Phase 1, the voluntary portion of this multi-year program.

Within Case Analysis

This section presents details of this researcher's case analysis that merge the theoretical constructs of the mental model shared-ness with the data collected to explain how and why the mental model shared-ness moderates the relationship between user participation/involvement and systems use.

System use

This learning management system was introduced into the institute's technology ecosystem to help students manage all facets of their academic (instructional) experience. This entailed the faculty adding all syllabi, assignments, documents, and grades on to this platform. All announcements/communications to the class happened through this system. Students found all information about all their courses in this system. This made it easier for them to manage their daily schedules, deliverables, and other engagements with the faculty and other members of the class. This was a step up from the previous environment where a student had to review multiple locations like a course website, faculty website,

email messages, multiple LMS systems, printed material, etc. to conduct their daily work on a course.

The user representatives and other members of the project felt the scope of the project was achieved as expressed by two of the user representatives.

"...um, the scope as defined by the deans who signed off on the project I would say...largely Yes. "

"...Was the scope met, the scope of the project? Yes. Okay. Um, did it meet your and your department's expectations? Yeah, it has. Um, but uh, our expectation was we have a system that we can use and then we'll be well supported and that there would be, um, you know, sufficient training and, and features and functions for us to teach courses that we wanted to and it's met those expectations. "

Most courses offered within the Omega academic environment were already available in Canvas. Starting in fall of 2019 all courses were in Canvas. This is 100% use of this new system. The legacy tool was decommissioned in late 2019. Furthermore, very few departments mandated the use of the tool. Based on these facts and the data, one can confidently state that the use of Canvas as a learning management tool has been high.

User Participation and Involvement

There was high user participation and involvement on this project. Even prior to the project kick off there was an official pilot project that was launched by the teaching and learning domain. The teaching and learning domain had members of various schools and departments. Some were faculty and others were staff that supported the faculty on technology or pedagogy. After the pilot project that ran for almost a year, a subcommittee

was formed to select the product. The product selection subcommittee comprised of members of the teaching and learning domain committee and a few select members of the faculty from various schools. The product selection committee chairs developed the report and the recommendation based on inputs, surveys, and insights from user community that attended the vendor demonstrations.

The enthusiastic user participation and involvement continued into the implementation project. The implementation team consisted on multiple user representatives, IT and other members of the teaching and learning domain. User representatives were in an advisory role on the project, and were involved in decision making and approvals. The project took special interest in training, testing and documentation.

"...Largely an Advisory role, in terms of, because I supported the proceeding, um, system mostly advisory communicating the various way faculty could use Blackboard and how that can translate into Canvas use."

"...lots of decisions and discussions about roles, permissions, access, layout, those kinds of things. Um, I was in the discussions when most of those decisions were made."

"...one of the things that was interesting throughout the project is that in order for, um, the legitimacy of decision making... A lot of overlap of the sort of the sub committees, um, and the working teams."

"...mostly communication, letting users and all students and faculty and instructors make sure that they understood that there's a transition coming when that transition was going to take effect."

The project team also engaged with individuals who were in roles to support the faculty after going live. This was essential for long term and overall success of the project, as the support model for the learning management system had shifted from a central unit to the distributed model, as per the direction set by the executive leadership of the institution.

"...we have a biweekly meeting of the tier two support folks, the school admins and the departmental admins."

The three distinct dimensions of UPI, overall responsibility, user-IS relationship and hand-on activity (Hartwick & Barki, 1994), can be seen in play within this project. The formation of various sub-committees in this project clearly shows the depth and breadth of user participation, involvement, and the user-IS relationship. The engagement of users during the selection process and the configuration phase clearly demonstrated the overall responsibility. In this case, users were engaged in hand-on activities such as testing, development of documentation, discussion of roles, etc. Based on the engagement of users and sponsors in this project, it is clear that the project scored high on factors associated with user participation and involvement.

The H1 hypothesis states UPI will have a positive effect on system use, and our findings in this case clearly illustrates high UPI and high system use. This hypothesis is supported.

Listed below are measures of Shared Mental Models extracted from the transcribed interviews. The ID and time stamps references to the transcribed text and original recorded interviews.

Table 7-5 Illustrative Evidence from Case: Academic Learning Management (TT & JT SMM)

ID	Time	Technology Task - Shared Mental Model
JCR	12:27	"...a new technology that was purchased from a vendor, um, was the user experience in this similar to other tools? Yes, Okay. It was similar to Blackboard.
JCR	12:27	***"…major limitations…there's some indications, uh, in the way that it manages, um, grade data. It's not as flexible as, as the tool replacing. Um, we'd, we've been able to deal with that by helping our faculty understand that the grade tool means something different than this product."***
LME	9:59	"...This was a total new system for the Omega main campus, and the Med school already had an instance."
LME	9:59	***"...Was the user experience similar to other tools that you use at home or other places? largely yes, in that it is a learning management system. So, switching from one to a different brand."***
LME	9:59	***"...faculty have had some significant challenges, specific types of content, like test-based questions from blackboard to canvas. It's created a lot of frustration. There are so key differences, um, just a conceptualization and way the two systems operate that has resulted in some frustration. But personally, I kind of look at the look at those as being growing pains as opposed to be a failure and limitation of the product."***
ACA	14:37	".... I wouldn't say it's absolute cutting edge, but is, I would argue that that's the market provides at this point. Uh, the vendor does a good job of releasing new features and content to try and keep up with the cutting edge."
ACA	14:37	"...I would argue it's user experiences significantly better and that is perhaps the most pointed feedback we've received. Is the, the user experiences a lot smoother."

ACA	16:24	***"...the main user experience takeaway is things are located in the same way you expect from a modern application. The basic business functions that you perform within the application are easy to find there, they will set a very straight forward and the terminology and the application is not, uh, it's not, it has not specific to the application. They do a good job of it's business friendly, yes. Of making it so that a user without LMS experience can pick it up and understand, you know, the various terms to a degree. The basic business functions do that well."***
		<u>Job Task – Shared Mental Model</u>
JCR	13:54	***"... when I do training, I explained why and what may be a benefit. Um, we do expect that communication happens through the system and that, um, at minimum grades do a feedback beyond the grades can be done outside of the LMS. But we also explain how it can be done through canvas, um, and delivery of content. Um, can be done within the system or can be done outside of the system. Um, so when it comes to the things that students feel most care about, um, you know, what's, what's due, when is it due, how I do, um, kind of the bare minimum for successfully completing a course. Um, all of those things happen inside of canvas."***
JCR	13:54	***"...so within the organization the expectation is, is, um, for pretty standard delivery but we do allow faculty to customize and be flexible about how they, how they meet that expectation. "***
JCR	15:22	***"...there were constraints around, um, who would have access to the course data for that is a constraint. Um, there were constraints around what the various, uh, stakeholders here. So Omega IT, the registered office and the representative of the users, what they wanted faculty to be able to do versus admins versus I'm teaching assistants versus students. "***
JCR	15:22	"...the support model for the tool was, had been centralized for the previous project. It was now decentralized and there was uneven adoption and uneven support across the schools. So some of the decisions had to be made at a sort of a lowest common denominator level."
JCR	15:22	"...before anything can be done, the information has to come from SIS, the administrative admission system. Um, and uh, anything that involved course management dependent on that information being accurate and timely…"
LME	14:39	"...processes standard within the organization or within the industry? I would say they are more standard within the industry, than within the organization if that makes any sense. It does it does...there are many universities that mandate the utilization of an LMS to a much greater degree than we see here. "
LME	16:04	"...Yes, I was present with those discussions. There were many discussions on various processes."
JSZ	4:23	"…Pretty much out of the box"
JSZ		"…tasks were pretty standard"

ACA	20:07	***"...fairly is fairly standard from a high level. Um, that being said, I think standard with the knowledge that whichever institution you go to, for the most part there's going to be a different degree of variability and on the instructor is actual process."***
ACA	20:45	"...Sometimes we had a variety of, uh, subject matter experts on the project who worked with faculty, not faculty themselves for the most part, but uh, people who were used to supporting faculty in the previous LMS and they would occasionally do more of a deep dive into, uh, a specific business process scenario and whether we wanted to try to support that"
ACA	22:14	"...having a homegrown student information system is both a help and a hindrance. Um, having to tailor solutions to our sis was more of a challenge for the vendor to come out with appropriate solution that met our needs than it would for say a banner implementation or something like that."

Note: Bold and italics rows were referred in the case as examples.

Shared Technology and Job Task Mental Model

There was shared-ness on the technology related mental model among users and project team. The new Canvas system had similarities with the old Blackboard system. One should also note that Canvas was not entirely new. One of the schools had been operating the system for its students. Canvas was a modern tool and users could find similarities with other tools that they used in their day to day activities. The ease of use in the user experience was a key element of feedback that the administrators heard from users.

"...the main user experience takeaway is things are located in the same way you expect from a modern application. The basic business functions that you perform within the application are easy to find there, they will set a very straight forward and the terminology and the application is not, uh, it's not, it has not specific to the application. They do a good job of it's business friendly, yes. Of making it so that a user without LMS experience can pick it up and understand, you know, the various terms to a degree. The basic business functions do that well."

"...Was the user experience similar to other tools that you use at home or other places? Largely yes, in that it is a learning management systems. So switching from one to a different brand."

".... I wouldn't say it's absolute cutting edge, but is, I would argue that that's the market provides at this point. Uh, the vendor does a good job of releasing new features and content to try and keep up with the cutting edge."

This was a new system, a vendor product. The switch was not easy for some users and they did face some initial challenges with the tool. This was primarily related to the change in the user experience. Users had to build a new mental model to operate in this system. As one of the user representatives called it, these were the growing pains of moving into a new technology.

"...faculty have had some significant challenges, specific types of content, like test-based questions from blackboard to canvas. It's created a lot of frustration. There are so key differences, um, just a conceptualization and way the two systems operate that has resulted in some frustration. But personally, I kind of look at the look at those as being growing pains as opposed to be a failure and limitation of the product."

"... some indications, uh, in the way that it manages, um, grade data. It's not as flexible as, as the tool replacing. Um, we'd, we've been able to deal with that by helping our faculty understand that the grade tool means something different in this product."

There was a shared task mental model among users. Many identified the processes to be quite industry standard. It became the necessary evil, as users had experienced this type of system from K thru 12. The deployment of the tool was out of the box implementation with limited to no customizations.

"...fairly is fairly standard from a high level. Um, that being said, I think standard with the knowledge that whichever institution you go to, for the most part there's going to be a different degree of variability and on the instructor is actual process."

The institution allowed greater freedom to its faculty than many of its peers. This created a challenge to those who implement policy and standards. It also created a challenge to individuals who train users.

"...so, within the organization the expectation is, is, um, for pretty standard delivery but we do allow faculty to customize and be flexible about how they, how they meet that expectation."

"... when I do training, I explained why and what may be a benefit. Um, we do expect that communication happens through the system and that, um, at minimum grades do a feedback beyond the grades can be done outside of the LMS. But we also explain how it can be done through canvas, um, and delivery of content. Um, can be done within the system or can be done outside of the system. Um, so when it comes to the things that students feel most care about, um, you know, what's, what's due, when is it due, how I do, um, kind of the bare minimum for successfully completing a course. Um, all of those things happen inside of canvas."

The wide user participation and the lack of policy create a unique challenge among the project team on how to meet the needs of various stakeholders on the team. Establishment of roles and access setup were especially challenging, and the business processes were discussed in detail to ensure the requirements were clearly understood.

"...there were constraints around, um, who would have access to the course data for that is a constraint. Um, there were constraints around what the various, uh, stakeholders here. So Omega IT, the registered office and the representative of the users, what they wanted faculty to be able to do versus admins versus I'm teaching assistants versus students. "

"...Sometimes we had a variety of, uh, subject matter experts on the project who worked with faculty, not faculty themselves for the most part, but uh, people who were used to supporting faculty in the previous LMS and they would occasionally do more of a deep dive into, uh, a specific business process scenario and whether we wanted to try to support that"

SMM Effect: The tool deployed was very similar to the tool it was replacing. They both were commercial learning management tools. Limited members of the user community were using another instance of the new tool, and lastly, these tools followed industry standards. Commercial tools that are designed well take modern usability trends into account. This was found to be true with this product. Not only was it well designed, it had better usability features that were more aligned to the current trends. The task functions were well organized and the capabilities within this tool make many tasks easy

to perform. These thoughts were expressed by various members of the team. These findings clearly state a strong support for H2A and H2B.

Listed below are measures of Shared Mental Models extracted from the transcribed interviews. The ID and time stamps references to the transcribed text and original recorded interviews.

Table 7-6 Illustrative Evidence from Case: Academic Learning Management (TI & TB SMM)

ID	Time	Team Interaction - Shared Mental Model
JCR	17:20	***"...there was, uh, meetings, regular meetings and um, uh, you know, email communication, things that were effecting. Did the team use common vocabulary? Yes. Um, we had a full document that actually defined some terms. Um, and the, the team members, um, largely had experience with LMS previously."***
JCR	18:45	***"...team dynamic did it meet your expectations. Most of the time there were occasions where, um, there was either, um, sort of overly conservative approach about, uh, risk management, um, and tolerance for sort of a freedom of flexibility versus privacy and security that I thought sometimes tilted away from what would um, sort of served the users better."***
JCR	20:20	"...thru out the project is that the, the main stakeholders on the teaching and learning domain committee, um, were, were consulted on the biggest decisions. Um, a lot of smaller decision that that didn't filter up and occasionally I felt that I had to go around the project manager to get information to the chairman of the committee, um, to make sure they knew what was happening, um, about the decision that would probably effect the end user choice"
JCR	21:25	"...was the environment safe to discuss issues. Yes, we can even have that difficult conversations. Like in these cases where there was, there was some disagreement. Um, the only time when I felt that the environment wasn't totally safe was one conversation where there was canvas representative on the phone call..."
JCR	25:26	"...there were a couple of other users on the group who privately he agreed with me and even asked what I was doing to, to support my faculty, but didn't express that openly in the meeting. So, they felt less safe than I did usually."
LME	16:04	"...wouldn't say constraints. I would say that, um, the various stakeholders necessarily have different points of view, um, and have different priorities. So, there's a bit of give and take."

LME	18:05	"...challenge sometimes it was faculty speak versus industry speak."
LME		"...team dynamics were largely, collegial. I think everybody made to think on the same team. Um, largely quite positive. I mean, sure, there were disagreement. That's because we have a group of people and we're all very passionate about what they do."
LME		"...decision making going on. Good, I think it was, um, so the, the project lead really tried to take into consideration the needs and the perspective of the stakeholders before making the top down and she wasn't afraid to defer to those with perhaps more experience, more knowledge getting a particular area."
LME	21:01	"...differences of opinion encouraged? I would say respected absolutely, but I'm not going to say it in the sense in that encouraging decent. Okay. So, difference in opinion absolutely respected. Um, but then there was also a move towards compromise and determining What was in the best interest of the users."
JSZ	4:23	"...I mean people really talk to each other and gather information from all parties that need to be part of the conversation and yeah. "
ACA	22:45	***"...I think by and large, yes. Uh, I think we had a good project team that was invested in the project and interested in moving, uh, moving their own objectives forward for better or for worse. So people were motivated whether our interests aligned was another thing. But communication I think was always pretty strong"***
ACA	24:34	"...responsibilities understood, I would say yes. Okay. There is that sort of asterisk on it. There were a couple of other instances where, uh, because project roles changed over time, transition can be difficult. And understanding where responsibility lies in the transitions.
ACA	25:02	***"...we had a pilot, we had people who used to be sort of the overall administrator in the pilot and then, uh, or having a lot of the sway in the pilot and then found themselves in a reduced role in the larger implementation And that was something where taking a step back was a challenge for folks "***
		<u>Team Behavior – Shared Mental Model</u>
JCR	24:15	"...on the shared goals of the project. Yes. Yeah. We had a pretty clear charter for what we were trying to do."
JCR	24:15	"...Experience with the team? So, it was largely positive. Um, the, like I said, I think I expressed there were cases where I've felt like I had to, um, be the person who was pushing back against overly conservative approaches."

JCR	26:41	"...there were definitely cases, um, sort of sharing credit and um, uh, emphasizing victories, celebrating things we did well, um, definitely was affected I think in motivating, uh, improvements. Um, I think, I think the team was pretty good about, uh, encouraging good behavior and good effort, um, both explicitly and passively."
JCR	26:41	***"...I think there's, this was, it was a good team. Um, and I think, you know, my, it was, it was my standing. Um, I'm happy with where we are with the project and that wouldn't have happened without strong team working hard and putting a lot of thought into their decisions."***
JCR	27:54	"...I wished at times that some people who didn't share opinions would have shared we think their opinions would have been discussed and would have been valuable contributions."
LME	21:01	***"...The team had the ability to look at the different solutions, creative solutions, for the most part. Um, I think different members understood different types of constraints."***
LME	22:34	"...working experience with the team? um, great with everyone from all areas of the institute who was working on it."
LME	22:34	"...team share information and enjoy thinking? I'm definitely yes! on sharing information and I mean, yeah, we had a lot of discussions about problem solving. So, I would say that, welcome to party."
LME	24:45	***"...this project was a good example of, um, almost campus received to see a lot of difference of division between IT and kind of with the academic area, and I think this was, this project was a great example of the two groups working together for a common goal..."***
JSZ	7:27	"...That's a really good team. It's a good project."
ACA	28:10	***"...team know and agree on the shared goals with the project? I think I know the answer to that is, listen, yeah, that's where we ran into the, uh, minority interests. So, I think, uh, with our institution being fairly decentralized, this is always going to be a problem."***
ACA	28:38	***"...as the project gained steam and as we added resources, the project took on more of a, uh, a majority mindset. Um, this was difficult for folks who are in it from the beginning to understand. But I would say ultimately that we took on more of a holistic attitude."***
ACA	28:38	"...working experience with the team? Good. Um, you know, there were some, there were some trying times, but uh, overall, uh, this was a pretty good and collaborative experience."

Note: Bold and italics rows were referred in the case as examples.

Shared team interaction and behavior mental model

The team on this project had many committees and subcommittees to help them make decisions. The team had good communications skills and interacted well with other members. There were some challenges with “institutional” versus “industry” terms at times, as expressed by some users. As mentioned before, there was a pilot project prior to the launch of the official Canvas implementation project. The members of the pilot project were included in the implementation project. This was a new role for those members, they formerly had elevated access to the system during the pilot phase, which had to be curtailed for the implementation phase of the project. Role switching was a challenge for some members of the team and created some challenging moments during the project.

"...we had a pilot, we had people who used to be sort of the overall administrator in the pilot and then, uh, or having a lot of the sway in the pilot and then found themselves in a reduced role in the larger implementation and that was something where taking a step back was a challenge for folks,"

"...there was, uh, meetings, regular meetings and um, uh, you know, email communication, things that were effecting. Did the team use common vocabulary? Yes. Um, we had a full document that actually defined some terms. Um, and the, the team members, um, largely had experience with LMS previously."

Another important shift the organization endured with this project was the decision to move away from the centralized support model to a de-centralized model. Leaders believed that local support of faculty within their department provided more

personalized and better-quality service. Various departments were already supporting their own faculty, and the appetite to add additional support staff to the central unit was limited. This was an important decision by leadership, and it give more autonomy to the various schools and departments. The legacy model was conservative and limited the use of the tool in order to provide standard quality and capability. The new approach was more open to meet the needs of all, keeping in mind that the support of the tool was not uniform across the institution.

"...team dynamic did it meet your expectations. Most of the time there were occasions where, um, there was either, um, sort of overly conservative approach about, uh, risk management, um, and tolerance for sort of a freedom of flexibility versus privacy and security that I thought sometimes tilted away from what would um, sort of served the users better."

"...team dynamics were largely, collegial. I think everybody made to think on the same team. Um, largely quite positive. I mean, sure, there were disagreement. That's because we have a group of people and we're all very passionate about what they do."

"...I think by and large, yes. Uh, I think we had a good project team that was invested in the project and interested in moving, uh, moving their own objectives forward for better or for worse. So people were motivated whether our interests aligned was another thing. But communication I think was always pretty strong"

The overall team operated in collegiate environment. The team members were aligned on the goals of the project. They were creative in finding solutions to challenging problems. They shared information and openly discussed challenging issues regarding team dynamics or operations. This team had limited experience working together, but the members came together to deliver a great project and effective product to the institution.

"...team know and agree on the shared goals with the project? I think I know the answer to that is, listen, yeah, that's where we ran into the, uh, minority interests. So I think, uh, with our institution being fairly decentralized, this is always going to be a problem."

"...as the project gained steam and as we added resources, the project took on more of a, uh, a majority mindset. Um, this was difficult for folks who are in it from the beginning to understand. But I would say ultimately that we took on more of a holistic attitude."

"...The team had the ability to look at the different solutions, creative solutions, for the most part. Um, I think different members understood different types of constraints."

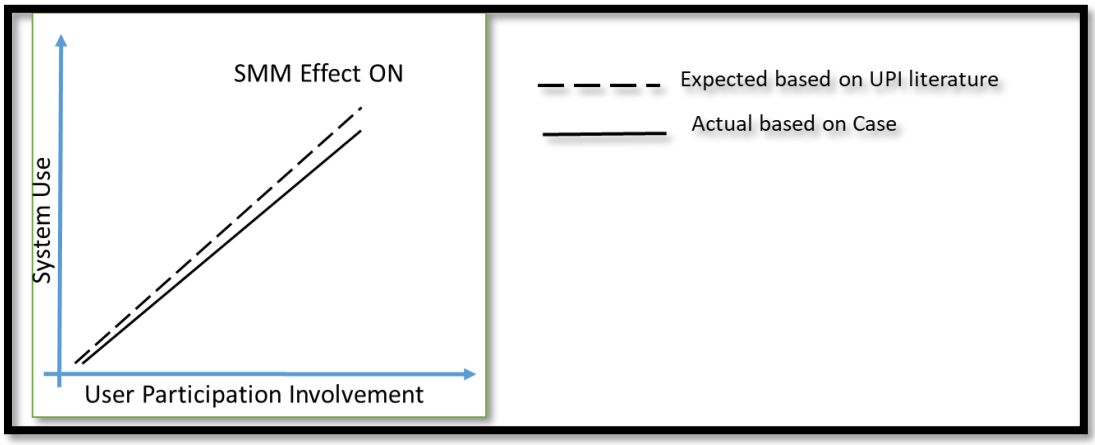
"...I think there's, this was, it was a good team. Um, and I think, you know, my, it was, it was my standing. Um, I'm happy with where we are with the project and that wouldn't have happened without strong team working hard and putting a lot of thought into their decisions."

"...this project was a good example of, um, almost campus received to see a lot of difference of division between IT and kind of with the academic area, and I think this was, this project was a great example of the two groups working together for a common goal..."

SMM Effect: The team was diverse and the number of sub-committees this project created could have raised a challenge, however the team worked in collegiate manner to achieve the common goal. Terminology was difficult at first and over time it was clarified. The team openly shared information and the roles on the project were clarified over time. The team had a shared understanding of the overall goal. These findings clearly showed a strong support for H3A and H3B.

Discussion

Figure 6-3: Impact of SMM in case - Academic Learning Management



This case illustrates, the impact of user participation on system use. The high use of the system can be credited to the high user participation and shared mental models among project team. Throughout the project, the team had open and good communication

among team members. They recognized communication challenges upfront and decided to develop a vocabulary to help with communications.

The technology mental model alignment was achieved with training and documentation, the users' familiarity other LMS, and their use of family-of-application. Students and faculty members were communicated to and made aware of the upcoming changes. The user interface and the ease of use of the product that was like the current application was an added plus to the building of the mental model and it supported the mental model alignment. The alignment of the product to leading practices within the industry, helped user to align to a shared task mental model. Mental model alignment occurs as project team members interact with each other. The alignment happened with time, as clearly expressed by multiple project team members with statements like "Working together for a common goal" and "…ultimately we took a more holistic approach" and "…lowest common factor". Team members had a common goal and aligned to it. They were able to move away from many of their idiosyncrasies and align with the overall goals of the project.

Overall, based on these findings, there is a strong indication that the shared mental models among the users helped to further enhance system use. As indicated in Figure 6-3 above, there is strong support for the UPI and SMM literature, with high UPI as predicted by theory, there is high system use. There is also evidence of high SMM, which further supports high system use.

Alternate Explanation

An alternation explanation to high use of the system could be associated with the suggestion from highest levels leadership to use an academic learning management

system and the leadership decision of creating as single platform for students manage their academic experience. Top management support has been highlighted as a necessary catalyst that promotes system use. The distributed support model coupled with the top management support could have further influenced system use. The Canvas application was exposed to the user population during evaluation and the pilot phase of the project. This could have created a perceived ease of use among the user community which could have further helped the system use case.

5.4 COIPAT [D]

Background

COIPAT project was initiated to support researchers and research administration which brought in over 600 million dollars in revenue for the institution. The incumbent systems that supported research administration were developed in-house and required the users to perform tasks in multiple systems to complete a process for their responsibilities. Agencies that fund research over the last few years have mandated the use of electronic submissions processes for grants and awards. Such mandates created a need within Omega to provide reliable systems that would help researchers and administrators electronically submit, receive, process, manage and report on grant submissions and awards.

Research has been highly regulated by federal agencies and parties engaged in research have been required to follow strict regulatory rules. For example, sponsoring agencies required reporting of conflict of interest. This process alone required researchers to submit volumes of disclosure documents on an annual basis. The research administration department that helps researchers needed the capability to store and track these submissions to ensure compliance. There was considerable revenue, reputation, compliance, and operational risk associated with this process. To complicate the matter further, federal and other sponsoring agencies have revised mandates on an annual basis, which in-turn demanded a change in applications that supported these processes.

Omega on average submitted about 4,000 research proposals annually to funding agencies, estimated at about $2-3 billion dollars. Many departments and central unit used shadow systems to support these ever-changing and ever-increasing demand. This

distributed model not only created an additional burden on researchers and staff members, it also created potential risk for the institution. Data in distributed applications within local departments created a reporting nightmare for administrators and leaders. Without accurate information, managing a multi-million-dollar operation became a herculean task.

Project context

This was one of the first major projects run under the new CIO's leadership. The project was funded and initiated under several new guiding principles. There was a significant push by the office of the CIO to move application to the cloud. The directive was to move towards a Software as a Service (SaaS) model to reduce the infrastructure burden on the institution. Since SaaS was a new concept at the time, the second axiom prevailed, which was "buy before build." The COIPAT project was the implementation of a vendor developed and hosted product to support research administration.

Within Case Analysis

This section presents details of this researcher's case analysis that merge the theoretical constructs of the mental model shared-ness with the data collected to explain how and why the mental model shared-ness moderates the relationship between user participation/involvement and systems use.

System use

This was a major system replacement project for Omega. Research at Omega accounts for over 600 million dollars in revenue. This was a major portion of its revenue and operations. The research administration department supported the administrative functions associated with research. This included researchers or principle investigators, faculty on functions associated with their proposal development, grants submission, award tracking, and sponsored research. The incumbent application that supported these administrative functions was an in-house developed application that had reached end of life. The institution decided to acquire a web-based application that was developed and supported by a third-party vendor.

The overall all system use was in par with legacy systems use, as reported by transaction counts. The number of transactions was a direct reflection of the continued use of the application at 100% levels of the prior system. Furthermore, research administration does not use other complementary application for perform their tasks. These facts indicate that system use was high.

User Participation

The project was initiated with support from business partners. The business representative or functional lead was engaged very early on, soon after the vendor RFPs were published. The user community was engaged for the product selection.

"...I was involved in after the RFI was written when the at the point where we were going to select the vendor. So I was involved in vendor selection all the way to implementation. "

The project had a core team that included a business representative, technical lead, module administrators, business analysts, and project managers. The user community was segmented into three distinct groups: the administrator, the department users, and the faculty. Each segment had a representative population, extended team, or user groups that helped the core team and business representative on various decisions and tasks.

"...there was the core team and then the extended team would be that business offices. So the central offices. Okay. So they pulled a group of people, I think they had like four people they pulled out of their business units and then from the academic business units, we created a group of super users. Okay. And that was probably about 20 people that were coordinated, being involved on ongoing basis."

"... And then an RMS, we created the super users group first. We had a small group. I think we had six people who are involved in our calls with the vendors. We kept them just, you know, they would, they would work with us throughout the project. And then as we got closer to implementation and we wanted more testing and we brought on, we had a total of 19 people."

Users and user groups were engaged in process design. The core team developed a prototype of various process and reviewed them with the user community to ensure the process design was optimal.

"...the faculty users, the people who are going to be processing COI disclosures every day. getting their needs and we got a couple of prototypes for them, you know, the limitations in the system. So would you prefer this set of limitations or this set of limitations and we allow them to guide the decision making because in the end it's about really creating at least disruptive process."

The newly-formed office of the CIO rolled out a new “cloud first” strategy, with the objective that a cloud product would create less reliance on IT. This project was initiated as a business project supported by IT. The business could make most decisions on the process as this was a configurable system. This was the central ethos of the “cloud first” strategy.

"...Plus, there's an expectation on the business side that, you know, if we have a configurable vendor system, shouldn't they be in a position to have a module administrator working on both the technical and functional side to make changes"

Based on the discussion above, one can say that users participated in activities, such as approval of process, selection of vendors, etc. which reflects taking responsibility of the project. The user-IT relationship was strong due to the effective communication that kept them informed of progress and management of these groups. The user community participated in numerous design and hands-on testing sessions. They were also responsible for some aspects of the training. This shows high degree of users’ hands-on activity. The three factors of user participation were present: overall responsibility,

user–IS relationship, and hands-on activities (Hartwick & Barki, 1994). Therefore, this project had high user participation and involvement.

The H1 hypothesis states UPI will have a positive effect on system use, and the findings in this case clearly illustrate high UPI and high system use. This hypothesis is supported.

Listed below are measures of Shared Mental Models extracted from the transcribed interviews. The ID and time stamps references to the transcribed text and original recorded interviews.

Table 7-7 Illustrative Evidence from Case: COIPAT (TT & JT SMM)

ID	Time	Technology Task - Shared Mental Model
BHU	21:25	"...you mention before that some user experience was similar to the other tools that people generally is at home or other places. I think So, one of things being intuitive, that's the way it strikes me. I think. "
BHU	23:36	"...I think that the conflict of interest side probably had more things that were unique to Omega in it then then what the industry might do... the proposal side's a little more standard in regard to the fact that every application has certain components to it. And if you're submitting to a federal agency in particular"
JSZ	8:36	"...there any Constraints? yeah just because of the application itself or something that it just couldn't do. So they had to find workarounds for some situations."
BEV	5:01	***"...it was an upgrade from what we had at Omega, but an old look and feel than standards of more modern technology."***
BEV	11:41	***"...It was similar to our old system and the fact that okay, when you put a grant together, a proposal, not a grant. When you put a proposal together that go to an agency, there is not many different gyrations. Okay. it's a budget and there's compliance. So you can't be too creative about it. "***
BEV	13:08	"...Failures of the technology. So we spent about a year working with the vendor to come up with a way to develop our, to have it calculate our fringe benefits. So we sort of were headed down a path that maybe we shouldn't have gone and we spend a lot of time on it. I think that was a failure"
RLO	10:51	"...was the user experience is similar to other tools, that you use at home or other places? Well. I guess the answer to that would be yes. I have used tools in other company, um, that were comparable."

		Job Task – Shared Mental Model
BHU	24:33	***"...yeah. Early on. Particularly one good example, a very good example of that. It is the combination of those four officers and them using assembler application one application to deliver all the conflict of interest. Um, you know, we brought in some outside consultant's types to basically conduct those sessions as an example. Um, other follow on things that we did on our own internally. But yeah. You know, in terms of getting it down on paper and saying here's what it is and here's what we need it to be. "***
BEV	15:13	"...It's standard. I mean, like the fringe benefit piece that I mentioned Omega was a little, there's probably not many institutions that have that do that at a detailed level. They have these rates. So there's a few things like that that aren't standard. But otherwise the way you create a budget, percent of effort, your compliance that is standard across the industry."
BEV		"...discuss these processes in detail? Yes, yes. Flow charts, but the fringes, yes, there was a lot of team discussion. Okay. "
BEV		"...Were there any constraints? There are constraints in actually going through this process of task and trying to figure those things out. Um, there were time constraints. "
RLO	13:56	***"...Is this a standard process in the organization or within the industry we are in? My understanding is that this is a standard process a research organization. "***
ARA	21:50	"...did the team actually discuss these processes and tasks in detail. Yes. All the time. Lots of discussion and may be that is why this project took so long. Um, a lot of conversation. "
ARA	23:06	"...yes, there was retirement of a project. IT was organizing. So all of the things that you would otherwise touch into in terms of information security, or integrations, all of those pieces were reshaping on us. So we'd find ourselves in a situation where there's now a new office that we have to talk to you."
Note: Bold and italics rows were referred in the case as examples.		

Shared Technology and Job Task Mental Model

There was consensus among those interviewed that the application implemented was a step up from what the users had in the legacy environment. The new product did follow many industry standards, although they were not on the bleeding edge to user experience. One of the user found many similarities to the legacy system, that should have enhances the mental model maintenance (Zhang & Xu, 2011).

"...It was similar to our old system and the fact that okay, when you put a grant together, a proposal, not a grant. When you put a proposal together that go to an agency, there is not many different gyrations. Okay. It's a budget and there's compliance. So you can't be too creative about it. "

"...it was an upgrade from what we had at Omega, but an old look and feel than standards of more modern technology."

The modules of the research administration system that were implemented had many features that were standard in the industry. In anticipation to this project, the research administration organization engaged in an effort to standardize their processes. The project team diligently documented all processes. The modules implemented, such as budget development of proposal and grants, were standardized by various agencies leaving very little creativity in the process. This does not mean that there were no custom processes. The fringe benefit calculation was very custom for Omega, and it continued to be one that this project did not alter.

"...Is this a standard process in the organization or within the industry we are in? My understanding is that this is a standard process a research organization. "

"...yeah. Early on. Particularly one good example, a very good example of that. It is the combination of those four officers and them using assembler application one application to deliver all the conflict of interest. Um, you know, we brought in some outside consultant types to basically conduct those sessions as an example. Um, other follow on things that we did on our own internally. But yeah. You know, in terms of getting it down on paper and saying here's what it is and here's what we need it to be."

"...It's standard. I mean, like the fringe benefit piece that I mentioned Omega was a little, there's probably not many institutions that have that do that at a detailed level. They have these rates. So there's a few things like that that aren't standard. But otherwise the way you create a budget, percent of effort, your compliance that is standard across the industry."

SMM Effect: The modern user experience of the tool enabled users to operate the technology with some familiarity. The standardization of the processes helped users to develop shared expectations for tasks. These findings suggest existence of shared expectations for technology and tasks. These ideas were echoed by many members of the team clearly stating a strong support for H2A and H2B.

Listed below are measures of Shared Mental Models extracted from the transcribed interviews. The ID and time stamps references to the transcribed text and original recorded interviews.

Table 7-8 Illustrative Evidence from Case: COIPAT (TI & TB SMM)

ID	TIME	Team Interaction – Shared Mental Model
BHU	26:41	"...I mean the core team in particular, um, the results sort of, you know, I thought a very good, consistent effort to keep the, you know, the immediate stakeholders, the people in the pool, for example, kind of up to speed and then the larger, you know, larger population"
BHU	26:41	"...vocabulary was very common that everyone on understood very well, I'd say where we have the most difficulty, which between us and the vendor."
BHU	26:41	"...how good was the teams listening skills? It kind of ebbs and flows you were trying to kind of everyone who goes for a meeting.

BHU	29:09	"... how the team dynamics was and did they come up to your expectations? No, it didn't come up to my expectations and you know, that was, to be honest with you is something that I was uh, I worked on, tried to work on throughout the project. "
BHU	31:35	"...how about decision making and problem solving when performing tasks? how did the team play in that space. So I think the core team work very well together in that regard. Um, you know, we had at times, daily sessions, you know, where we would just touch base for x amount of time and it wasn't so much the um, uh, a methodology where we're using just let's get together and see what we got and we need to get taken care of the day. And, um, so yeah, I think the fact that we kept things out on the table is the key there. "
BHU	33:23	"...did you see that improved over time? Because it's a four-year period? I mean, yeah, I think it did, I mean everybody kind of got, there was a comfort level with the people you were working with and so it doesn't make any one personal approach. Any better, better than the other. It's just a matter of knowing what to expect and sort of sort of, you know, kind of balancing out my habit was somebody else's habit to get to the end result."
BHU	33:23	"...decision making during meetings? Oh, between getting diverse opinions on the table, I for decision making, I really think that works well as well as it could have because basically we had the project organizational structure."
JSZ	6:18	"...basically my ideas were taken to the team for final approval and that's that specifically documentation and training part.
JSZ	9:52	"..., I think it, it did. The part that got a little frustrating is I think a lot of side conversations that took place and those side conversations, sometimes that information didn't get trickled where it needed to go. Um, and that's in part is that everybody is sitting right there, that could have those side conversations very easily. Um, but yeah, I mean from I experience, I, I thought everybody communicated well."
JSZ	9:52	"... I know the BA had actually started a list of terms and acronyms for us and we just kept building them out."
JSZ	11:00	"...I had heard stories before, um, at the dynamics were not good, so I was a little hesitant going in. Um, then I guess I just didn't have the same experiences, but by then they were a year, maybe year and a half into it. So maybe some that had already worked at time."
JSZ	13:34	"...how was decision making? Those are mostly done during meetings. um. I don’t I know why the decisions were made in the meetings when I was there. But I think that was a lot of decisions that were made outside of meetings."

BEV	17:10	"...? So we had three project managers. Yes, I had learned that. So that was that hinder I think somethings because we kept re-training people, even our BA, a nice BA who turned out to be excellent. I mean bill and I were the two that who were there the whole time but we had to keep retraining people as they came on board. And that was a lot of waste of time and energy. Yeah. Cause we were a lean team."
BEV	18:05	"...team use a common vocabulary? We've learned that over time. I think especially for me coming in from, not from the IT world but even with the vendor product so that, I think that evolve pretty quickly. "
BEV	18:05	"...I mean the turnover of the, of the project manager, it was a problem but I do believe that the rest of us who work together, we had a good strong team, very strong team."
BEV	19:09	"...But I'm primarily talking about our core team, we had really strong workers and we had people, you know, for COI, if somebody had to be there on the weekends or the nights that we had to get done. Everybody pitched in the issue everyone who was the workers, we would stay and do whatever we needed to do. I think there is for me, there is a misunderstanding or a lack of understanding of what the project manager's role was."
BEV	19:09	"...So for talking about the business with conflict of interest, that one, um, they're very particular in what they want to get in the system. So I think we really, it just sort of round and round to get there."
BEV	20:14	***"...Roles and responsibilities written down on paper, um, PPMO, their very first capital project. Right. So they're all new"***
BEV	22:20	"...third project manager full trust that again, when you've had somebody who came in at the tail end and that was everyone trusted in each other and work together very good. "
BEV	23:15	***"...well I mean, you know, sometimes there was emails, but we always came back, if there was a decision. We had our, I was just looking at these notes because I wanted to copy the form. It was called the leads meeting. So we had the leadership, which at the time, you know, Joe before Denise left, and then we would come back and we would have, here's everything that happened in the last week. This meeting, this called with the vendor. And we would summarize everything that happened at each event or maybe a call. "***
RLO	19:44	***"...during our weekly status meeting. I, um, required the lead to all meet an hour and half discuss them. Okay. And the decision would be made. And it would be a part of our raid log"***
RLO	20:28	"...Not Initially. No. Okay. They were, it was difficult for them to trust me. Okay. Initially…..Because of prior history with prior project managers in the project.

ARA	24:06	".... if you are talking about just the core team and get the core team did a very job of staying in communication with each other"
ARA	25:07	***"...did they use common vocabulary? Jargons .. Yes, eventually, For COI module specifically. Um, I think at the beginning of the project management terms, didn't mean the same thing for the function teams, as an example. Improves over time. "***
ARA	26:00	***"...Really experience, honestly most of the working decision is made by the core team as you go, we have this problem with all these inputs we need this solution for."***
ARA	28:34	"...So there were differences of opinion. A lot of big personalities and in this project and I think towards the end it was like we just have to move forward. We had to hit the date. if you had a different opinion we can talk about it"
		<u>Team Behavior – Shared Mental Model</u>
BHU	36:24	"...I think we did well as long as we were in a situation where we had at the time to do so we found ourselves frequently in a position, unfortunately where the calendar worked against us "
BHU	37:38	"...Did the team Know about the shared goals of the project? I think everybody was pretty much on board with that in terms of, you know, at a high level, you know, what is it we're trying to achieve. Even when do we have to achieve it. "
BHU	38:57	"...You're working experience with the team. How do you feel? Um, on balance I think that we ended up in a very good spot. It wasn't that great of an experience throughout. "
BHU	39:56	"encouraged other team members so that they can improve the task outcome? Uh, yeah. And some of that just came in the form of or saying, Oh, if you provide this information to me in this way, here's why it works better that it happened over time. "
BHU	40:57	"...I think, yeah, individually the work people brought to the table, people have pride in what they did."

JSZ	14:49	"...you're working experience with the team. Mine was good. I feel like had a good relationship with everybody. Um, yeah, I, and again, I don't know if that's because when I came into the project at that point or just personalities are different and don't know"
JSZ	15:50	"...Yeah. "I think to a point where it hurt .. deep deliberations, um, did the team take pride in their work. Yeah, definitely was the team committed to the team goals.
BEV	23:15	"...did the team have the ability to complete the task that was assigned to them? They did. I mean there was sometimes some discussions because yeah, I mean you had to learn things about the system, about the database, but absolutely, yes. "
BEV	26:26	"We had some really high performers. So I'm not so sure how much... encouragement was needed... You know, we had a couple of new people, Garret was a brand new hire contract people. Someone would encourage those that otherwise had some really top performers on our team."
BEV	27:20	"...Did the team share Information and enjoy thinking? Yes. And then there was brainstorming, drawing on the board with the, were actually some fun times doing that."
RLO	20:56	***"...the team had the ability to complete tasks that were assigned to them? absolutely, we had people there, the technical side was fabulous. the business knew the PDS system inside and out and knew all their business processes to a T. They knew what they needed to have delivered in RMS."***
RLO	23:29	"...they agreed and knowledgeable of everything that was expected and that was just desired to be delivered on the project. They did not necessarily agree at the end when we delivered deployment with only the ability to submit a proposal."
RLO	24:19	***"...however that decision was made by our sponsor. So it was a leadership decision, which of course as we all know we need to learn how to accept and adhere to that change and decision"***
ARA	29:36	"...the ability to look at different solutions. And, ha ha more appetite in the beginning, than at the end. But ability Yes. "
ARA	29:36	"... I think the core team was very good about understanding limitation for timeline and budget. Extended teams weren't "
ARA	29:36	"...Yes, everybody agreed with the goals. In the end we thought they were too much like too lofty a set of goals"

ARA	29:36	"...There were couple People who have a hard time working with the teams with the newness. That said established teams having easier time working together with the other established teams, than newer teams. Specifically the PMO was a newer office is harder for them to get their way in"
ARA	32:14	***"...Most of the people or a team had high expectations of themselves and others "***
Note: Bold and italics rows were referred in the case as examples.		

Shared Team Interaction and Behavior Mental Model

This project was approximately four years long, and during this period the core team worked very closely with each other. There were some challenges at the beginning but over time they would work things out. Most team members from the business used research terminology that was unfamiliar to some new IT members on the project team. The vendor terminology also posed a challenge in the beginning. The BA started a list of terms to help bridge the gap. The core team communicated well between them.

"...did they use common vocabulary? Jargons .. Yes, eventually, For COI module specifically. Um, I think at the beginning of the project management terms, didn't mean the same thing for the function teams, as an example. Improves over time. "

"... I know the BA had actually started a list of terms and acronyms for us and we just kept building them out."

As discussed previously, this was one of the initial major projects under the leadership of a new CIO, who introduced a new philosophy of specialized workforce, a workforce that grouped individuals into distinct job categories, like project managers, business analysts, developers, etc. This was new to Omega as the organization considered many of these jobs as skills that all must possess, rather than a specialized role. In the

former model an individual on a project could perform multiple roles such as a developer, business analyst and project manager. The developer could do 50% development, 30% business analysis, and 20% project management. The model had been very effective at Omega, but it had a major flaw. It was not scalable. The new CIO needed to scale to grow the organization. The proposed new model created uneasiness among IT staff who were used to being the “Jack of all trades”, and now were being challenged by roles, methodologies, and standards such as PMBOK and ITIL. Roles and responsibilities that had been fluid became rigid. The PMO office that was newly formed had new staff with limited policies and procedures. When project realities met the rigidity of PMO the project gained an upper hand. After two project managers, the team was successfully able to accept a project manager into their core.

"...Roles and responsibilities written down on paper, um, PPMO, their very first capital project. Right. So they're all new"

The core team were high performing members of the organization, and to them the success of this project was personal. Many team members would agree that they were disappointed on the scope that was delivered. However, it was a sponsor decision. It was also the sponsors who decided to cut scope to meet the project deadline. The self-imposed high expectations of delivery were now reduced drastically. This did not sit well with the team.

"...Most of the people or a team had high expectations of themselves and others"

"...however that decision was made by our sponsor. So it was a leadership decision, which of course as we all know we need to learn how to accept and adhere to that change and decision"

"...the team had the ability to complete tasks that were assigned to them? absolutely, we had people there, the technical side was fabulous. The business knew the PDS system inside and out and knew all their business processes to a T. They knew what they needed to have delivered in RMS."

The core team communicated well, and it made a lot of decisions related to the project. If a decision was not made during project, there was a mechanism to flow the information down.

"...Really experience, honestly most of the working decision is made by the core team as you go, we have this problem with all these inputs we need this solution for."

"...during our weekly status meeting. I, um, required the lead to all meet an hour and half discuss them. Okay. And the decision would be made. And it would be a part of our raid log"

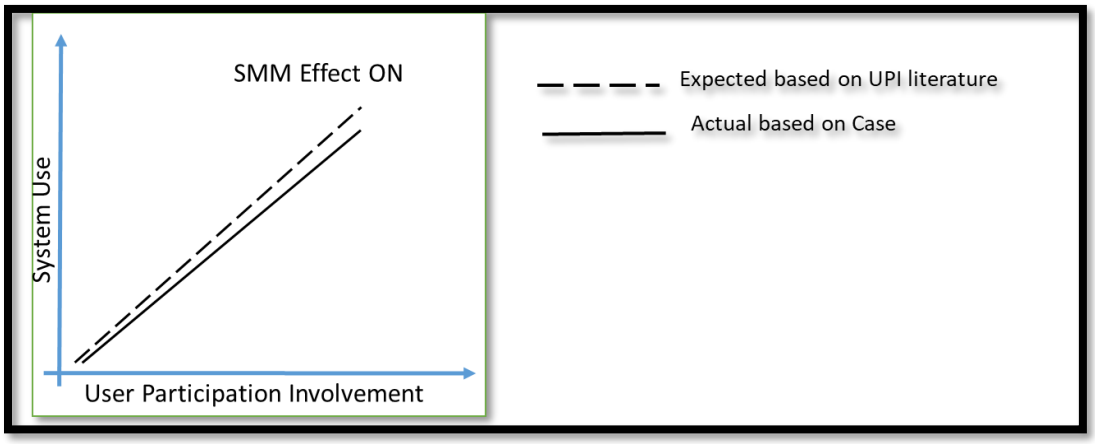
"...well I mean, you know, sometimes there was emails, but we always came back, if there was a decision. We had our, I was just looking at these notes because I wanted to copy the form. It was called the leads meeting. So we had the leadership, which at the time, you know, Joe before Denise left, and then we would come back and we would have, here's everything that happened in the last week. This meeting, this called with the vendor. And we would summarize everything that happened at each event or maybe a call."

SMM Effect: This was the first major project under the new CIO's buy vs build strategy. There were challenges in working with the vendor and vendor terminology, and the team developed a dictionary to overcome them. The team faced multiple challenges on roles and responsibilities due to the changing PM role and the new Office of Project

Management. Operating processes were changing constantly. The team communicated well and made decisions. The core team was able to overcome these challenges over time to achieve smooth operations. These findings clearly state a medium support for H3A and H3B.

Discussion

Figure 6-4: Impact of SMM in case - COIPAT



Overall this was high performing core team that became more aligned over time. This finding was echoed in literature where scholars found that metal model alignment happens with time and communication (Denzau & North, 1994). The findings in this case is that the team performed well over time. However, this researcher would classify shared-ness of interaction and behavior to be high towards the end of the project. The initial misalignment can be attributed to the project management office. The organizational shift that occurred alongside project initiation did not sit well with many high performing team members. The experience with the vendor was less than optimal and the overall experience of the team members, who had to many frustrations throughout the project. One team member surmised it as:

"...Um, on balance I think that we ended up in a very good spot. It wasn't that great of an experience throughout. "

As seen in figure 6-4 above, there is clear support for UPI theory and its effect on system use. Findings also indicate strong support for SMM within the core team throughout, and with the project management role later in the project. The effect UPI on System Use is further supported by SMM.

5.5 Asset Tracker [E]

Background and Project Context

Many Omega employees are knowledge workers or they are engaged in supporting knowledge workers. In either case the institution provided the employee with an equipment, in this case, and a desktop or laptop computer. The leadership at Omega decided to embark on a major IT efficiency improvement program. The office of the CIO was instrumental in identifying the various IT teams with various departments and unit that performed similar tasks but in different ways. The opportunity was right to streamline these process and place them with in the Central IT leadership. Departments and units then paid a nominal fee in to the central IT funds annually to leverage these services. Services that are common across all departments and units are infrastructure, email services, security and access to applications, on and off-boarding functions, help/service desk functions, etc. This was a simple economy of scale problem that was explained and understood by the leadership. No expectation for cost reduction was set, but there was an expectation to maintain services at current levels. This was very promising for the units, as they would be able focus their attention on mission-specific tasks and let the central IT team manage the mundane common, yet essential, functions.

As more departments started to transfer their people and IT functions to central IT, the need for tagging assets grew. Asset tagging is a valuable accounting function. It would help the institution understand who is assigned to which institutional asset. The accounting team could estimate and allocate asset and software costs to units, etc. There was another pressing need that an asset tag would have solved for central IT team. At the help desk center, users found that central IT had no clue about the computer they were

using. Every time the user called the help desk he or she had to explain the type (laptop/desktop) and the operating system (Windows/Mac) before the helpdesk would answers any questions. The user community felt this was a degradation in service compared to their previous local IT model where the local IT representative not only knew what asset the user had because they set it up for the user, but were able to provide a quick response because they resolved similar issues for other users.

Asset tagging becomes a complex proposition when users are allowed to bring their own devices (BYOD). There are network discovery tools that could be deployed along with the implementation of a configuration management database (CMDB) that could resolve this issue. Unfortunately, CMDB implementation in an organization of this size is a multi-year and multi-million-dollar effort. The institutional leaders had no appetite for such a major program. The IT leadership and the CIO's lead team decided to mitigate the issue with a simple project where known assets from multiple sources will be loaded in to ServiceNow and linked to the employee's record. So, when an employee called the helpdesk, the customer service representative would not only be able to talk knowledgably about the asset, but also provide a better experience.

Within Case Analysis

This section presents details of this researcher's case analysis that merge the theoretical constructs of the mental model shared-ness with the data collected to explain how and why the mental model shared-ness moderates the relationship between user participation/involvement and systems use.

System Usage

System Usage for the asset tagging feature was very low. About 2% of the service tickets had this information on them. There are multiple reasons for the low usage. Data in the mapping table were never updated post go-live. Limited user training could be attributed to the lack of usage. However, the feature that was developed was not very complicated to necessitate training, especially since it was developed for the helpdesk team, which specialized in multiple applications. Members of the project team found very limited value for the feature, which was developed based on requests from the helpdesk team for an automatic asset tracking and CMDB function. The “squishy CMDB” or “Asset Lite” fell way short of user expectations.

"...Scope of the project met? I don't think it was. No. Did it meet your or your department’s expectation? No."

"...How many hours? Even your team doesn't use it? Uh, not really because it's only as good as the data that's loaded into it. We loaded the data, whether it was first released and that about it."

"...We didn't do a whole lot. I didn't help a lot with design because it wasn't, there wasn't a whole lot to wireframe. Yeah. But I did requirements, I did testing on it. Um, I helped set up the, the table and help get the stuff set up properly. But beyond that, I didn't do much else."

Here, I would like to make the reader aware, although the feature fell short of user expectation, the feature was tested and approved by the user representative.

"...was your responsibility during that phase of that project? See it that asset lite will meet our needs and also to gather the information to put into the database. "

Based on evidence from usage statistic and the discussion above, it is clear that this feature has practically no use among members of the helpdesk groups and bad data loads did not help the cause either. Hence, the evidence clearly shows low system use.

User participation and Involvement

The feature that was developed was very simplistic and required very limited design conversations. Users were engaged in a limited manner. Although, there were initial conversations about the features to be developed, there were no design sign offs. Users were engaged soon after design and configuration was complete. There was very limited testing, training or communication to the user community, i.e. all helpdesk users.

"...? I think I was involved in earlier stages because I had to help with the data load. Okay. For that. Okay. So then it must be most probably after the design was completed during the development phase."

"...Um, I don't know how well it was communicated and people were trained on...there are easy ways that these are called that you can add a new workstation like from, from that interface."

"...actual value of this produced the system produced? Um, I would say minimal. I mean I think it met what was being asked for, but there were more underlying problems with them."

"...you involved in some approval? I think just in kind of Does this, does this work? Okay. Just kind of a more of the testing approval."

There are three distinct dimensions of user participation, namely, overall responsibility, user-IS relationship, and hands-on activity (Hartwick & Barki, 1994). As observed in this case, the user participation and involvement were very low. There was

one user representative who was engaged after a “quick and dirty” feature was produced. There was limited training and no communication about the newly-developed feature. There was no overall responsibility. One could find some trace amounts of user – IS relationship and hands-on activity. Overall, user participation was low.

The H1 hypothesis states UPI will have a positive effect on system use, and our findings in this case clearly illustrates low UPI and low system use. This hypothesis is supported.

Listed below are measures of Shared Mental Models extracted from the transcribed interviews. The ID and time stamps references to the transcribed text and original recorded interviews.

Table 7-9 Illustrative Evidence from Case: Asset Tracker (TT & JT SMM)

ID	TIME	Technology Task - Shared Mental Model
JST	23:29	"...was the user experience similar to other tools that you use or, um, I would say similar to that interaction.
JST	24:34	"... the biggest limitation is that we found there was not a single source of that data in the institute and there was some stuff from SCCM, um, something from spreadsheets and other things like that...it really relied a lot on manually loading data. And so the process for that was like Brian would give us a list of users and workstations, some of that from SCCM and it was manually loaded by the team.
JST		***"...Um, I don't know how well it was communicated and people were trained on...there are easy ways that these are called that you can add a new workstation like from, from that interface.***
JST		"...what was bad as it was a complete departure from that system's implementation of how to manage assets and configuration items."
BSC	24:02	***"…new field that was built on to service now to kind of show machines that their primary role compared to what they're attached to the user. So squishy CMDB for assets."***
BSC	26:20	***"...major limitation would be just the, the updating, just keeping it up to date, uh, the uploads. They didn't process it. Right. So I didn't show current. So basically the machines that we gave to them wasn't, wasn't activated the main database. "***

CMA	24:55	"…Constraints? CMDB, um, was a big one. Um, really just what needed to be in the field was confusing. So we were just ended up with the name of the computer, which I have no idea for keeping it up to date because it's in a custom table that only a couple people can update.
		Job Task – Shared Mental Model
JST	25:46	"...how standard was this process for the industry or for the organization. Um, I think the organization, um, do you have any standards? for industry, I would say like the name like asset lite. It mocked, uh, some of those standard type behaviors."
JST		***"...I think the same as the other one, data not being available data not being available. Plus time constraints."***
CMA	21:28	"...another one where we're like, well, we can't actually set up assets or we're going to just add a field onto our incidents and give you a table to fill in. So it was a lot less, um, I guess user, anything. Um, because it was great for the, the help desk. But if that wasn't filled in then they'd have to go fill it in themselves. "
CMA	23:54	***"…was it just purely a field that was added where data got loaded and then if no data is there, they have to fill it in themselves...just, that user has to do it manually."***
CMA	23:58	"...the limitations, we have our tracking that through different kinds of things we don't, um, ideally when you set up an actual asset piece, you know what software they've got on, you know, what servers they're connected to, you know, all that kind of stuff. We don't have any of the connective pieces to it. It's just giving them that information to know what computer it's on."

Note: Bold and italics rows were referred in the case as examples.

Shared Technology and Job Task Mental Model

This researcher observed that the user representative and the project team had considerable mental model shared-ness, both in the technology task related mental model and in the team interaction and behavior mental model. However, it is clear that they were aligned on the lack of value for the developed feature. The team was aware that the challenges of manually updating the assets in the application would not work. The team

members echoed the lack of a CMDB function as a major limitation and constraint on this project.

"...I think the same as the other one, data not being available data not being available. Plus time constraints."

"...new field that was built on to service now to kind of show machines that their primary role compared to what they're attached to the user. So squishy CMDB for assets."

"...major limitation would be just the, the updating, just keeping it up to date, uh, the uploads. They didn't process it. Right. So I didn't show current. So basically the machines that we gave to them wasn't, wasn't activated the main database. "

"...was it just purely a field that was added where data got loaded and then if no data is there, they have to fill it in themselves...just, that user has to do it manually."

"...I would assume so. Yes. However, they are limited by time and money"

SMM Effect: Based on the finding, we can clearly see the shared mental model alignment that the technology and job task will not meet the expectations and this was echoed by many members of the team clearly stating a strong support for H2A and H2B but in the negative direction.

Listed below are measures of Shared Mental Models extracted from the transcribed interview. The ID and time stamps references to the transcribed text and original recorded interview.

Table 7-10 Illustrative Evidence from Case: Asset Tracker (TI & TB SMM)

ID	TIME	Team Interaction - Shared Mental Model
JST	28:20	"...safe not as with the broader customer. Team safe within the technical team, so I think there was that little bit of difference for some time things would be discussed first and then determine how to bring that to customers. "
JST	28:20	"...differences of opinion and encouraged? Um, on the technical side. Yeah. And I think really from the customer side it was just really, I mean we were trying to give them what they asked for in the simplest way possible. "
CMA	26:14	"...It was definitely frustrating from a, like trying to provide a solution. I don't think we really thought through the user experience at all. Um, with the exception of just like, if I'm on the help desk, what do I need to know? Where do I want to put it? Um, and so it was something that we just of determined was a customization, which is something we don't want to do, but we did anyway. Um, so it was a little bit frustrating on that point of view, but, um, I think we could done a better had we had a better understanding of what was really needed."
		Team Behavior – Shared Mental Model
JST	29:21	"...team's ability to complete a task that was assigned to them? Yeah, I think it was fine for this one. Um, I think I had to kind of reign in sometimes to fit it to the time constraints.
JST	29:21	"...shared goals of the project? Yes, I think on this one, more so than the others.
JST	29:21	"...I think there was somebody who was talking about having fun."
JST	30:32	"...everyone's opinions were heard? On this one, yeah, I think they were more so maybe they were heard, but I think more so on this one. Okay. This was a little more of a direct scope, so it was a little harder to get rid of."
BSC	29:19	"...I would assume so. Yes. however they are limited by time and money"
BSC		"...know and agree on the shared goals of the project? I think so"

CMA	25:27	"...Um, I would say as far as training and all that goes, I don't think we did much. Okay. Um, I, I think this one was another one that wasn't communicated well. I think everyone who uses service now should have been communicated to how, what this is, but it wasn't, it wasn't widespread."

Note: Bold and italics rows were referred in the case as examples.

Shared team interaction and behavior mental model

On the team interaction and behavior shared mental model, it is interesting to note that this was the same team as the worker on-boarding, including the user representative.

"...team's ability to complete a task that was assigned to them? Yeah, I think it was fine for this one. Um, I think I had to kind of reign in sometimes to fit it to the time constraints."

"...everyone's opinions were heard? On this one, yeah, I think they were more so maybe they were heard, but I think more so on this one. Okay. This was a little more of a direct scope, so it was a little harder to get rid of."

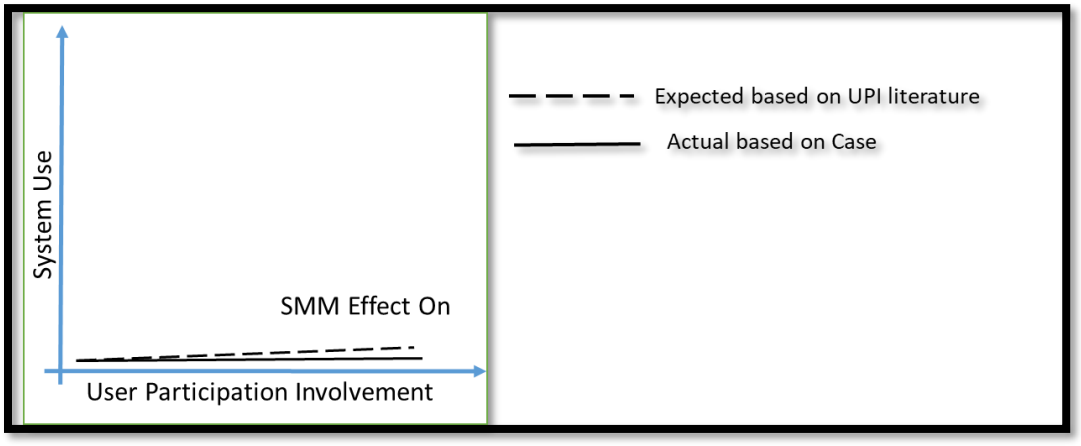
"...differences of opinion and encouraged? Um, on the technical side. Yeah. And I think really from the customer side it was just really, I mean we were trying to give them what they asked for in the simplest way possible. "

SMM Effect: This team had worked on the worker onboarding project (discussed earlier) prior to taking on this effort. The two projects almost overlapped each other. The interaction dynamic and behavior of team members did not change over the course of this project as seen from the comments expressed by team members. The team environment was safe. Differences of opinions were encouraged. Team members understood the

shared goals and supported each other to achieve the project scope. They developed trust and shared understanding of different skills that members of the team had and created an environment to successfully operate in a stressful environment. These ideas were echoed by many members of the team, clearly stating a strong support for H3A and H3B.

Discussion

Figure 6-5: Impact of SMM in case – Asset Tracker



This researcher argues that the strong mental model shared-ness in this case was not influencing the system use outcome. Team members knew that the product would not be useful for the end user. The project scope was best expressed by a team member as "checking the box" with no real concern of meeting the need of the community. User representatives on the project knew the true need was a CMDB tool, and what was delivered as part of the project was a very limited feature set, as one user put it "Squishy CMDB". However, the finding does support the UPI theory of low user participation leading to low system use.

These were interesting findings; at high SMM the theory would predict some positive impact on system use. However, there was no such evidence. This raises the

question why a strong SMM did not produce any effect? More research needed to understand this anomaly.

Alternative explanation: This research study was designed with the assumption that all participants were motivate to achieve project success. The findings show that, although the team was aware of an eminent project failure, there were no actions taken to prevent it. The primary reason for this behavior could be attributed to top management support. The organizational leaders wanted to deliver this limited features and they were not interested in the right solution. As one team member best put it "...what was bad as it was a complete departure from that system's implementation of how to manage assets and configuration items." The project was doomed from the beginning and was dead on arrival. Further research is required to study the effect of strong shared mental model that drives a different outcome.

5.6 Financial Assistance Reporting [F]

Background

Omega is a large not for profit institution engaged in the business of educating young minds from all over the world. As a premier institution, educators and individuals interested in higher education and research are drawn to it. Omega has about fifteen thousand students who are enrolled in various programs at any point in time. The campus is divided in to seven schools and has multiple programs that cater to a variety of learners. As a premier institute with a not-for-profit status, the community looks up to Omega to lead the way in serving those who are less fortunate. Like many other institutes of higher learning, Omega has a program office that focuses on supporting those who cannot afford the ever increasing cost of modern education. Omega leadership has set a strategy that would require an increase in the mix of students in various categories like gender, economic status, and various other cross sections of the society. It is a service for the society, as there is enough empirical evidence cited in news media that suggest as strong correlation between higher education and upward movement on socio-economic ladder. This diversity is another metric that is reviewed and published by agencies that evaluate and rank institutions in higher educations.

Senior leader at Omega have made it a mission to increase the number of students from economically underprivileged communities. This is a challenging task as the cost of higher education is on the rise. In order stay economically stable the institution needs to get the right mix of students who can compete and succeed in the educational environment. There are funds allocated for an incoming class, but how much should be allocated for a particular student was based on many factors of need and the overall need

for the incoming class. Allocating all students equally does not solve the problem. The mix or percentage of who gets how much of the available fund is critical. These questions could be answered by collecting data from various sources and running complex algorithm against it. The need for data for decision making was a known factor and modern tools have made it much easier to collect and process data for decision making.

Today, organizations generate tons of data daily. Sifting through data to get the best data set to help answer questions has become a challenge. The team of individuals who reviewed a student's application package to assess the financial need was a small group of over 10 to 15 individuals within the office of Financial Assistance. The goal for this office was to know each student who requested financial aid in detail. The service was personal. They had the task of assessing the need and allocating the percentage of funds that would be given to support the student. Understand and accurately predicting the need was critical for the institution's admission process and for the institutions ability to convert a potential prospect to a student. It was important to recognize, even though Omega was providing a percentage of financial assistance. So were other competing schools who were also trying to attract the best minds. It was a complex problem of data, mix, and personal interactions which can be solved by data.

Project setting

The analytics project to support the office of financial assistance was attempted a couple of times prior to the launch of this project and had failed to gain traction due to various reasons. The office of financial assistance had data collection apparatus and had their own data querying tools to help them answer complex questions. This organization was operating under the older paradigm where departments and units captured their own

data and developed reports or queries against them. This was problematic on many fronts. The institution was setting up a data warehouse and a business intelligence practice. Data stored within unit level applications became stale, especially if it was maintained by a different department. Data in local applications posed a security threat to institutional data. As the institution began to invest in data warehouse that was centrally managed by IT, the office of financial assistance decided to play in the sandbox to get values out of it. The grand IT vision was to create a centrally managed data warehouse and store all information about the prospect in this data warehouse and link it to the overall HR and financial data.

Although this task looked straightforward on paper, it became complex and ugly fast. The execution of this vision was plagued with both IT and business challenges. There were resources that moved in and out of the project. There was a complete rejection of user perspective on the project even when the user representative felt there was participation and involvement.

Within Case Analysis

This section presents details of this researcher's case analysis that merge the theoretical constructs of the mental model shared-ness with the data collected to explain how and why the mental model shared-ness moderates the relationship between user participation/involvement and systems use.

System use

The sponsor was made aware of the lack of system usage by the reporting and data manager and responded: "...she's not querying the data warehouse then I might even say that it's, that it's limited." There were many reasons that were called out of the dismal usage, like lack of capabilities, incomplete project, completed features not valuable, etc.

"...if you look at the phases that were complete, I guess that would be yes. But overall, no, because we haven't really completed the project yet."

"...Well, I would say it hasn't yet because it's not really functioning, you know, it doesn't do what we need it to do."

"...I don't use it either. I'm going to say. It's not a major part of my role, like it is for some others around campus. Um, but, and the way I think about this is if we're still having to use web focus for most of the reports that we need, it doesn't make any sense to, to use, to use the data warehouse because just because we can on one aspect of the data."

"...I think the, the biggest failure is kind of where we're at. If we're looking at it as a whole. That's what we're sitting now is we have something that we put a lot of effort into, but we never finished. And so, I mean, the, the, the ultimate goal of the project was to eliminate the need and use of web focus and move to the data warehouse. And we are still, we're still on Web focus ..."

The usage of the financial assistance reporting was very limited to none. This was explicitly clear from the narrative provided by the sponsor and the user representative on the project. Based on this finding it is clear that the system usage was low, close to 0% use.

User participation and Involvement

This was a long project that lasted about eighteen months. Many members of the project team, including the user representative, were involved. There were frequent interactions between the BA and the user representative. They even mentioned it as fact "...he came frequently". The user representative was involved in development of the requirement along with the BA. There were email approvals on the project requirement by the sponsor. The users and user representative were involved in the testing of the system. Although the user representative had the belief that they were intimately involved in project, some members of the technology team were totally unaware. This potentially could have been a result of an extremely compartmentalized role-based approach to the project.

"...my responsibility was, I mean, I was involved in, uh, the, uh, the discovery, I was involved in setting up definitions. I was involved in testing. MMM. I was intimately involved in the project. ...going to ask you the same question, Mike? You know, I was involved on, you know, reviewing things like requirement, finding and overall, overall more strategic kind of directional things and not so much, not so much detailed data."

"...I think that, and I think I eventually would respond to that email and say, yes, these look good. So, I was approving those."

"...it was not an easy project because the business requirements gathering phase was very tumultuous l, just it was, that was not proper. Proper time was not provided to us by the users in of what they expect out of this project. So, it was signed a vague and nebulous..."

"...The total number of users who actually participated in the team? MMM, in the team. Probably zero."

"...the total number of users who participated on this particular project? I have no idea. We were insulated from the users."

As observed in the case above, UPI included approval of project requirements, aspect of securing of funds, and the constant feedback on the progress of the project and participation in the testing of the reports. These actions reflect aspects of all three facets of user participation, namely overall responsibility, user-IS relationship, and hands on activity (Hartwick & Barki, 1994). Based on the above stated findings this researcher classifies UPI as high.

The H1 hypothesis states UPI will have a positive effect on system use, and the findings in this case clearly illustrate high UPI and low system use. Therefore, this hypothesis is not supported.

Listed below are measures of Shared Mental Models extracted from the transcribed interviews. The ID and time stamps references to the transcribed text and original recorded interviews.

Table 7-11 Illustrative Evidence from Case: Financial Need Reporting (TT & JT SMM)

ID	Time	Technology Task – Shared Mental Model
API	13:51	"...it was probably brand new for the, uh, for the users obviously because they've, it's not something that they've ever seen.
API	14:50	"...there's some slight similarities to, for example, if you, there are options. to you use filters, for example, in some websites that work similarly to a Cognos report slash uh, framework?"
API	15:45	***"... Limitation? ...yes. In, in how the, how that ultimately, how the tool was implemented. So, it went back against the design recommendations and design recommendations were essentially over it. And because the worry was that it was too complex for the, for us from the development side to implement and also for the users to grasp, but that ultimately led to its low to probably nil adoption rate at this point."***
MIJE	16:25	"...so, the idea of the data warehouse, was to overcome both of those give us a place where we could easily get to our data, but also kind of provide some sort of a data dictionary or data format. So, if you are going out and grabbing a certain field, the user knew what that field was that they were grabbing. So they didn't come to incorrect conclusions cause our data is, is complicated. "
MIJE	17:54	***"...I don't think we've ever, um, you know, we have a reporting tool now. Yep. But the, that the data warehouse reporting tool would have been significantly different in how you query the data and still what you had to know…..we, I talked about the Cognos package for work study."***
AGR	6:48	"...for the users. They had never used Cognos before and it's very different from web focus reporting. So it was new for them."
AGR	7:18	***"...the things that we took out of scope, which was the combined packages, which if we had done that, that would have met more of the needs that they had. "***
BJO	10:44	"...We built a data warehouse. We built Cognos framework packages. We did not build reports. We did not build anything that was usable by the user from day one. They had to take what we built and then go ahead and develop more stuff for it."

BJO	11:32	"...One being that we didn't talk to them or somebody didn't talk to them and find out the user, the end users didn't talk to them and find out what they actually needed. It was kind of, I think there was a lot of assumptions made. Okay. And there was the second limitation or failure was the restrictions that we had and what we could build and how we would build it."
BGO	14:38	"...There were limitations as far as times and deadlines because they have very tight deadlines and timeframes in that area where they have to get awards out ...admission notices and certain reporting that they have to do. So, they weren't always available... I would say a big limitation is we never have had a dedicated SME on the team that understood this data...
		Job Task – Shared Mental Model
API	17:34	"...any constraints? Um, no. There were no constraints at the time of the discussion. Okay. But you know, when it comes to implementing the design, there were constraints. Yeah. Okay. Um, what were the constraints? Uh, there are two things. Uh, one is the do do their business requirements being vague and all encompassing. So it's kind of weird to say it that way, but they wanted if there were 300 fields and then entire set up. They wanted to track all the changes to all the fields which was which, and they insisted that they wanted it. So, we couldn't get any leeway with our management or their management in terms of coming up with some reasonable. Middle ground. "
API	19:38	***"...yeah, especially at that time, one of the key aspects of the team, um, directive so to speak, where that once design is complete, um, architects needs to hand it over and the build team will take that on and then way little communication needs to happen between the architects and the build team."***
MIJE	20:27	"...are these reporting tasks within the organization or within the industry? I think many of them will be standard based on what it is we're doing. Okay. I mean, you know, aid offices around the country have to ensure that they are compliant. I can't guarantee that they are all using specific audit reports to, to look for compliancy irregularities."
MIJE	21:48	"..., I would agree. And I think to echo what Mike is saying is that a lot of the, the audit reports that we have that drive out our compliance, there's a whole host that aren't necessarily compliance related, but there's a bunch that are compliance related and there are some that are operational related. It says, oh, this action happened. So, here's a report from that report and do something, you know, somebody scholarship changed in the financial aid system."

MIJE	23:11	***"...we showed them the audit reports and the reporting that we had to do and you know, I specifically showed them ones that were, would crossover packages, but there's a, like there's a package that deals with awards and there's a package, that deals with student eligibility and package it yields with documents and of course they don't"***
MIJE	24:20	***"...I guess from a resource on our side, you know, it was just difficult. There was a lot of work to do. Um, I didn't feel really constrained on resources from the IT side …"***
AGR	8:30	"...the team talked with each other because they knew what they were trying to accomplish and um, but I think that the communication with the users needed to be more robust."
AGR		"...They were going through a period of turnover and so their schedules just didn't have the flexibility to, um, give them a lot of time to work with us and help, you know, forge that partnership and, you know, get, I think that we could have gotten more from them had they had more availability"
AGR	18:29	"...there was a lot of separation at that time because when, uh, going back again to when BIDW was first formed, it was really like, here's architecture, here's development business requirements. And there was a like clear defined hand off for each instead of this overlap where you worked with the other person"
BJO	13:09	"...we communicated, um, in the beginning with documents and we had some like handoff meetings and things, but I mean there was a lot of back and forth as we started to get into it and have questions and talk about different things. There were some very lively disagreements. Um, and I'm not sure that those got resolved in the best way."
BJO	14:23	***"...one of the last projects were a due date was promised and even though the tasks at the beginning slipped, the due date couldn't move. And so, when you got down to that last jam, we were trying to get everything done and still meet the deadline."***
BGO	18:18	"...technological constraints. For example, uh, again, some of the things we were attempting to do, we didn't have a lot of experiences doing as far as, for example, making three distinct buckets of data Talk to one another. We we had a lot of experience in making bucket one work independently bucket to work independently and bucket three work independently. But when all three of them had to work together, we did not have a lot of technological expertise in that area either from a data architecture database perspective and from a Cognos tool perspective, that was a, I guess that was a major constraint"

Note: Bold and italics rows were referred in the case as examples.

Shared Technology and Task Mental Model

As per the findings from the above case, there were limitations and a lack of experience in developing Cognos packages. This was new technology for the user and the implementation was flawed. Based on flawed assumptions, the scope was reduced to meet the knowledge base of the development team. Some developers and the architects wanted to attempt this new approach, however leadership team within the group restricted any such innovation. The shared technology mental model was fractured within this team.

"... Limitation? ...yes. In, in how the, how that ultimately, how the tool was implemented. So, it went back against the design recommendations and design recommendations were essentially over it. And because the worry was that it was too complex for the, for us from the development side to implement, and also for the users to grasp, but that ultimately led to its low to probably nil adoption rate at this point."

The development process deployed by the team was in siloes. Team members communicated via documents. There was limited collaboration. The approach was so pervasive that some developers had no awareness about their user persona. One could attribute these decisions to a newly formed team that wanted to be risk averse and achieve success. However, these decisions further contributed to the lack of a shared mental model.

"...yeah, especially at that time, one of the key aspects of the team, um, directive so to speak, where that once design is complete, um, architects need to hand it over and the build team will take that on and then way little communication needs to happen between the architects and the build team."

There were some bad assumptions among the team members. The importance of the linked packages an essential component of the project was de-scoped from the project. Furthermore, the incumbent tool did perform this essential task. Some team members felt the user requirements were vague. Other members felt this was an industry standard based on a compliance requirement. These opposing thoughts again highlight the lack of a shared mental model.

"...I don't think we've ever, um, you know, we have a reporting tool now. Yep. But the, that the data warehouse reporting tool would have been significantly different in how you query the data and still what you had to know…we, I talked about the Cognos package for work study."

"...we showed them the audit reports and the reporting that we had to do and you know, I specifically showed them ones that were, would crossover packages, but there's a, like there's a package that deals with awards and there's a package, that deals with student eligibility and package it yields with documents and of course they don't."

SMM Effect: These findings suggest there was very limited or low shared-ness on the technology or task mental models among project team members. The technical members had challenges with alignment on the approach. The users and the business

analyst were in touch, but missed the opportunity to ensure the technical members were aware of the most critical requirements for the success of the project. These ideas were echoed by many members of the team clearly demonstrating weak support for H2A and H2B.

Listed below are measures of Shared Mental Models extracted from the transcribed interviews. The ID and time stamps references to the transcribed text and original recorded interviews.

Table 7-12 Illustrative Evidence from Case: Financial Need Reporting (TI & TB SMM)

ID	TIME	Team Interaction – Shared Mental Model
API	20:41	"...I would say generally yes. Um, the problem has always been, um, whether they understand the implications, but that I guess you could say that that's probably because the communication wasn't clear. "
API	21:33	***"...What was it team dynamics like did that meet your expectations It was very rough. No. Yeah, it did not."***
API	21:58	"…problem solving when performing tasks? …Poorly...The standards on the, uh, technology side, uh, especially on the Cognos side, uh, was not industry standards. And so, uh, developer was confused to put the best spin on it as to what the best option is to go about doing it. Because even now we see this conflict in their heads because they're not used to doing things this new way because on the one side there, there torn between the ambiguity on one side and the clear direction that's pushing you into the new side."
API	23:25	"...trust among team members?...with a lot of them, yeah. But not everybody obviously, but with the, the core members that were stressed."
API	24:05	"…Differences in opinion encouraged? Uh, no not at that level...there are some absolute basics that you can't give up, you know, so that unfortunately the difference of opinion happens to be in those areas and that leads to clear different friction."
API	24:47	"...some of the major decisions were made Not in any meetings. Yeah.."
MIJE	3:29	***"...I don't think technically I was the sponsor. I don't know who the sponsor was. Maybe Mike, I don't know. "***
MIJE	27:32	"...vocabulary. I think so for the most part. Okay. I mean, I wasn't ever afraid to make sure that I understood what they were saying."

MIJE	27:32	"...did the team have good listening skills? I guess, again, I think that, I think they listen fine, but I don't think they always, again, my, my, my statement about, you know, it felt like we were okay, we're going to do, regardless of kind of what we were saying about we need this overall solution. Okay, we're going to do it. It needs phases and then we'll worry about bringing the phases together later or packages to get there later. You know, even I kept saying, we're going to need this, we're going to need this, we're going to need this. But we still kept down that path and maybe that's because that whole project was designed to go down that path "
AGR	8:30	"..., sometimes I think there were mmm. Some team members who didn't always get along with other team members."
AGR	11:57	"...problem solving while performing tasks? MMM, I think that it was spotty. Um, meaning that maybe people were afraid to make decisions and so they took longer thinking about things because they wanted to make sure that they got every angle and thought about things or they, you know, if it was a decision that had to go back to the customer, then it was waiting to get that response back because they were so busy. Um, and then there were some decisions that were made by like, not by the group in the project, but by leadership."
AGR	13:19	"...I think that there was, there's some level of distrust because some people hadn't worked together much before and so they, you know, they weren't sure that if you, if they told you the full truth that you weren't going to go and like rat them out or throw them under the bus or whatever."
AGR	14:48	"...I think Tim and Anil kind of butted heads a little bit about, um, either the way that things were being architected or the way that, not necessarily the way he was doing it, but the way he was getting the work done. "
AGR	15:32	decision making, was that done during meetings? Um, I think mostly not during meetings. Um, mostly, um, these are one off kind of things. One off one conversations."
BJO	15:31	***"...did the team dynamics, did that meet your expectations? sometimes it got a little uncomfortable"***
BJO	15:50	"...I was at that point, kind of a jack of all trades kind of thing in that. So, your responsibilities kind of float over to what was needed at that time to make something work."
BJO	16:37	"...We didn't really do a lot of get the team together and solve a problem kind of thing. It was kind of more of a, you go do your thing and we'll get it done. "
BJO	17:01	"...was there trust among team members? No, you said No."

BJO	17:29	***"...There was, yeah. Some of the dynamic on that team was just not healthy. Yeah. And sometimes it got a little uncomfortable."***
BJO	17:56	"...Differences in opinion. Encouraged? …from my point of view. No. You did what you were told.
BJO	18:03	***"...decision making done during meetings? Yes. But not team meetings, so individual meetings one on one."***
BGO	1:37	***"...I started off as being the data architect in a data architecture type role. And then about a third of the way through the project, I ended up switching to a business analyst role... "***
BGO	19:59	"...team dynamics, did it meet your expectations? I believe I've worked well with most members of the team... but when you look at the dynamics? We were strong in some areas and we were a little weak in some other areas. So the overall team composition I think could have been improved."
		<u>Team Behavior – Shared Mental Model</u>
API	12:20	"...I did design and testing, design and testing and some doc. Some documentation. Yeah. Oh, could you elaborate? Like what does it mean? Technical design documents, a data dictionary, things like that. "
API	26:17	talking about goals "...was that reevaluation done by the team? Or with everybody, like sponsors and everybody….No, it was not done with the, especially the architects were not involved at that point"
API	26:35	***"…What was your working experience with the team? I toward the end, I had to check out. It was that bad, so I just said it's not ...basically the decisions were made, um, without really letting anybody else know. And it just like done by, you know, some, uh, two or three people without talking to the architects and that basically is, it basically did not deliver in the end."***
API	27:20	"...No, I think there was, uh, there were a lot of frustration, so towards the end they were not happy at all."
API	28:20	"...Did you feel that everyone's opinion was heard? No. Okay.
API	28:20	***"...data warehouse is somewhat different, obviously quite complicated in its start to this end part…And if somebody is not familiar with it, it becomes very hard for the whole team to be on the same bridge. So same, same path because there, there's BA who's not aware of how the intricacies of a project goes. It's on a different road. And then the pm is on different road and then the architects and developers are in different road. And then of course the stakeholders have no idea because they are just told by different people in this group."***

MIJE	30:42	"...the team have the ability to complete the task that was assigned to them? Well, if we look at just the individual phases, yes, yes. But since we didn't ever overly finish, I can't really say yes or no. So, I don't know if what's holding held back the final was because we didn't know how to do it or because we just .... the resources. Were there"
MIJE	36:07	***"...we were constrained by we're going to do it in these steps and worry about trying to pull it all together later. And I kept, I, you know, was saying kind of as soon as I say we, I understood what was happening with these packages that didn't talk to each other. I kept saying we had to have them talk, we got to have him to talk, we've got to have him talk. And I didn't, I felt like a broken record because we weren't and all I got was, well, we're going to do them all and then we'll worry about putting them together later. And so I, you know, if I didn't feel good about that because it, I mean that part of the project always frustrated because I kept feeling like you're doing all this work and until we did a whole bunch of more stuff the product we weren't going to see a benefit for a year and a half after delivering this type space."***
AGR	16:15	"...Did the team have the ability to look at different solutions? MMM, I think they had the ability to do, like they knew how to do that, but they weren't encouraged to do that."
AGR	17:13	"...I mean there were those, the question of like, from the beginning there was this like we didn't have, our requirements weren't detailed enough and so the goals were pretty high level."
BJO	18:33	"...teams' ability to complete task that was assigned to them. I think we did a pretty good job given the, the environment that we had to work with. "
BJO	18:45	"...Team's ability to look at different solutions? No. Okay. That's that whole conflict. It was like discouraged"
BJO	19:33	"...Again, we, I have no idea what they wanted because we never got to talk to them. We never found out what they wanted. So, I don't know if the user's goals, well obviously 20, 20 hindsight. The user's goals were not our goals"
BJO	20:00	"...your working experience with the team? Certain people on the team. I worked very well with. Um, there was another group that was definitely. I was definitely an outsider of that group. Okay. And sometimes that made things difficult."

BJO	21:53	"...it was kind of, there was parts of it that were kind of uncomfortable. There were some people that stayed completely out of it, some people were caught in the middle of it. Um, there was some kind of outside side-taking on some of it and I don't know, it was kind of like, I kind of felt like if somebody came and said, you know, I think I have a better way. It shouldn't have been met with such a hostile reception. And then the fallout of that got to the point where I think for a long time there were people that really weren't speaking and it made things uncomfortable a little bit and the team environment and it was very much on some parts of it us against them within the team kind of thing."
BGO	23:03	"...I think we had the ability. I think it's a matter of whether we had the ability was there, I don't know if we had all the necessary knowledge and skills and time and resources."
BGO	24:05	"...I'm not sure if the overall goals from the get-go whereas well defined as they could have been. So that makes it a gray area sometimes."
BGO	24:55	"...I think everybody had a strong desire to quote unquote get it right and deliver something of value. Okay, so that's a very strong point I think of all members of the team."
BGO	26:30	"...looking back on this project, other projects that I've been involved with, in my opinion, I think we need to have increased involvement from our business partners."
Note: Bold and italics rows were referred in the case as examples.		

Shared Team Interaction and Behavior Mental Model

This team suffered from challenging interpersonal relationships. There were clear insiders and outsiders within the team, which make developing a shared mental model very difficult. The team leadership did not encourage differences in opinion. It was frowned upon and there were many heated arguments on the team, which led to “people not talking to others” according to a team member.

"…Differences in opinion encouraged? Uh, no not at that level...there are some absolute basics that you can't give up, you know, so that unfortunately the difference of opinion happens to be in those areas and that leads to clear different friction."

"...Did the team have the ability to look at different solutions? MMM, I think they had the ability to do, like they knew how to do that, but they weren't encouraged to do that."

The team environment was rough to the extent that it was uncomfortable for some members. Such hostile environment led some members to mentally “check-out” of the project or some other team members were afraid to talk as they believe they were going to be “thrown under the bus” or “someone would rat them out”. There was very little to no trust in the team.

"...What was it team dynamics like did that meet your expectations It was very rough. No. Yeah, it did not."

"...did the team dynamics, did that meet your expectations? Sometimes it got a little uncomfortable"

"...There was, yeah. Some of the dynamic on that team was just not healthy. Yeah. And sometimes it got a little uncomfortable."

"...it was kind of, there was parts of it that were kind of uncomfortable. There were some people that stayed completely out of it, some people were caught in the middle of it. Um, there was some kind of outside side-taking on some of it and I don't know, it was kind of like, I kind of felt like if somebody came and said, you know, I think I have a better way. It shouldn't have been met with such a hostile reception. And then the fallout of that got to the point where I think for a long time there were people that really

weren't speaking and it made things uncomfortable a little bit and the team environment and it was very much on some parts of it us against them within the team kind of thing."

Decision making rarely took place during meeting, important decisions were made in closed rooms or one-on-one conversations. This kept many team members in the dark and made their ability to perform extremely challenging.

"...decision making done during meetings? Yes. But not team meetings, so individual meetings one on one."

"…decision making, was that done during meetings? Um, I think mostly not during meetings. Um, mostly, um, these are one off kind of things. One off one conversations."

"…What was your working experience with the team? I toward the end, I had to check out. It was that bad, so I just said it's not ...basically the decisions were made, um, without really letting anybody else know. And it just like done by, you know, some, uh, two or three people without talking to the architects and that basically is, it basically did not deliver in the end."

Roles constantly changed during this project, data architect and business analysts officially switched roles in the middle of the project. Communications with user representative became a challenge, leading user frustration. Many members of the team participated in the documentation and testing effort, without clear accountability. Roles were unclear even within the user community.

"...I don't think technically I was the sponsor. I don't know who the sponsor was. Maybe Mike, I don't know. "

"...I started off as being the data architect in a data architecture type role. And then about a third of the way through the project, I ended up switching to a business analyst role."

"...we were constrained by we're going to do it in these steps and worry about trying to pull it all together later. And I kept, I, you know, was saying kind of as soon as I say we, I understood what was happening with these packages that didn't talk to each other. I kept saying we had to have them talk, we got to have him to talk, we've got to have him talk. And I didn't, I felt like a broken record because we weren't and all I got was, well, we're going to do them all and then we'll worry about putting them together later. And so I, you know, if I didn't feel good about that because it, I mean that part of the project always frustrated because I kept feeling like you're doing all this work and until we did a whole bunch of more stuff the product we weren't going to see a benefit for a year and a half after delivering this type space."

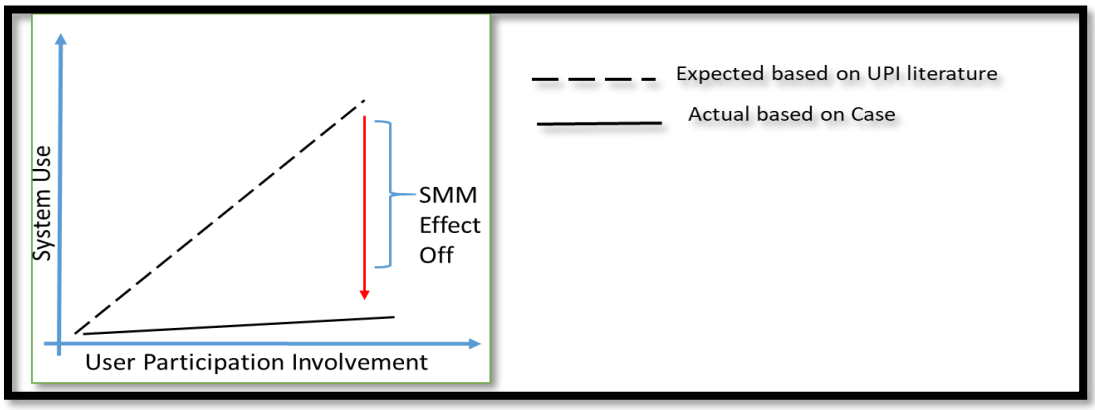
"...data warehouse is somewhat different, obviously quite complicated in its start to this end part…And if somebody is not familiar with it, it becomes very hard for the whole team to be on the same bridge. So same, same path because there, there's BA who's not aware of how the intricacies of a project goes. It's on a different road. And then the PM is on different road and then the architects and developers are in different road. And then of course the stakeholders have no idea because they are just told by different people in this group."

SMM Effect: The environment was hostile and contentious. Team members did not feel safe to exchange ideas and, furthermore, team leadership did not encourage

exchange of ideas. Roles of team members were changed. That caused confusion on roles and responsibilities leading to very limited shared interaction or behavior mental model. These ideas were echoed by many members of the team clearly demonstrating weak support for H3A and H3B.

Discussion

Figure 6-6: Impact of SMM in case – Financial Assistance Reporting



As observed in the discussion above, there were no attempt to coordinate actions or adapt behavior to meet the demands of the task or other team members. Based on these facts, this researcher concludes there was limited to no shared-ness of behavior to interaction mental model among members of this team. Furthermore, there was very little technology or task-related mental model shared-ness among the team members. One could find evidence of poor communication among various team members. Effective communication helps members of a team develop mental model alignment (Denzau & North, 1994).

Many team members worked hard to deliver a good product, but in the end failed to meet the expectation of the user. A complete misalignment of assumptions and no shared-ness of mental models can be highlighted as contributing factors for the failure of this project. As shown in Figure 6-6 above, based on the UPI literature, one would expect

system use to be high since user participation was high in this case. UPI theory cannot explain these results. The introduction of SMM into the model clearly demonstrates how the lack of SMM within the team negatively impacted the effect of high UPI on system use, resulting in limited system use. This case clearly demonstrates the need to incorporate SMM in UPI – System Use models.

5.7 Advancement Reports [G]

Background and Project context

This case study is centered on an IT project that was necessitated due to a completion of a major event. The advancement office at Omega was about to complete a ten-year capital campaign. The advancement office conducted most of its administrative and campaign-related functions within an application that was developed and maintained by the central IT team. The application, which was web-based, was initially rolled out in 2009. It captured and stored all donor demographic, relationship, and contact information. It also included a gift processing module that allowed users to record gifts and donations given to Omega, which included gifts toward all campaigns. The application was specifically designed and built to support this ten-year capital campaign. There was limited consideration given during design and development to end a campaign or run multiple capital campaigns on the platform. Ten years seemed too far away to plan for. So, as the organization approached the close of the campaign the advancement office was faced with two challenges: a) how to close a campaign, and b) how to continue recording gifts and donations after the campaign was over.

To close a campaign required some configuration changes and development of specific campaign close reports. All reports in the application were tied to the one capital campaign. Unfortunately, it was recognized that certain groups within the advancement organization had no operational reports. All reports they used to run their business were linked to the campaign. This meant that after the capital campaign was closed these groups would have no reports available to run their day-to-day operations. This realization initiated another request, which was to create new reports for these groups.

This case will review the effort put forth by business and IT teams to build these reports. This was a reporting project with a tight timeline as the campaign was scheduled to close on a widely publicized predetermined date which coincided with the organization's fiscal year end. The pressure to meet the project timeline on this effort was not trivial. Executive leadership from the advancement office, other executives from the organization and the board of trustees were very eager to review the capital campaign close reports. The numbers from these reports were scheduled to be published across the country as the campaign was about to set fundraising records for the institution. While the successful delivery of the campaign end reports was eagerly anticipated, the operational leaders from groups that had no reporting post the capital campaign close were anxiously awaiting their specific operational reports that will help them continue to run their business on a daily basis. Failure to deliver or a delay in the timeline was not an option of this team.

Within Case Analysis

This section presents details of this researcher's case analysis that merge the theoretical constructs of the mental model shared-ness with the data collected to explain how and why the mental model shared-ness moderates the relationship between user participation/involvement and systems use.

System use

The project met the scope and expectations of both the IT and business departments. This opinion was independently expressed by all members of the project

team. It should also be noted that the team was extremely small, consisting of just two members. The scope of the project was to develop over fifty reports for departments that would lose operational reporting after the campaign was closed since all their reports were exclusively linked to the campaign.

All developed reports were in use. The users had not requested any new reports, nor had they started using any shadow system for reporting purposes. We can confidently say the developed reports met the operational needs of the department at 100% utilization. Based on these facts the usage of these reports can be classified as high.

User Participation

User participation on this project was channeled through the user representative on the project. The project team engaged this individual multiple time over the course of the project. The project team was small and the lead designer played the roles of BA, designer, developer and tester. The business representative also played multiple roles in the project, that of user representative, tester, documenter, and trainer.

As the project was initiated the business representative assembled the users and discussed the need with the user community. They also discussed the possibilities that exist within the application. As noted in the earlier section the organization wanted to make minimal changes to the application as it was reaching end of life. The user representative and the designer then came together to finalize options and the final option was presented to the user community. The user engagement process was initiated by the user representative and was followed up by more communications of options.

"...Bring together initial group to talk about what the possibilities were...then kind of present what we came up with."

Users were further engaged via two channels of communications a) lunch and learns and b) “one pager” for department leadership.

"...Design approvals, yes. Because I create tested and implemented it. I presented to the customer. And um, then they approve it."

"... Became trainer for department on how to use the reports… wrote some one pagers so that the new report could be socialized with senior staff and department"

There are three distinct dimension of user participation, overall responsibility, user-IS relationship and hands-on activity (Hartwick & Barki, 1994). This researcher found that the user representative in this case was engaged in some hand-on activities such as testing, development of documentation, design approvals, etc. But the overall user community was engaged in the beginning and then via lunch and learn, which was done after the project was developed. The user-IS relationship was mainly between two individuals within the team. Based on the format of engagement of the users and leadership (early and late engagement, but not during) on this project and the fact that the entire project was accomplished by two individuals, the project scored low on factors associated with user participation and involvement during the project phase.

The H1 hypothesis states UPI will have a positive effect on system use, and our findings in this case clearly illustrates low UPI and high system use. This hypothesis is not supported.

Listed below are measures of Shared Mental Models extracted from the transcribed interviews. The ID and time stamps references to the transcribed text and original recorded interviews.

Table 7-13 Illustrative Evidence from Case: Advancement Reports (TT & JT SMM)

ID	TIME	Technology Task – Shared Mental Model
SSA	8:55	***"...Design of actual reports. They were already basically designed as we were going to, um, we sort of hijacked the current campaign structure"***
SSA	11:04	"...the set of reports mimic the same features as previous reports"
SSA	11:19	"… rows tested perfectly, but in reality, as we have learned are not accurate. There are things that the filter is not handling correctly. Okay, but the decision has been made not to fix it."
RMO	4:40	"…Some of which was the prior design, because we leveraged the same structure that we had. Whether it was data entry part, whether it was the um, we did not modify tables to have any kind of additional data that when we presented it, um and I think that reduced the whole scope, but because the reports actually produced outputs in a format that senior leadership in the department was satisfied with... in the past? Yes"
RMO	7:15	"…Was it (user experience) similar to the pattern within this particular application? This application only."

Shared Technology and Job Task Mental Model

The technology and task capabilities of the reports that were developed were very similar to the current features experienced by the users. This approach enabled the user mental model to default to the maintenance mode, which is the default operating mode, and limited the need for learning something new. The approval on the design by senior leadership added the required top management support, which further influenced system use.

"...the set of reports mimic the same features as previous reports"

"...Design of actual reports. They were already basically designed as we were going to, um, we sort of hijacked the current campaign structure"

"...Some of which was the prior design, because we leveraged the same structure that we had. Whether it was data entry part, whether it was the um, we did not modify

tables to have any kind of additional data that when we presented it, um and I think that reduced the whole scope, but because the reports actually produced outputs in a format that senior leadership in the department was satisfied with... in the past? Yes"

The user representative also expressed the opinion that reports like these could be common within the advancement industry. Following industry standards or best practices helped users to associate with similar constructs and enhances the metal model alignment.

"...I would guess a report similar to this is probably pretty standard across the industry."

SMM Effect: The team according to a member "Hijacked" the designs of current reports. The task of executing the report function was a standard feature to the application. In this model the user would experience limited change and will continue to operate with the mental model maintenance model. Based on the above stated findings, and the consensus in ideas that were echoed by members of the team, clearly state a strong support for H2A and H2B.

Listed below are measures of Shared Mental Models extracted from the transcribed interviews. The ID and time stamps references to the transcribed text and original recorded interviews.

Table 7-14 Illustrative Evidence from Case: Advancement Reports (TI & TB SMM)

ID	Time	Team Interaction – Shared Mental Model
SSA	14:04	***"…Common vocabulary? Yes, I think we did. Okay, and if not, we were very careful to, to add additional language to make sure that we were being clear about where, what our view point was and what vocabulary we were using."***
SSA	14:31	***"…Team dynamics… it's a team that I've worked with before and the dynamics have been excellent in the past and were excellent again.***
SSA	15:00	***"…There was a lot of collaboration, a lot of bouncing off ideas. If something didn't seem right and making sure we understood what, what the other person was saying."***
RMO	8:45	"…Common vocabulary? Yes, common among us.
RMO		***"…This was interesting, decision making actually went up to, um, senior leaders, high leadership … so that actually took a little time at times to get responses...Decision making was, um, sometimes decisions were made quickly. Based on what time it was. Other times it took multiple meeting to get decisions because some of the key participants or decision makers were not there.***
		Team Behavior – Shared Mental Model
SSA	16:09	"…look at different solutions? … this was the solution that was chosen, Okay, and there wasn't time or resources to do something else."
SSA	17:03	*"…working experience with the team? It's long term. The team members, somebody I've worked with for quite a while and it was good."*
SSA	17:50	**"…we always work at our highest level."**
SSA	18:48	***"…this may have been a unique circumstance because it was a small team and it was a team that had established problem solving collaboration in the past. So you know, I've worked on other projects where the answers to those questions wouldn't be quite the same.***
RMO	8:45	"…I don't think we really had an option for any other solution in this case. It was based on a prior structure.
RMO	12:15	"… um, my working experience, very close working experience based upon years, um, of interactions. I think mutual respect was there.
RMO		***"…improve task outcome? Yes, if something was a possibility to improve, yes.***

Note: Bold and italics rows were referred in the case as examples.

Shared Team Interactions and Behavior Mental Model

This was small team from a project standpoint, and each individual played multiple roles. The key factor to recognize about this team is that user representative was an integral part of this small team. Have the user representative play other roles of the project like documentation specialize or trainer, would have further helped the users understand the vocabulary and would have minimized any translation issues.

"…Common vocabulary? Yes, I think we did. Okay, and if not, we were very careful to, to add additional language to make sure that we were being clear about where, what our viewpoint was and what vocabulary we were using."

There was only one user representative on the team, so one can effectively say the user participation was low compared to other projects where there were many representatives from different offices. Another key aspect of this team would be their long history. These individuals have work together for many years; their past interactions were very successful, and the team inherently formed a bond of respect and understanding.

"…Team dynamics… it's a team that I've worked with before and the dynamics have been excellent in the past and were excellent again.

"…working experience with the team? It's long term. The team members, somebody I've worked with for quite a while and it was good."

"… um, my working experience, very close working experience based upon years, um, of interactions. I think mutual respect was there."

Decision making by leadership was expressed as a challenge, and due to the interest express by senior leadership on this project many decisions were made at the highest level of the department. This would have added more constraints to team that was in a time constraint.

"…This was interesting, decision making actually went up to, um, senior leaders, high leadership … so that actually took a little time at times to get responses… Decision making was, um, sometimes decisions were made quickly. Based on what time it was. Other times it took multiple meeting to get decisions because one of the key participants or decision makers were not there."

"...There were big time constraints and there were big constraints on the resource who was developing them (Reports)."

Although, the team faced such adverse conditions the overall work morale and the need to perform at the highest echelon was evident.

"...we always work at our highest level."

"...improve task outcome? Yes, if something was a possibility to improve, yes."

The long history and close working relationships that span multiple years created an interesting dynamic with the team. The mental models of the user representative and the designer/developer after having worked together for many years would have aligned and created a shared mental model that facilitated many aspect of team dynamics, like the desire to understand the other team member's opinion, one which enhances idea generation and problem solving capacity of the team.

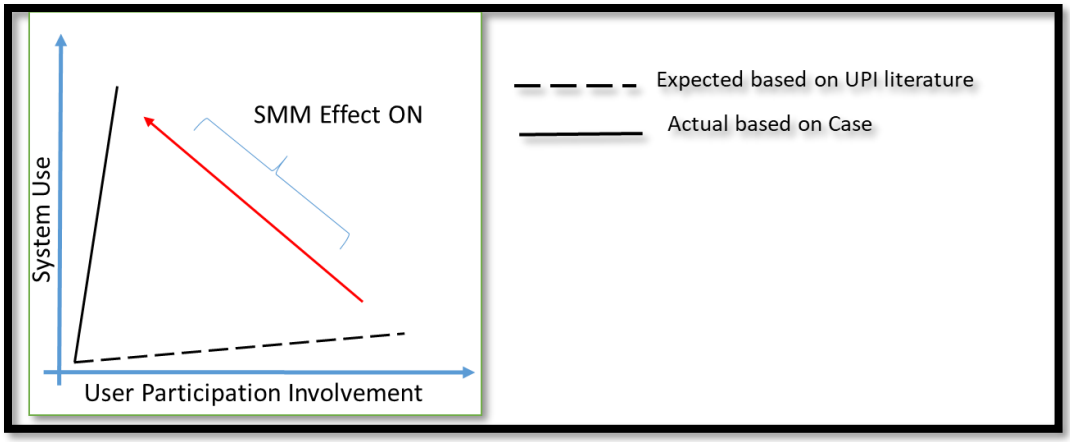
"...this may have been a unique circumstance because it was a small team and it was a team that had established problem solving collaboration in the past. So, you know, I've worked on other projects where the answers to those questions wouldn't be quite the same."

"...There was a lot of collaboration, a lot of bouncing off ideas. If something didn't seem right and making sure we understood what, what the other person was saying."

SMM Effect: The team members had a common understanding of the vocabulary and had many years of close working experience. As expressed in theory, constant communication and working relationships over time will help members develop a shared mental model (Denzau & North, 1994). There was mutual respect, and they encouraged members to improve performance. The team was able to make decisions and operated effectively even under time constraints. The findings above clearly show the existence of a shared mental model and these ideas were echoed by many members of the team, clearly stating strong support for H3A and H3B.

Discussion

Figure 6-7: Impact of SMM in case - Advancement Reports



As shown in figure 6-7 above, this case clearly demonstrates how mental model shared-ness could generate positive system use, even when UPI is limited. The design of the technology was very similar to the existing features, increasing familiarity and aligning the user's mental model with that of the systems mental model. The benefit of mental model maintenance is clearly supported by this case (Zhang & Xu, 2011). The team on this project was small, but the team had multiple years of working together on projects related to this business unit, an artifact of how the technology team are aligned to the certain business units. The experience of working together for many years helped the team to align on the team behavior and interactions mental model. This inherently reduced communication barriers and the team was able to engage in effective brainstorming and idea generation. The team was able to overcome resource and time constraints and managed to deliver the project on time. The team and technology mental model alignment thus further enhanced user participation and interactions and their impact on system use.

UPI literature alone cannot explain this phenomenon, for as per the UPI literature, with low UPI one should experience low system use. The findings in this case are contrary to the UPI literature. This researcher found that there was high system use

despite limited UPI. This anomaly can be explained by reviewing this case in the light of the shared mental model. There was a high SMM alignment with the team and the designers leveraged the existing mental models to ensure the users would engage in mental model maintenance activities while using the system. This clearly demonstrates that strong SMM within the team moderates the UPI – System Use relationship, such that in low UPI environment one can achieve high system use.

Alternate explanation

Another explanation for system use in this case would be the "available options". The users were just provided with one option. So, if they needed reports that were essential for their daily operations, they had to use this system. Furthermore, this project and its design had top management support. Hence the user community was left with no choice but to use this system. This argument does hold some merit, but as discussed in the literature review section of this paper, mandatory use of systems has never been good indicator of system use and system use metrics seems to drop with time.

5.8 RAD [H]

Background

Research administration is an $800 million operation at Omega. It is directly aligned to the core mission of the institution. There are approximately over 3,500 researchers at the institution, conducting studies in a variety of fields. Researchers at Omega submit over 4,000 proposals with an estimated value of $2-3 billion dollars to various sponsoring agencies. Project COIPAT (discussed earlier) was initiated to improve the operations, reduce operational burden on researchers and administrators, mitigate risk, and gain a competitive advantage. To accomplish this the organization needed to have the capability to process data from various administrative systems and produce data for leaders to make informed decisions. Data must be reliable and available for decision making.

Project context

During the implementation of COIPAT, a vendor product, it was realized that the reporting capability of the product would not be sufficient to meet the needs of the institution. To support the operational needs many key data elements were placed in custom (user defined) fields, which were not available within the standard reporting mechanism of the tool. This was the differentiating factor for the institution, so leadership determined that a supporting project needed to be initiated to satisfy the reporting needs of the institution. A research administration data warehouse was initiated to support the analytical and reporting needs of the institution.

Omega had a low maturity in data warehouse capability. Like many of its peers', the data warehouse was primarily used as an operational reporting engine. Users had very limited exposure to the capabilities and complexities of a true data warehouse. This project was expected to start towards the tail end of the COIPAT project. Subject matter experts from COIPAT were supposed to ramp down on their efforts on COIPAT and ramp up on RAD. This approach did not pan out due to delays encountered in the COIPAT project. Due to time and other organizational constraints RAD was initiated with limited resources.

Within Case Analysis

This section presents details of this researcher's case analysis that merge the theoretical constructs of the mental model shared-ness with the data collected to explain how and why the mental model shared-ness moderates the relationship between user participation/involvement and systems use.

System Use

The research administration system is a vendor solution that was customized and configured for Omega. During the implementation of the system, many user-defined fields were used to capture key data elements that are essential for reporting. Standard reports out of the research administration system did not support user-defined fields, therefore very few reports had been activated in the research administration system. Users ran most of the operational reports from the newly-developed data warehouse.

"...scope of the project met? No Uh, did it meet the expectations of you or the department? No "

".... I would say the way it's currently being utilized? It's a low value. Because it's complex. It's not the plug and play that people want, you will need to have a different structure where we had a few experts in reporting and who will build reports and we did do some of that. But it still kind of a very low level."

Based on the usage data collected during this study, this researcher found the usage of the reports to be concentrated among a handful of individuals. This could be attributed to many reasons such as the complexity of the reporting function, lack of experience with the new environment, etc. There were many reasons for the project to not meet the defined scope for the user. The value produced was low. Furthermore, it was not widely used. Based on these facts, this researcher classifies it as low usage. Similar sentiments were expressed by the development staff and the user representative.

User participation and involvement

This project had multiple user groups, namely users (general research community), research administrators, department users, office of research administration, and sponsored projects administration. The key user representative who was the subject matter expert for the project was asked to run the user group meetings where they reviewed item and prioritized issues related to the project. Users were also engaged in testing, training, and documentation related to tip and tricks were provided to the users. This was a mandatory project to support the research administration system replacement program.

"...So each office has their own representation of users OSRES is primary one, and the trick there is that they aren't the users of the data for strategic purposes. They use the data for operational purposes. They user of the data for strategic purposes are the departments and the deans."

"...up until the middle this summer, I was a SME responsible for a small portion of the mapping activity um, right around in August. Um, I always asked to continue the user group meeting after their project officially ended and so I run those meetings. And help organize issues prioritize..."

The case documents show evidence of users and central IT team communicating on formal release approval, it shows evidence of hands-on activities such as user testing and sign off. The evidence presented in the case are distinct facets of user participation (Hartwick & Barki, 1994). This coupled with the continued wide engagement with various members of the user community using user groups leads this researcher to conclude that user participation was high on this project.

The H1 hypothesis states UPI will have a positive effect on system use, and the findings in this case clearly illustrates high UPI and low system use. This hypothesis is not supported.

Listed below are measures of Shared Mental Models extracted from the transcribed interviews. The ID and time stamps references to the transcribed text and original recorded interviews.

Table 7-15 Illustrative Evidence from Case: RAD (TT & JT SMM)

ID	Time	Technology Task – Shared Mental Model
EAS	14:43	***"...the new version of Cognos. I like it but it certainly is not less complex, which was another problem. You have a, now you have a more complicated model in a more complicated tool and I think that did not help."***
EAS	15:47	***"...people want to be able to combine desperate data set. However, these same people can't figure out how to work the thing with one. Yeah, so it's a resourcing problem, the expectations are too high for some of our users to be able to create things with complicated tools."***
ARA	41:15	***"...It was all about what people needed for reporting. If we're talking about user experience, that's where the Cognos tool upgraded implemented alongside our implementation and I don't think that was very successful change completely. And changed the interface completely, So people who knew how to use the tool now have new packages and don't know to use the tool. "***
AGR	4:27	"...the data is more complex than the previous system, so they're more like more possible records for each proposal. So it made reporting more complicated and I think that that is, it's a little bit of a limitation. Okay."
		Job Task - Shared Mental Model
EAS	18:23	"...And we continually tried to express that and to explain that there was still has some disconnect and then it's not easy."
EAS	9:18	"...We never really had a requirement gathering phase, we sort of jumped right into development and project manager and the business analyst had no understanding of the end result or the source system. And so no useful documentation was ever produced. So I was often in a position where I had to just try and get answers to things that we needed to develop. "
ARA	43:46	***"...I think we haven't mentioned with that. Part of what we were trying to achieve with COIPAT was the elimination of shadow systems, access front ends, sequel database, that the departments are keeping on, it's still keep because the data looking at the data out from the formal systems don't meet the need to provide these numbers for their proposal and every department does that differently. "***
ARA		***"...Lots of detailed conversations. I think there were a couple of things that were missing in terms of details, but really in my opinion it was trying to implement that alongside trying to implement RMS at the same time. Okay. So there were constraints? Absolutely, because it is the same people who know everything, then, those people were involved in actual system implemented. Were their task dependencies? Yes, Implementation of RMS, post support."***

AGR	5:50	"...we did have some resource constraints that, um, if we had had unlimited resources, I think that we probably would have extended the project a little bit longer to give the users more time to feel comfortable with the product before we released it. Um, but because we didn't have the availability we discussed and we're given the go ahead to go ahead and, you know, go live as it was and give them some time. And when we're calling the Beta"

Note: Bold and italics rows were referred in the case as examples.

Shared Technology and Job Task Mental Model

The project team's biggest challenge was a technology upgrade that took place during the project. The user community was familiar with the use of the Cognos reporting tool. This project was modifying some existing Cognos packages creating some new ones. The new reporting environment was complex. The technology team constant attempts to warn the users of the complexity were rejected by user community under the pretext of required for business. As the RAD project progressed through various phases, another environment maintenance project was launched by the central IT team – the upgrade of Cognos environment. This project was essential to ensure the organization had supported reporting environment. The upgrade was challenging as it had many user experience changes, which added an additional burden on the user community. The situation was best described by the user representative:

"...It was all about what people needed for reporting. If we're talking about user experience, that's where the Cognos tool upgraded implemented alongside our implementation and I don't think that was very successful change completely. And changed the interface completely, so people who knew how to use the tool, now have new packages and don't know to use the tool."

The overall situation posed some major challenges for the team. They now had an almost new reporting tool in Cognos accompanied by a complicated model or packages that were difficult for users to comprehend. This situation was further exasperated by unavailability of subject matter experts who were busy implementing the research administration system.

"...the new version of Cognos. I like it but it certainly is not less complex, which was another problem. You have a, now you have a more complicated model in a more complicated tool and I think that did not help."

"...people want to be able to combine desperate data set. However, these same people can't figure out how to work the thing with one. Yeah, so it's a resourcing problem, the expectations are too high for some of our users to be able to create things with complicated tools."

"...Lots of detailed conversations. I think there were a couple of things that were missing in terms of details, but really in my opinion it was trying to implement that alongside trying to implement RMS at the same time. Okay. So there were constraints? Absolutely, because it is the same people who know everything. Then those people were involved in the actual system implemented. Were their task dependencies? Yes. Implementation of RMS, post support."

The heavily-governed area of research, compliance, and other forms of agency reporting became critical and any black mark could mean the loss of millions of dollars in research funding for years. Departments that work in this space take reporting seriously,

and if they are unable to produce necessary reports from official systems, they create their own shadow systems. Elimination of shadow system was a key objective of project.

"...I think we haven't mentioned with that. Part of what we were trying to achieve with research administration replacement project was the elimination of shadow systems, access front ends, sequel database, that the departments are keeping on, it's still keep because the data looking at the data out from the formal systems don't meet the need to provide these numbers for their proposal and every department does that differently. "

SMM Effect: The team from a technology perspective had a complex tool, that changed mid-project. Users now had to engage in mental model building activities in the middle of the project. To perform the necessary tasks, users did not have enough information as resources were not allocated appropriately to the project. There was no project manager and the lead developer performed all project-related tasks. Based on the evidence presented above, this researcher argues that there was limited shared-ness in the team on technology and task mental model. These ideas were echoed by many members of the team clearly stating weak support for H2A and H2B.

Listed below are measures of Shared Mental Models extracted from the transcribed interview. The ID and time stamps references to the transcribed text and original recorded interview.

Table 7-16 Illustrative Evidence from Case: RAD (TI & TB SMM)

ID	TIME	Team Interaction - Shared Mental Model

EAS	10:27	"...you involved in the prioritization, estimation, budget, things like that? No, not on the project, I was also sort of just handed a, here's your implementation date."
EAS	20:02	***"...I don't know that it was a communication issue. People seemed to be willing to communicate. It was just nobody could get anything done at all…did they use common vocabulary? Probably not. I mean we had a project manager who, I had no familiarity with, data warehousing at all. and at First created this project plan that had nothing relevant to anything anybody was doing and then got some help from somebody who had done project management, work and then had no idea what any of the tasks meant. So there was a vocabulary issue. "***
EAS	20:02	"...And then so every meeting was let's all get together and redefine what these things mean over and over and over. Nobody actually responsible or accountable for anything and it just was not management. I don't know what it was. Time consuming and frustrating."
EAS	20:02	"...listening versus learning. I don't feel like the project manager was learning anything. I don't feel like the business analyst was learning anything."
EAS	22:07	"...The dynamics were like friendly enough, but it was so extremely frustrating that nobody was accountable for anything. Okay. So there were a few, we did have some tense moments where there was like a point where we were on the phone with the key users and I was trying to get some requirements nailed down so I can move on to some development. And the analyst was angry because I had stepped on the analyst's toes. So that turned into several hours in a meeting"
EAS	22:07	"...roles and responsibilities clearly understood. Not even a tiny bit. Okay. Perhaps they were understood, but they certainly not been met, and then there was nothing happening to make them be met. "
EAS	24:40	"...Well for a long time there was no decisions made, unless I made them. Okay. And there were some things like this piece that became way complex. I tried to make the decision that we're not going to do that. It's not going to work. And I got so much pushback, um, from the user group, that I waffled or that Yeah. "
EAS	24:40	"...Was the environment. Safe to discuss issues? That I think yes, it just, nothing's ever come up in discussions, but we did have discussions. They didn't end up resulting in anything meaningful."

ARA	45:01	"...I personally find data communication is very difficult. You have to be very specific and very clear. I walk thru many example, do lots of testing. People don't understand, I feel like the developer understand each other well, the technical teams understand each other well. The functional teams don't always understand each other well in terms of what they're asking. I see a person might not even understand what they're asking for and they don't know what they mean and the communication between those two groups is highly fraught "
ARA	45:01	***"...so when the technical teams understand what the function teams are asking for it is a beautiful thing. There were some instances of that in this project, exactly what was needed was developed. There are also instances where the functional people thought they were saying one thing and the technical team thought another or they didn't hear at all. "***
ARA	45:01	***"... did the teams use common vocabulary? We tried, …. the vocabulary for the functional processes keep varying the overall award process is very technical step like processing and award or even money itself. So no, I don't think there's a whole lot of time spend getting that. "***
ARA	46:15	***"...what happened with the developers themselves. And the functional team was what I would expect It is a gap in project management and gap in business analysis the need and ability get down in the weeds to document that that level, for what was need is a huge challenge. "***
ARA	46:15	"...was roles and responsibility understood? No, So outside of like technical teams, probably that project management and BA staff keeps talking about for the first six months of that, we got changed and it got better. "
ARA	46:15	"...When we had people in the room they Discuss the issue until everyone understands. when people were not in the room it was vague. When people don't understand the complex issue they would talk around it they don't talk about it."
ARA	46:15	"...decision making mostly done during meeting? No. some decisions, key decisions were made during meeting. a lot of one off conversations"

ARA	48:54	"...did the team have the ability to evaluate their limitations? No rather than one. So if we're talking about money and time, um, we didn't do good on either actually. So no this time.
AGR	00:36	"...I was a SME early on in the project. Um, kind of just there to provide the, like more data warehouse expertise on the, for Renee who was the project manager at the time."
AGR	7:13	"...team have good listening skills? Most of the time. "
AGR	7:26	"...I mean; you always have a little problem child. Um, you know, we did have some conflict I guess with Barry (BA) no longer with us, so,"
		Team Behavior – Shared Mental Model
EAS	26:11	"...team's ability to complete tasks assigned to them? That was extremely problematic at the beginning. Okay. Um, there were definitely people who were very capable and very on top of their tasks, but there were also people that weren't so that, that made that very difficult. Just there were some big holes.
EAS	31:49	"...Probably sometime because it was such a scramble, you know, and not feeling great. Yeah, very good. Yeah. Um, but I think we all have that sense that we wanted, we wanted to out a good quality product and we really try and hard but that there were some things going on or making that more difficult. "
ARA	48:54	"...Did the team know and agree the shared goals with the project? Yes, but I think there was some scope missing."
ARA	49:24	"...how you feel about working with that team? part of the team It was good. parts of the team was frustrating."
AGR	8:35	"...I would sit there in the meetings and like prompt people if they were like giving me that I want to say something, but I'm not gone a say anything and I, you know, try to get them to speak up cause I can tell that they're holding something back."
Note: Bold and italics rows were referred in the case as examples.		

Shared Team Interaction and Behavior Mental Model

This project had challenges on establish shared expectations on role and responsibilities. The project manager and the business analyst resources were unable to

make tangible progress to help the rest of the team move forward. There were real gaps in knowledge with these individuals on factors that impact a data warehouse project. This was evident to other members of the team including the user representative.

"...what happened with the developers themselves and the functional team was what I would expect It is a gap in project management and gap in business analysis the need and ability get down in the weeds to document that that level, for what was need is a huge challenge. "

"...I don't know that it was a communication issue. People seemed to be willing to communicate. It was just nobody could get anything done at all… did they use common vocabulary? Probably not. I mean we had a project manager who, had no familiarity with, data warehousing at all. and at first created this project plan that had nothing relevant to anything anybody was doing and then got some help from somebody who had done project management work and then had no idea what any of the tasks meant. So there was a vocabulary issue. "

"...listening versus learning. I don't feel like the project manager was learning anything. I don't feel like the business analyst was learning anything."

"...roles and responsibilities clearly understood. Not even a tiny bit. Okay. Perhaps they were understood, but they certainly not been met, and then there was nothing happening to make them be met."

The world of data is challenging and people find it hard to express what they need because much of the conversation is in the abstract. This becomes extremely complicated

when the source system configurations are in flux, which was the case as they were implementing the research administration system. The lack of vocabulary and subject matter experts further complicated the situation.

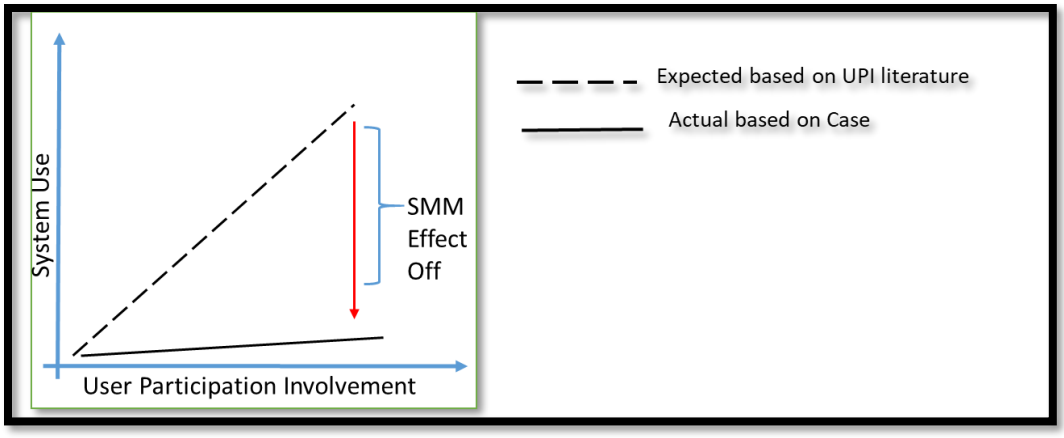
"... did the teams use common vocabulary? We tried, …. the vocabulary for the functional processes keep varying the overall award process is very technical step like processing and award or even money itself. So no, I don't think there's a whole lot of time spend getting that."

"...so when the technical teams understand what the function teams are asking for it is a beautiful thing. There were some instances of that in this project, exactly what was needed was developed. There are also instances where the functional people thought they were saying one thing and the technical team thought another or they didn't hear at all."

SMM Effect: Team members felt disconnected. Decisions were made and handed down without any input or deliberation. There was no common terminology within the team. The team also experienced role confusion between the lead developer, the business analyst, and the project manager. There was frustration among team member for lack of responsibility and decision making. The attitude towards team members degraded over time as some took no effort to learn role-related tasks. These findings and the fact that these ideas were echoed by many members of the team, clearly demonstrate weak support for H3A and H3B.

Discussion

Figure 6-8: Impact of SMM in case - RAD



As shown in the figure 6-8 above, with high UPI the theory predicts high system use. Unfortunately, we see the opposite effect in this case. The lack of role clarity, vocabulary and communication challenges, combined with some incompetent team members, frustrated many members of the team. There was a clear lack of shared mental model within team members involved in this project. This case clearly presents the evidence why empirical testing of UPI theory alone produces confounding results. High UPI in this case could not yield in the expected high system use. However, when reviewed with the moderating variable of shared mental model one can clearly explain how the lack of shared mental model moderated this relationship and negatively impacted UPI's effect on system use. So, when there is no SMM in the team, no amount of UPI can improve system use.

5.9 Cross Case Analysis

The cross case analysis assesses the effect of the shared mental model across cases to further understand the generalizability of the effect of shared mental models on the relationship of user participation and system use.

Table 8 presents a summary of user participation results from each case. Table 9 summarizes the actual System Use based on metrics collected and interview data. The cross case comparison is summarized in Table 10 and Figure 7.

Table 8: User Participation & Involvement Summary

Case ID	Overall Responsibility	User – IS Relationship	Hands on activity	Findings
A	+Design Approval	+BA Engaged with user over multiple phases of the project +Technical lead engaged with the user	+User testing +Documentation development	High UPI
B	- There were two primary groups of users. Team engaged with group 1 approval and there was limited review by group 2.	- Engage with only one user community. + Changes recommended by the community was incorporated		Low UPI
C	+ User engaged in product purchase decision +User engaged in design review/approval	+User engaged in Pilot +User sub-committees engages in feature design	+ Engaged in user testing of the product + Engaged in documentation development	High UPI
D	+ User engaged in RFP/ Product selection process + Prototype and design approval	+ Managed multiple user communities +Steering committee engaged	+ Hands on testing activities	High UPI
E	- No design sign offs	- Engaged with users to review finished project		Low UPI
F	+ Approval of budget and project designs + Frequent project updates	+ Frequent engagement with BA and user reps	+ Hands on testing	High UPI
G		+ Multiple meetings + Lunch and learn and one pager for leadership	+ 1 user testing	Low UPI
H	+ Engaged in prioritization + Release approvals	+ Multiple user groups	+ Hands on testing + Engaged in documentation developent	High UPI

Table 9: System Use Summary

ID	Case Description	System Use
A	Interaction Accounts Sharing	High[1]
B	Worker Onboarding	Medium[2]
C	Academic Learning Management	High[3]
D	COIPAT	High[4]
E	Asset Tracker	Low (None)[5]
F	Financial Need Reporting	Low (None)[5]
G	Advancement Reports	High[6]
H	RAD	Low[7]

Legend
High (66% or higher)
Medium (33% - 66%)
Low (Lower than 33%)

1- Classified usage as high because a) team has deployed this for all available data and when new data is added they are deploying it as well b) this was a risk mitigation project and the risk has not materialized or is mitigated.
2- Classified usage as medium because on average the organization hires about 1000 new employees each year, the usage reflects about 50% assuming that there is one per new employee. Some managers may have used more than one form per employee. The number still falls with the specified range.
3- Classified usage as high because all courses from student information system is now in the new tool and starting Fall 2019 all courses will be in the new tool. The legacy tool will be decommissioned.
4- Classified usage as high because we find similar levels of usage when comparing data recorded to pervious years for proposals and awards and there is no other system available for research to get approval.
5- Classified usage as low (none) because users are not using the system at all.
6- Classified usage as high because users are using reports that were developed and no additional request have been made for new reports from that department.
7- Classified usage as Low because of lower usage and usage concentrated among few individuals. This could be attributed to the complexity of the project that is preventing other users from using the feature.

Table 10: Cross Case Summary Analysis

			Shared Technology/Task Mental Model		Shared Team Mental Model	
Case (ID)	**System Use**	**User Participation**	**Technology Mental Model**	**Task Mental Model**	**Interaction Mental Model**	**Behavior Mental Model**
Interaction Accounts Sharing [A]	High	High	+ Similar to current tool/platform	+ Minor changes to existing process	+ Improved with time + Existing long term working relations + Effort on creating common vocabulary + Roles and responsibilities understood - One new team member	+ Complementary skills within team + Good collaborations
Worker Onboarding [B]	Medium	Low	+ Similar to current tool/platform + Simplistic UX	+ Keeping user perspective + Self-service approach - Lack of defined business processes - Lack of requirements or vague - Limited communication	+ Management support + Open to change + Looking for better solution - Misaligned goals - Role confusion - Limited user feedback	+ Open to feedback
Academic Learning Management [C]	High	High	+ Follows current industry standards + Similar and better UX	+ Flexible product design + Out of the box implementation + Industry wide effective practices + Standardize to lowest users	+ Effort on creating common vocabulary + Passionate team + Collaborative leadership + Keeping user prespective + Good negotiators + Agreement on shared goals - Specialized agenda - minor role challenges	+ Complementary skills within team + Shared credit + Good collaboration across teams + Moved to greater good, with time
COIPAT [D]	High	High	+ Follows current industry standards + Similar and better UX - Vendor product challenges	+ Standardized processes + Documented processes + Detail discussion on process - Organization change/shifts	+ Good team communication + Effort on creating common vocabulary + Decision at team level + Strong team knowledge & commitment + Gain trust over time - Organizational change/shift - Multiple PM	+ Aligned to goals + Pride in work + High expectations + High performers - Time constraints
Asset Tracker [E]	Low (None)	Low	+ Similar to current tool/platform - Departure from IT Recommendations - Incomplete data/functionality - Focus on speedy delivery of product	- More effort to users - Inefficient business process	- Limited user interactions - Limited communication about feature - No management support	+ Skilled team
Financial Need Reporting [F]	Low (None)	High	- New UX - Departure from IT recommendations - Incomplete data/functionality - Better capability in current tool	+ Standard industry processes + Detail requirements - Limited communication - Organizational change/shift	- Communication challenges - Dysfunctional team - No trust - Discouraged differences in opinion - Role confusion and changes - Decisions made outside of team	+ Team was eager to provide value - Team checked out - Hostile environment
Advancement Reports [G]	High	Low	+ Similar to current tool/platform +Limited changes to UX	+ Minor changes to existing process + Standard industry process	+ Existing common vocabulary + Existing long term working relations	+ High expectations + High performers
RAD [H]	Low	High	- New UX - Departure from IT recommendations	- Lack of requirements or vague - New business processes - Lack of subject matter experts - High complexity	- Misaligned goals and scope - Missing skills - Role confusion - Lack of common vocabulary	- Limited skills on team - Frustration

Shared technology mental model

Across all the cases this researcher found that having a shared technology mental model influenced system use. To complete a task one requires knowledge of the equipment's operation and the processes involved in the completion of the task. Having this shared knowledge allows teams members to perform at a superior level (Langan-Fox, Anglim, & Wilson, 2004). In cases A, G, and B, the use of existing application user experience patterns helped users to adapt to the new feature that was developed. In case G there was very limited change for users. They were used to running reports prior to the campaign and they continued to run reports from the same location. However, the reports executed were the new report. In certain cases, like C and D, applications introduced a similar but better user experience. They followed effective practices that were promoted by current tools, yet they maintained some similarities with legacy tools. These similarities acted as a bridge and helped the users transition from the old system to the new system. These finding echo recent studies that suggest mental model maintenance enhance system acceptance when replacing technology (Zhang & Xu, 2011).

In this research, the findings show evidence of change in user experience, as the experience of users in case H, had negative impact on system use. Team recommendations and collaborative decision making is very effective when the team leader does not override these recommendations. This was the experience in cases H, F and E where users were unable to use the systems effectively.

As observed in these cases, the existence of the shared technology mental models had a positive influence on user participation and system use. The effect of user participation on system use was stronger when there was a shared technology mental

model among users and team. The effect of user participation on system use was weaker when there was limited or no shared technology mental model among users and team.

Shared Task Mental Model

Task related mental model is the knowledge of the process that is required to complete the task (Cannon-Bowers, Salas, & Converse, 1993). In these case studies, this researcher encountered two types of tasks, a) the task to complete the project, and b) the business process tasks that a user would complete using the technology.

In cases A and G the new process was just a slight variation of the current process. Systems built by designers with certain business process in mind are also known as the system image (Norman, 1988). Using out of the box functionality, organizations can optimize their business processes to match that of the systems, thus acquiring the optimal business process that one can achieve using that system. Case C deployed standard out of the box features with minor tweaks to achieve the lowest common model that met needs of all parties. Documenting and producing detail descriptions of the business processes helped the team to align on the business processes as seen in case D.

Lack of requirements or vague requirements can create application development process challenges as experienced by the team in cases B, F, and H. This situation places the team in complete chaos with no understanding of how to build something to meet the users' expectations. Another factor for vague or no requirements is a lack of business processes within the business unit. In either scenario, the team has no clarity on the objective of the project and the team members are unable to generate share task mental models. Organizational change or new process introduction without proper change

management creates uncertainty among team members who become unsure of the process. This was evident in cases H, and F.

Teams need to communicate and engage in mental model building activities. Lack of subject matter experts to guide the team can impact a project as team members may not know all aspects of the business processes. There is evidence in cases E and F of developed features falling short of what was required to complete the task. If the required capability is available in the incumbent tool, then users will find it hard to switch. If the new capability adds additional burden to the user community, then users will not switch unless there are some other driving factors like audit, compliance or top management oversite.

As observed in these cases, this researcher found that the existence of shared task mental models had a positive influence on user participation and system use. The effect of user participation on system use was stronger when there was a shared task mental model among users and the team. The effect of user participation on system use was weaker when there was limited or no shared task mental model among users and the team.

Shared team interaction mental model

The team interaction mental model helps team members to set expectations of each other and know how best to interact with one another (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000). In cases A and G, this researcher found that team members had long-term working relationships, which motivated them to adjust their behavior to meet the needs of the project. Mutual respect and trust existed between these

members. Furthermore, these findings show that in projects that ran longer, such as case D, the team gained trust over time.

Communication is the fourth dimension of user participation (Hartwick & Barki, 2001). Effective communication helps align mental models (Denzau & North, 1994). Teams create documentation or list of terms to bridge communication gaps. If team members are new they can ask and acquire an understanding of the terms over time, as observed in cases A, G, C, and D. Project teams with good communication are able to produce better outcomes as noted in cases C and D. Furthermore, this researcher found that teams having poor communication were unable to produce effective results, as seen in cases E, F, and H.

Clarity in roles and responsibilities is a major factor in developing shared team interaction. When roles and responsibilities are clear projects have better outcomes, as seen in case A. However, when there is lack of clarity in roles and responsibilities, team members suffer as there is no accountability and decision making. This was observed in cases C, B, D, H, and F. Similarly, collaborative decision making in meetings promote alignment. Whereas, when decisions are made in closed door conversations, the members are un-informed and the overall project performs poorly, as seen in cases F.

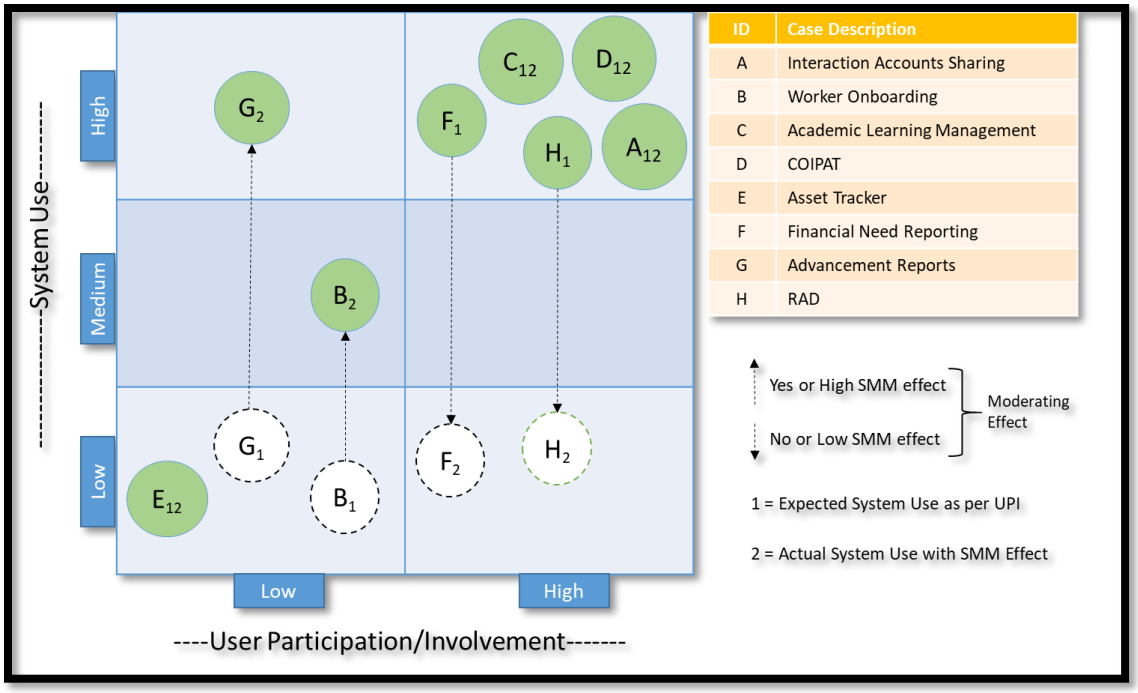
As observed in these cases, this researcher found that the existence of shared team interaction mental models had a positive influence on user participation and system use. The effect of user participation on system use was stronger when there was shared team interaction mental model among users and the team. The effect of user participation on system use was weaker when there was limited or no shared team interaction mental model among users and the team.

Shared team behavior mental model

The team behavior mental model helps team members to tailor their behavior to other team members. Collaborative attitude and complementary skills between team members allow teams to view things from different perspective, as seen in cases A, C and G. In cases B, C, and D, this researcher found members of the team to be extremely skilled in what they do. This had a positive impact on the team's performance and, ultimately, system use. However, this researcher found that teams lacking certain critical skills in cases F and H either caused the team to underperform or required other members to pick up the slack. Team dysfunction and hostile work environment, as seen in case F, are detrimental for project progress and the development of shared behavior mental models.

As observed in these cases, this researcher found that the existence of shared team behavior mental models had a positive influence on user participation and system use. The effect of user participation on system use was stronger when there was a shared team behavior mental model among users and team. The effect of user participation on system use was weaker when there was limited or no shared team behavior mental model among users and team.

Figure 7: Cross Case Illustration of SMM Effect



As observed in the cases discussed, the impact of user participation and involvement (UPI) on system use was quite inconclusive: Four of the eight cases cannot be explained by UPI as seen in Figure 7. Cases F & H experienced high UPI with low system use. Cases B & G experienced low UPI with medium and high system use. Therefore, these cases cannot be explained by UPI.

In cases A, C, & D there was high UPI and high system use. Lastly, in case E there was low UPI and low system use. These case are in alignment with our expectation of UPI. Hence, this researcher concludes that UPI by itself is not a good indicator of potential system use. These confounding findings on UPI and its impact system use are consistent with what many scholars had concluded in the past (DeLone & McLean, 1992). However, when one looks through the lens of shared mental models these anomalies can be clearly explained. In each case where system use was measured high, there was higher shared-ness of mental model among the team. And in each case where this researcher

found low system use with high UPI, there was low shared-ness of mental models. The moderating effect of the shared mental model was impactful and real.

6. IMPLICATIONS

6.1. Theoretical Implications

This study further enhances our understanding of the effects of user participation and involvement on system use. It introduces new moderating constructs of shared mental models in the study of system use. This research suggested shared mental models as a concept would help designers, and the study attempts to make this concept a reality. It emphasis the need to understand and tap into the "family-of-applications" or other applications used by users and their influence on system use. Technologists have kept themselves at arm's length from application users with the assumption that they know how to design efficient systems. Unfortunately, from the publication of the first Standish report until today, these technologists have not improved their overall scorecard on system success/usage. Therefore, now is the time to take a step back and examine how applications are being developed and how shared mental models could be incorporated in the application development paradigm to ultimately improve system use.

Incorporating the variable of shared mental model within IS empirical research is another novel aspect of this study. Research in the last 30 years has suggested that mental models could add great value to system design and enhance system usability (Carroll & Olson, 1987). However IS has been hesitant to adopt this construct due the complex and ever-changing nature of the mental model (Turner & Sobolewska, 2005). Measuring mental model alignment and the benefits of the shared mental model has been studied for many years in the area of cognitive psychology and team performance,

education, and training literature. Most studies on system use, adoption and acceptance are based on intention, which has limited number of antecedents for which action could be taken before or during system development. The model developed for this study provides antecedents to the project teams, to proactively take action on, to enhance their project outcomes. This study also underscores the importance of user involvement/ participation during application development as an essential variable to predict system use and provides an explanation of why measuring user participations/involvement effects on system use sometime yields inconclusive results.

6.2. Practical Implications

Training modifies the mental model of the user to improve adoption. With training costs skyrocketing at an exponential rate and the insatiable need for new technology to promote and differentiate businesses, organizations will be forced to seek out easy-to-use applications. This research underscores the critical role that a business user needs to play to make system use a success, not by just providing top management support or implementing policies, but by actually participating in the software development process. For long-lasting success, businesses need to optimize their business processes (unique or standard) and develop a shared mental model within their business units. This research sheds light on certain essential factors that organizations should consider before they undertake a “make” versus “buy” software decision. Decision-makers must develop a good understanding of the shared mental models within their organization and work toward supporting or modifying those models. The cost of poorly adopted systems is very expensive both from sunk costs and ongoing costs of ownership.

Practitioners in the field of technology must always keep the user's mental model at the heart of discussion, and the user's mental model should be central to all design. Furthermore, design should be egoless (Alexander, 1979), and designers should take the current trend in User Interface /User Experience and family-of-applications used within the user community into consideration when designing applications. In addition, designers should restrain from imposing their own mental model onto the user, although this might be difficult due to the reciprocal nature of communication and the mental models. By paying careful consideration to shared mental models technologists can develop systems that will be used voraciously.

Increase Shared Mental Models

Shared mental model are formed when members of a group, team or community have shared expectations. Organizations can take actions to establish SMM. Listed below are some techniques that leaders may employ.

Objective setting workshop: Prior to the start of any effort: project, initiative or engagement, organizational leader could conduct workshops that discuss the overall objective of the effort. The workshop should include leaders and members of the team. The group should engage in detail conversation on topics like goals, success criterion for the effort, roles and responsibilities, etc. The purpose is to develop a shared understanding among the team.

Business process alignment: Standardization plays a major role in improving efficiency, traceability, and measurability of tasks. By ensuring alignment in tasks associated with different business processes organizations can align their business processes to leading practices of the industry. Standardized business processes allow

team members to set a shared understanding of processes are executed within an organization, i.e. developing a shared mental model of how a task is performed and the expected outcome. Process leaders should have frequent process related meetings with their teams, such that every member of the team develops a clear understanding of the expectations for their role within the process.

Day at the shop: Technical team should be exposed to users and their environment. A day at the shop will allow the technical teams to understand the users, their persona, and the environment in which the application will be deployed. This helps the technical team to understand why certain requirement are critical for the system use. Similarly, when the application is ready to be deployed, users must be presented with a preview of how the application will transform their future operations. These exposures will help members of the team to developed shared expectations about the product.

Joint Application Development (JAD) Session: JAD sessions are joint sessions where technical teams and business users work together to develop systems features. The close and frequent interactions allow users and the technical team to develop SMM about the processes and the functioning of the system.

Select representative users: Engaging the right mix of users is critical for the development of a more accurate SMM. Organizational leaders must recognize the technical aptitude of their user community. Selecting technically savvy users to represent a non-technical user community will create SMM that are misaligned with the user community. This would force a majority of the community to engage in the building of new mental models. The objective of the team should be to maximize mental model maintenance of the user community.

7. LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

Shared mental models are ever changing and as evident in from the case studies they could hinder or speed up system use. Shared mental models' influence on system use is dependent on various factors such as prior knowledge, family of applications, life experiences, and mental model creation versus mental model maintenance, etc. The elusive nature of a mental model makes it a difficult concept with which to work. This study focuses on one organization and all teams in the cases discussed are in-house team that builds applications or configured applications for in-house use. To further expand the generalizability more studies are needed that study the moderation effect of SMM within different organizations. Furthermore, there are numerous kinds of team environments, such as 1) the offshore development (outsourcing) environment 2) the staff augmentation environment 3) 3rd party implementation vendors and more. The impact of these environments on a project team and their shared mental models is unknown. More work is needed to better understand factors that may influence application development teams' shared mental model in various environments and how they ultimately influence application use. More case studies are needed to understand the moderation effect of SMM on UPI and System Use within these blended teams. To achieve population generalizability a survey instrument could be developed that evaluates and test the model proposed in this study.

This study was conducted with an assumption that the team would like the system developed to be used. A case that violated this assumption was Asset Tracker, in which we saw clear evidence that the team was aware of limited utility of the feature developed

and took no action. Hence, a strong shared mental model had no impact on the system use outcome. The shared mental model reinforced the idea that the system will not be used, in a way the project was dead on arrival. More research is needed to understand this SMM effect and there might be other independent variables that influenced the effect of SMM.

Lastly, more research to understand the effects of shared technology mental model or shared team mental model would further refine our understanding of how and why types of SMM effect UPI and system use. This would further help practitioners to understand the value of family of applications, standard user experiences, industry practices, understand the value of users goes beyond requirement gathering and training phase, and the importance of accurate representation of user personas within an IT project team to ensure the development of a true SMM.

8. CONCLUSION

This study extends our understanding of the effect of UPI on system use. Most system development and implementation projects consider UPI a critical component of their process, however empirical research studies found confounding results on the effects of UPI on system use. The cases reviewed in this research study had similar inconsistent results if reviewed from the UPI – system use model. However, by introducing the moderating effect of SMM into the UPI – system use model, this study was able to explain all of the case results. This is an important finding, and it further emphasis the importance of UPI in system development and implementation projects. Furthermore, it gives practitioners another tool to influence system use outcomes in both system development and implementation projects. It also sheds light on why project team composition should be carefully evaluated, and why users should be engaged or embedded within the project team to ensure creation of the SMM. This study provides a perspective for leaders and change managers on how and why training works and how they can leverage SMM to influence transformation within their organizations.

This study provides valuable insights for designers and application developers on the importance of SMM and why the users' mental model is an impactful antecedent to system use. It warrants the need for users to be engaged from the beginning of a project and for designs developed to lean more towards the users' mental models. The more engagement the better for shared mental models within the team and UPI should be leveraged to influence the product design or configuration.

These research findings are based on multiple case studies from a single organization. More research is need to understand how the moderating effect of SMM

impacts different types of teams. More studies are needed to generalize the moderating effect of SMM. Developing a quantitative study would help further the generalizability of the proposed research model.

SMM is elusive, and there are limited instruments designed to capture SMM. There might be other variables that were not included in this study that could impact SMM and influence the effects UPI on system use. A variable that was not collected, identified or used in this study could explain why strong SMM did not enhance UPI's effect on system use as found in one of the case that was reviewed. This anomaly opens new avenue for future research.

SMM impact on system use is real. This study has highlighted the importance and the impact that SMM can have on system use. More research on SMM can greatly influence the field of IS and help practitioners improve system use outcomes.

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Appendix A: Semi Structured Interview Guide

Please describe your experience with the recent application development project. Describe the project and your role in the project team.

Demographic
Name
Gender
Years in the technology industry
Tenure in the company
Team size
Project name
List of applications you use other than the current application
Does this application follow industry standards or/and similar UX patterns

Also describe the following:

System Use
In your experience talk about 1. Was the scope met? 2. Did it meet your/department expectations? 3. How much of the feature do you use? 4. How much (Hours) do you use the system? 5. Is this routine or specific use?
UPI
In your experience talk about 1. Your responsibilities during the various phases of the project. 2. Your involvement in prioritization, estimation, budget, etc. 3. Your role in approvals associated with the project (Formal or Informal). 4. Your role in design, testing, documentation and training. 5. Your thoughts about the value of the system developed.
Shared Mental Models (SMM)
Technology Equipment SMM
Talk about your experience and expectation in relation to 1. The application that was built, user experience, and/or new features added. 2. Was the user experience similar to other tools you use at home or other places. 3. Any major limitation or failures.
Job and Task SMM
Talk about your experience and expectation in relation to 1. The process/task that was implemented. 2. How standard are these processes/tasks in your organization or industry? 3. Did the team discuss these processes/tasks in detail? 4. Were there any constraints. 5. Were there any task dependencies.
Team Interaction SMM

Team Interaction Patterns

Talk about your experience and expectation in relation to

1. Did the team communicate well with other members of the team?
2. Did the team use common vocabulary?
3. Did the team have good listening skills?

Team Roles, Responsibilities and interdependencies

Talk about your experience and expectation in relation to

4. The team dynamics and your expectations
5. Was roles and responsibilities understood?
6. How was decision making and problem solving when performing tasks?

Team Interaction Patterns

Talk about your experience and expectation in relation to

7. The trust among team members?
8. Safe environment to discuss issues?
9. Encourage difference in opinions?
10. Decision making is during meeting?

Team Behavior SMM

Team Knowledge and Skills

Talk about your experience and expectation in relation to

1. The team's ability to complete task assigned them.
2. Team's ability to look for different solutions.
3. Team's ability to evaluate their limitation.
4. Did the team know and agree on the shared goals of the project.

Team Attitude and Preferences

Talk about your experience and expectation in relation to

5. Your working experience with the team.
6. Did you feel that they like to work on various tasks?
7. Did the team encourage other members to improve task outcome?
8. Did the team share information and enjoy thinking?
9. Did the team take pride in their work?
10. Was the team committed to the team goals?
11. Did you feel everyone's opinions are heard?

Adapted from (Johnson, et al., 2007) (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000) (Hartwick and Barki (1994)

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DATE:	July 27, 2018
TO:	Rooji Sugathan
FROM:	University of Missouri-St. Louis IRB
PROJECT TITLE:	[1287835-2] System Usage: A Shared Mental Model Perspective
REFERENCE #:	
SUBMISSION TYPE:	Response/Follow-Up
ACTION:	APPROVED
APPROVAL DATE:	July 27, 2018
EXPIRATION DATE:	July 27, 2023
REVIEW TYPE:	Expedited Review
REVIEW CATEGORY:	Expedited review category # 7

The chairperson of the University of Missouri-St. Louis IRB has reviewed the above mentioned protocol for research involving human subjects and determined that the project qualifies for expedited review under Title 45 Code of Federal Regulations Part 46.110b. The time period for this approval expires one year from the date listed below. You must notify the University of Missouri-St. Louis IRB in advance of any proposed major changes in your approved protocol, e.g., addition of research sites or research instruments.

You must file an annual report with the committee. This report must indicate the starting date of the project and the number of subjects to date from start of project, or since last annual report, whichever is more recent.

Any consent or assent forms must be signed in duplicate and a copy provided to the subject. The principal investigator must retain the other copy of the signed consent form for at least three years following the completion of the research activity and they must be available for inspection if there is an official review of the UM-St. Louis human subjects research proceedings by the U.S. Department of Health and Human Services Office for Protection from Research Risks.

This action is officially recorded in the minutes of the committee.

If you have any questions, please contact Carl Bassi at 314-516-6029 or bassi@umsl.edu. Please include your project title and reference number in all correspondence with this committee.