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Knowledge Sharing Within IT Projects

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ABSTRACT

Even though today's corporations recognize that they need to understand modern project management techniques (Schwalbe, 2002, p2), many researchers continue to provide evidence of poor IT project success. With Kotnour, (2000) finding that project performance is positively associated with project knowledge, a better understanding of how to effectively manage knowledge in IT projects should have considerable practical significance for increasing the chances of project success.

Using a combined qualitative/quantitative method of data collection in multiple case studies spanning four continents, and comprising a variety of organizational types, the focus of this current research centered on the question of **why individuals working within IT project teams might be motivated towards, or inhibited from, sharing their knowledge and experience in their activities, procedures, and processes**. The research concluded with the development of a new theoretical model of knowledge sharing behavior, '*The Alignment Model of Motivational Focus*'. This model suggests that an individual's propensity to share knowledge and experience is a function of perceived personal benefits and costs associated with the activity, balanced against the individual's alignment to a group of '*institutional*' factors. These factors are identified as alignments to the project team, to the organization, and dependent on the circumstances, to either the professional discipline or community of practice, to which the individual belongs.

Keywords

Knowledge Sharing, IT Project Management, Theory of Planned Behavior, Motivators and Inhibitors.

INTRODUCTION

While much theory already exists on knowledge management, Alavi & Leidner, (2001, p216) argue that little empirical work has been undertaken and hence there are large gaps in the body of knowledge in this area. Despite the fact that knowledge management is becoming ubiquitous in the IT world, there is a paucity of empirical work concerned with the factors that enable its adoption (Ryan & Prybutok, 2001). The potential importance of managing knowledge for competitive advantage has been widely discussed (Nonaka & Takeuchi, 1995), with the sharing and application of knowledge being widely identified in recent years as key sources of sustained competitive advantage (Hall & Sapsed, 2005, p57). However, it is suggested by Bresnen, Edelman, Newell, Scarbrough, & Swan, (2003) that only recently has attention been specifically directed towards managing knowledge in project environments.

Many knowledge management initiatives fail because of the reluctance of employees to support KM systems such as those introduced in the form of electronic knowledge repositories (Kankanhalli, Tan, & Wei, 2005, p113). Motivation and commitment of knowledge workers is being increasingly recognized as a critical success factor for knowledge management system implementations and for virtually all knowledge management projects (Malhotra & Galleta, 2003; Davenport, De Long, & Beers, 1998). A better understanding of why individuals engaged in project teams would be motivated towards or inhibited from sharing their knowledge and experiences should have significant practical implications. The present research centers on why individual knowledge workers within IT project teams would be motivated towards or inhibited from sharing their knowledge and experiences in their activities, procedures, and processes.

Although the primary unit of analysis for the present research is the individual within a project team, it was considered necessary to also investigate characteristics of both the project team and the broader organization in which the project team operates, in order to better understand an individual's motivation or inhibition to share their knowledge and experiences. In an attempt to determine what conditions are required to create environments in which more knowledge sharing is likely to take place, together with an implicit assumption that such environments can in fact be reliably created or enhanced, the following questions are posed:

- What motivates or inhibits knowledge sharing by IT project team members?
- What are the most and least important motivators or inhibitors?

The answers to these research questions should lead to a better understanding of how knowledge might be better managed within knowledge intensive IT project management environments, thus contributing to increased chances of project success. A better understanding of motivators and inhibitors in knowledge sharing should have significant practical implications.

The complexity of problems in our knowledge society requires that problem solving activities be shared across disciplinary, cognitive, geographic and cultural boundaries (Leonard-Barton, 1995, p61). The research presented here used an empirical approach, involving multidisciplinary research subjects over a wide geographic base with diverse organizational types that exhibit a broad set of cultural characteristics. This research uses concepts from the areas of project management, knowledge management, and general management theory (with an emphasis on social psychology) in an attempt to provide a more holistic view of an opportunity (or problem) confronting everyone concerned with creating sustainable value in our knowledge society.

The data collection approach chosen was one of multiple case studies. The research involved participants from Australia, America, Asia, and Africa and included government and quasi government organizations, a large multinational corporation, an entrepreneurial development company, a banking conglomerate, a privately owned organization supplying IT maintenance services to a national oil company and a government owned IT services organization. The projects that these diverse organizations had been undertaking were also diverse, and included standard operating environment installations, robotic warehouses, knowledge management system analysis, software system upgrades, IT maintenance services and new system developments.

Research on motivations to share knowledge already conducted has generally either been very narrowly based (Bock & Kim, 2002; Brink & Van Belle, 2003; Disterer, 2001) or related to only one specific motivator or inhibitor (Constant, Kiesler, & Sproull, 1994; Kolekofski & Heminger, 2003; Ryu, Ho, & Han, 2003). The present research sets out neither to investigate one specific issue relating to motivations to share, nor limits itself to one specific environment.

The research not only answered the question of what are the most and least important motivators and inhibitors for knowledge sharing, but it also led to the development of a new theoretical model—*'The Alignment Model of Motivational Focus'*. This model provides the most significant contribution of the current research.

Due to space limitations this paper will concentrate on the quantitative findings.

RESEARCH APPROACH

A comparison of previous exploratory studies with a review of the literature (Jewels, 1999, 2002, 2003; Jewels, Baker, & Underwood, 2003; Jewels & Berger, 2005; Jewels, Partridge, & Underwood, 2003; Jewels & Underwood, 2003, 2004; Jewels, Underwood, & de Pablos, 2003) had indicated that the propensity to share knowledge could be divided into motivators and inhibitors together with external variables that were unrelated to an individual's willingness to share. It also appeared that the various motivators and inhibitors could be split into both extrinsic and intrinsic forms:

- Motivators — Extrinsic and Intrinsic
- Inhibitors — Extrinsic and Intrinsic
- External Moderating Variables — perceived power and control beliefs

It was evident from these previous studies that no suitable instrument was available for quantitatively measuring these possible motivators and inhibitors. A decision was subsequently taken to construct a new survey instrument that could specifically address the issues being investigated—one that would measure the relative importance and interrelationships of identified knowledge sharing motivators/inhibitors. A model of how multiple constructs relate to a principal effect, i.e. individual propensity to share, also needed to be developed.

The theory of planned behavior (TPB) (Ajzen, 1985, 1991) has been used extensively to predict and explain behavioral intention and actual behavior in the fields of social psychology, marketing, and information systems (Lin & Lee, 2004). This theory contends that the intention to behave in a certain manner results from an individual's attitudes towards the behavior, their subjective norms, and their perceived behavioral control over an outcome. These ideas were used to develop a new model that includes motivator and inhibitor constructs, which do not occur in Ajzen's model. The new model is presented in **Error! Reference source not found.** and also shows the limitations of this research, with the dotted rectangle indicating that it was only intentions to share and not the behavior itself that was being investigated.

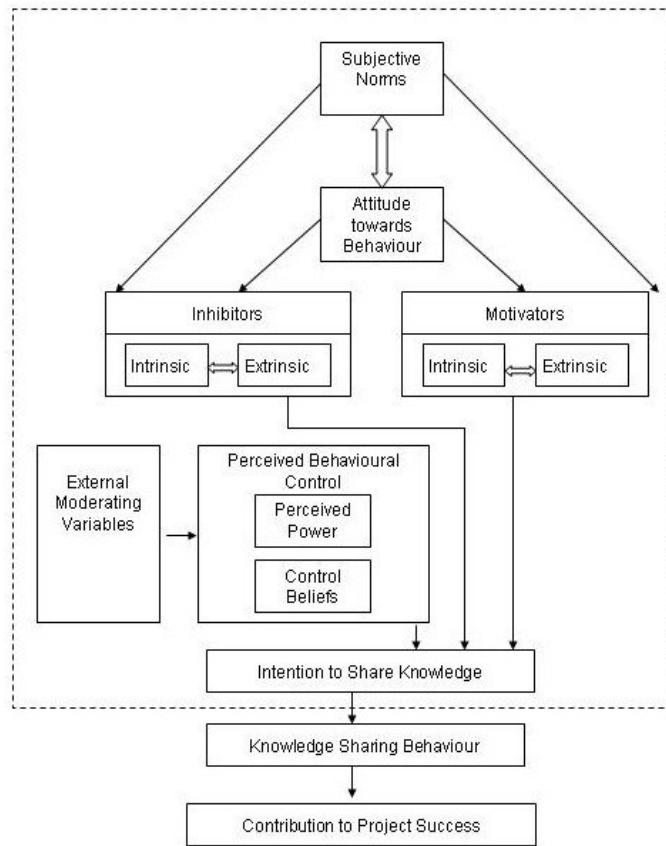


Figure 1. Research Model Based on Theory of Planned Behavior

As can be seen from **Error! Reference source not found.**, subjective norms and attitudes towards behavior can provide both inhibitors and motivators in intention to share knowledge. Further, external moderating variables can lead to perceptions about behavioral control, which also influence intention to share. Aligning with this model, two-part questions attempted to identify two conceptually independent factors which interact together to determine intention, i.e. attitude towards possible individual motivators/inhibitors to a behavior and the strength of subjective feelings (norms) of the importance of that attitude. Observations from both the exploratory case studies and the literature review indicated that there were likely to be local external factors in particular project environments that might only be applicable to that one project environment and might never be applicable to others. Regarding external moderating variables, only questions relating to the availability of resources were considered in the survey instrument. Attempting to include all these types of identified external factors would have made any survey instrument unwieldy and unjustifiably onerous to complete. Instead, these external factors were believed to be best identified by using a non-participatory observation approach coupled with convergent interviews. This paper presents only the results of the survey instrument responses and thus the qualitative findings will not be presented here.

From the exploratory studies and literature review, nine knowledge sharing constructs were identified which formed the foundation for the survey instrument (see Jewels, Underwood, & Ford, 2005; Jewels, Underwood, Gregor, & de Pablos, 2004 for detailed discussions of how these constructs were identified). These constructs are presented in Table 1.

Table 1 Original Constructs Derived from Exploratory Studies and Literature Review	
C ₁	Financial reward
C ₂	Project success

C ₃	Value of knowledge
C ₄	Expectations of sharing
C ₅	Learning more
C ₆	Higher esteem
C ₇	Job security
C ₈	Personal status within team
C ₉	Available Resources

Between 2 – 4 sets of two-part individual questions were then created which would be able to test propositions based on the identified individual constructs, (Ajzen, 1985; Fishbein & Ajzen, 1975).

The survey instrument thus consisted of 54 questions using a 5 point Likert scale to measure responses with the questionnaire divided into 2 sets, taking the form:

- I believe that sharing my personal knowledge and experiences in projects will increase the chances of success of my future projects (requiring responses ranging from the extremes of strongly agree to strongly disagree)
Strongly agree [] Agree [] Undecided [] Disagree [] Strongly disagree []
- Wanting to be successful in future projects is important to me (requiring responses ranging from the extremes of very important to unimportant)
Very Important [] Important [] Moderately Important [] Of little importance [] Unimportant []

Research Participants

Table 2 shows details of the organizations involved in both the exploratory and main case studies. Case study organizations were carefully selected to address the potential problem of generalizability; the choice of research participants purposely involving a disparate range of knowledge intensive industries in different organizational forms across a wide geographic boundary. These cases spanned four continents and represent disparate organizational types.

Table 2 Research Participants			
Organisation Name	Principal Business	Location	Type of Research
Tarong Energy	Electricity Generation	Tarong, Wivenhoe & Brisbane - Queensland	Exploratory
Ditchbrook ASRS Pty Ltd	Robotic Automated Stock Retrieval Systems	Rocklea - Queensland & Taoyuan - Taiwan	Exploratory
Corporate Services Agency	ASP to state government depts.	Brisbane - Queensland	Exploratory
Associated Banks of South Africa	Banking services	Pretoria – South Africa	Main Study
State Information Technology Agency	Public sector IT Services Provider	Johannesburg – South Africa	Main Study
Boeing	IS System Provider	Brisbane - Queensland	Main Study
Phantom Works (Boeing)	System Provider	St Louis - Missouri	Main Study
Ledder Enterprise Sdn. Bhd.	IT Support Services	Miri - Sarawak	Main Study

Main Case Study Data Collection

The number of individuals from each organization who responded to the survey ranged from 5 to 24: 20 for Boeing (MIS), 5 for Phantom, 24 for Ledder and 11 for Associated Banks of South Africa together with the State Information Technology Agency of South Africa. These last two cases were subsequently combined into what was renamed the 'South African Case'. This represented a response rate of approximately 35%. In carrying out the research, quantitative data was obtained through the survey instrument. As well as providing a quantitative component, the survey instrument itself also provided the foundation for interview questions posed, in what started as semi-structured interviews but which took on a more convergent interviewing approach (Dick, 1990) whenever responses indicated further examination in a particular area was necessary. The main case studies therefore used a combination of three research techniques:

- survey responses
- interviews
- participant observation

Because this research was geographically distributed it was, except for the Boeing MIS case, impractical to revisit a participating organization for follow up interviews or additional participatory observations. The reality of obtaining what was in essence only a 'snapshot' in each case, must by its very nature limit the validity of these findings. It would have been more advantageous if each of the cases had contributed equally to each of the three types of research technique adopted, but this was a practical impossibility. In what was the most intense interviewing and participatory observation case (Phantom Works), the survey responses were disappointingly low. On the other hand, the case that had contributed the most survey responses (Ledder), because of the remoteness of their operations, contributed the least in participatory observations.

FINDINGS

Quantitative Analysis

One would assume that responses to questions intended to measure a particular construct would be correlated, if they were, indeed, measures of the construct. One possibility would have been to have used a Confirmatory Factor Analysis, but this was deemed inappropriate as there were only 60 subjects. Instead, to determine whether the questions were measures of the same construct, a bivariate correlation was performed on the combined survey responses from all the main case studies. Using a Pearson correlation coefficient with a two tailed test of significance, it was found that for some of the constructs the questions were significantly correlated with each other, while for others they were not. The question groupings relating to these constructs were subsequently reviewed.

The following five original constructs were able to be retained, although their question groupings were modified.

- Financial rewards (C_1)
- Value of knowledge (C_3)
- Expectations of sharing behavior (C_4)
- Status within team (C_8)
- Available resources (C_9)

The question groupings were now such that the questions for each of these constructs correlated highly ($p < 0.01$).

The remaining four constructs could not be retained:

- Project success (C_2)
- Ability to learn more (C_5)
- Higher esteem (C_6)
- Job security (C_7)

In reviewing the correlations for the questions for the four constructs where the original questions did not correlate, it was found that a different grouping suggested four revised constructs. The lack of correlation between the questions relating to project success (C_2) had been particularly disturbing, as the literature and qualitative data had both strongly pointed to this

issue as being an important motivator for sharing. It was fortunately discovered that the revised question groupings relating to project success did in fact address the issue of success, but in three separate forms, resulting in the three revised constructs that related to:

- Personal success
- Team success
- Practice success

Furthermore, a high correlation ($p < .002$) between the questions relating to influencing decisions and the need for autonomy in making decisions contributed clearly to another construct relating more to an individual’s influence beyond the scope of the project. A distinction could then be made between the individual’s perceived status within the project team construct (C_8) and a revised construct that relates more to the individual’s organizational influence:

- Organisational influence

The final nine constructs, along with a listing of those not used are presented in Table 3.

Table 3 Revision of Constructs after Correlation Analysis		
Original Construct	Revised Construct	#
Financial reward	No change	C_1
	Team success	C_2
	Project practices	C_3
Available Resources	No change	C_4
Value of knowledge	No change	C_5
	Personal success	C_6
Personal status within team	No change	C_7
Expectations of sharing	No change	C_8
	Organisational influence	C_9
Job security	Not used	
Higher esteem	Not used	
Ability to learn more	Not used	
Project success	Not used	

Having obtained measures on each construct for all the individuals in the five case studies, repeated measures analyses of variance were performed on the mean scores for each case study. The question now to be answered was ‘**What are the most important and least important constructs?**’ The results showed that there were significant differences between the constructs for all main case studies:

$F(8,152) = 26.4, p < .001$, for Boeing; $F(8, 184) = 21.5, p < .001$ for Ledder; $F(8,80) = 10.195, p < .001$, for South Africa; and $F(8,32) = 2.6, p < .05$, for Phantom. Mauchly’s test showed that the assumption of sphericity was not violated in any of the cases. Post hoc pairwise comparisons of the means for the constructs were performed using Bonferonni’s correction for the number of comparisons. Using these pairwise comparisons it was possible, for each case, to determine the most important and least important constructs. The resulting groupings are shown in Table 4.

Table 4 Most important and least important constructs		
	Most important constructs	Least important constructs
Boeing Aust.	8, 3, 2, 5	7, 1
Ledder	3, 8, 4, 2, 9	7, 6, 1
South Africa	3, 5, 8, 2	1, 4
Phantom	2	7

For Boeing, Ledder, and South Africa, the constructs listed as most important differed significantly from those listed as least important, and constructs listed within one cell, that is, 'most important' or 'least important', did not differ significantly from each other. For Phantom, the case with the least number of subjects and thus the least power, the highest and lowest scoring constructs were not significantly different from other constructs, but they were the extremes and were almost significantly different from each other, with $p = .068$.

It is clear that team success (C_2) is a very important construct, appearing in the most important list for all four cases. Likewise, contribution to project practices (C_3) and expectations of knowledge sharing (C_8) are also important, being in the top three constructs for 3 cases. Value of knowledge (C_5) is also important, being particularly important for both Boeing Australia and South Africa. It is clear that financial rewards (C_1) and perceived drops in status (C_7) are considered to have the least impact on an individual's intentions to share knowledge.

DISCUSSION

The level of consistency in what were considered the most and least important constructs is remarkable. The survey respondents came from organizations in four different continents with quite different cultures and yet there is great agreement in what they see as motivators or inhibitors to knowledge sharing. The consistency shows that knowledge workers in very different cultures have such similar views to motivation to share knowledge, and it also supports the reliability and validity of the constructs themselves: the constructs are seen as differentially important and their differential importance is shown in four different cultures. The two constructs that were found to be least important were classified as personal extrinsic motivational factors and these findings confirm the general view in the literature that knowledge workers are less likely than traditional workers to be motivated by extrinsic rewards. The conclusions are that *individuals are not motivated towards sharing knowledge and experiences by the promise of financial reward nor are they inhibited from sharing knowledge and experiences if they believe that their status would decrease*.

In the most important construct list, there was a clear indication that team success was strongly linked to propensity to knowledge share, with all four case studies confirming that *individuals are motivated towards sharing knowledge and experiences if they believe that it will contribute to team success* (C_2). The attitude shown towards contributing to project practices (C_3) was ranked highly for all four cases. This construct clearly has a high impact on propensities to share knowledge, thus strongly suggesting that *individuals are motivated towards sharing knowledge and experiences if they believe that it is likely to contribute to project practices*. The belief that knowledge sharing would be expected from individuals (C_8) was also ranked high in all four cases, thus suggesting that *individuals are motivated towards sharing knowledge and experiences if they believe that it is expected of them to do so*.

The low importance of the availability of resources to share construct (C_4) was in the South African case clearly matched by a correspondingly high importance for the value placed on knowledge construct (C_5). In each of the other three cases there appears to be the same type of 'trade-off' for these two constructs. If one construct is considered moderately high then the other is considered moderately low, the higher one construct the lower the other appears in ranking. This relationship is not simply one of negative correlation, as in one case (Ledder) the rankings are reversed from the other three cases.

It seems probable that the importance of these two constructs might depend largely on local environment issues and that each may be a function of other factors present in either the organization or even in the project team itself. Logically it might also be argued that the two constructs are related to each other, as an organization (or project team) that values knowledge might also be more likely to provide resources to assist individuals to knowledge share. The exact nature of this relationship is still unclear given the scope of this research although the findings would indicate that *individuals might be inhibited from sharing knowledge and experience if they believed that the knowledge sharing act is not valued enough for resources to be provided for the knowledge sharing act*. Alternatively *individuals might be inhibited from sharing knowledge and experience if they believed that resources are not provided for the knowledge sharing act because the knowledge sharing act is not valued*.

The Alignment Model of Motivational Focus

Each of the case studies provided quantitatively strong evidence of common knowledge sharing tendencies, ultimately to be confirmed by the qualitative findings. Kolekofski & Heminger, (2003) suggested that the role that attitude and beliefs play in influencing intentions to share information may be more complicated than they originally thought. Their suggestion appears to have been confirmed by this research.

The literature has suggested that both motivators and inhibitors to knowledge sharing could be segregated into extrinsic and intrinsic factors. Based on this indication, the original theoretical model had intrinsic and extrinsic factors embedded within separated motivators and inhibitors. Synthesizing the results of this study through a careful analysis of the collected data, it is concluded that the original theoretical model appears not to adequately represent an individual’s motivators and inhibitors of intentions to share knowledge in IT project teams. The research findings indicate that a different orientation of the factors contained within the original model might contribute to a more accurate theoretical model of intentions to share knowledge.

While the revised constructs could still be used in the original model, the combination of constructs which were ultimately developed in this research seems to have provided new insights that the literature has not yet adequately addressed. This prompted the researchers to investigate whether the constructs might be somehow linked, rather than acting as stand alone factors. Although each individual case provided slightly different perspectives, there was a reasonably clear indication from the need for the revised constructs that for people, there is segregation between motivational areas - individual, team, organization, and professional practice. The final nine constructs can be seen to align to four motivational focus groups:

- Personal motivations (combinations of intrinsic and extrinsic)
- An individual’s project team.
- An individual’s organization.
- An individual’s professional discipline or community of practice.

The way in which each of the constructs can be aligned to one or more of the four motivational focus groups is shown in Table 5.

Table 5 Constructs Aligned to Personal & Institutional Factors		
	Construct	Motivational Focus Alignment
C ₁	Financial reward	Personal
C ₂	Team Success	Project team
C ₃	Project practices	Professional practice
C ₄	Available resources	Organisation
C ₅	Value of knowledge	Team/Organisation
C ₆	Personal success	Personal/Team/Organisation
C ₇	Personal status within team	Personal
C ₈	Expectations of sharing	Team/Organisation/Pro. Practice
C ₉	Organisational influence	Personal

A new theoretical model is named “**The Alignment Model of Motivational Focus**”, and suggests that an individual’s motivation (positive and negative) for their intentions to share knowledge and experience is a function of four identifiable factors. The model can be illustrated by the simple function:

f_n (personal motivations, team alignment, organizational alignment, professional practice alignment) = propensity for intention to share knowledge.

As this research never attempted to extend beyond the intention stage, a useful area for future research might be in comparing intentions to share with actual sharing behavior. Applying the Alignment Model of Motivational Focus in other case studies will further validate the model as an indicator for propensities to share knowledge.

CONCLUSIONS

Those naïve enough to believe that there is some type of a silver bullet, a term applied by both Brooks Jr, (1987) and O'Connell, (1996), or who believe that a simple formula exists for determining propensities to share knowledge, will be somewhat disappointed by these research findings. As Kalling & Styhre, (2003, p21) admit, the management of intangible assets is always susceptible to processes that are indeterminate or not fully known, as knowledge management is a highly contingent phenomenon. A better theoretical understanding of how professional knowledge workers might develop attitudes towards sharing their most important resource (knowledge) would appear to be significantly important. The future of knowledge management may in fact lie not in debating ontological, epistemological or political perspectives but in determining how it may be embedded into modern management practices.

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