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Workshop Proceedings

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AIS Special Interest Group on Information Technology Project Management

Contents

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WORKSHOP WELCOME

Welcome to the AIS Special Interest Group for Information Technology Project Management's 3rd International Research Workshop on IT Project Management (IRWITPM 2008). This year's workshop includes nine high quality completed research papers as well as six research-in-progress papers. It is my sincere hope that this year's workshop will continue to facilitate the exchange of ideas between IT project management researchers, educators, and practitioners from around the world and provide an opportunity for us to renew and extend our network of IT project management colleagues.

I would like to take this opportunity to thank the workshop authors, 29 reviewers, participants, organizers, and sponsors. Without these individuals, this 3rd annual meeting would not have been possible. Thank you again for engaging with this AIS SIG and hope you continue to participate in its activities.

Deepak Khazanchi, University of Nebraska at Omaha, Founder and SIGITProjMgmt Chair

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IS Project Success: Evaluating Beyond 'On Time and To Budget'

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ABSTRACT

There is considerable uncertainty about what to evaluate in IS projects and how this might be undertaken. Recent attention to the value that projects add to organisations indicates that evaluation at project closure needs to move beyond simplistic measures of 'on time and to budget'. This paper argues that formal evaluation is an important aspect of IS project management and describes the evaluation activities undertaken for a project to develop a prototype web-based portal. The paper contributes to IS project management in the following ways: it sets out key dimensions for evaluating IS projects, presents an evaluation framework constructed for the characteristics of the project, and provides details of the application of the evaluation framework.

Keywords

Project evaluation, IS project success, project management, knowledge systems.

INTRODUCTION

Evaluating an IS project builds on concepts from both project management and information systems (IS). In the project management literature, typical measures of project success rest on the three pillars of time, cost and scope and formal evaluation plays a minor role in determining success. In the Project Management Body of Knowledge (PMBOK) (PMI 2004), for example, the Closing Out process focuses on administration and contract closure rather than evaluation. However, as projects are increasingly used to manage organisational activities, evaluation of projects is becoming more important. This is evident for IS projects, whose contribution to organisational strategy and operation is receiving increased attention (Jones and Hughes 2001; Klecun and Cornford 2005). There remains considerable uncertainty about what to evaluate in IS projects and how this might be done, so that evaluation at project closure moves beyond simplistic measures of 'on time and to budget' to examine whether the project has added business value.

These issues are addressed through a rich case study of the evaluation undertaken at the end of a project to test the Proof of Concept of a web-based portal to support knowledge management in the Australian Army. The project was part of a major, organisation-wide initiative to shift the organisational culture to one appropriate for the modern information age and so was important not just for the deliverables produced but also in its contribution to this initiative. The project raised the issue of what should be evaluated in an IS project; the authors dealt with this problem by constructing an evaluation framework that addressed both usability and usefulness from potential users' point of view as well as the knowledge processes that underpin a knowledge management system.

The paper is structured as follows. Project success in the project management literature is discussed through comparison of traditional views evident in the PMBOK and broader views that reflect the role of projects in enacting organisational strategy. Next, an overview of evaluation in IS projects is presented. The context of the portal project is then outlined, including the organisational strategy of which this project is a part. The evaluation framework devised by the authors is explained and the evaluation process is described along with its outcomes. The implications of the project evaluation for the project and organization are discussed and the paper concludes with areas for future research.

BACKGROUND

Traditional indicators of project success are conformance to cost, time and scope constraints (Maylor 2001; Schwalbe 2004; Winter and Szczepanek 2008). The increasing 'projectification' of organisations—where work is

undertaken through multiple, often inter-related projects—has led to broadening of the type of projects undertaken (Soderlund 2004) and consequent re-evaluation of these indicators. Projects can be viewed as value creation processes (Winter and Szczepanek 2008), change management programs (Maylor 2001), and as ensuring excellence, continuous improvement and delight for the customer (Maylor 2001). Cooke-Davies (2008) argues that organisations undertake projects to achieve business strategy. Thus, corporate strategy and goals are translated into projects. Each individual project delivers products that are exploited in order to derive organisational benefits that, over multiple projects, achieve the organisational strategy, as shown in Figure 1.
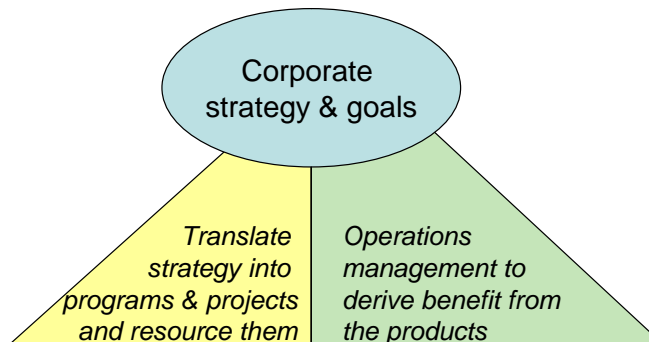
Figure 1 Relationship of projects to overall organisational strategy (Cooke-Davies 2008:248)

Despite the importance of projects in adding value to organisations, this view has not yet become a part of orthodox project management. The PMBOK (PMI 2004) still reflects the old view that projects aim to deliver "on time, in budget, to scope". At present, detailed specification of evaluation of the project outcomes is a significant omission from the PMBOK. Indeed, the term 'project evaluation' is not in the index of the PMBOK. The PMBOK pays little attention to the early, initiation phases of projects and so contains few references to organisational or project strategy, project definition and value management (Morris 2008). This separation of project definition, where linkages with business performance are established, from other project management activities can be catastrophic if one views the focus of project management as "delivering business benefits through projects" (Morris 2007: 194).

In contrast, organisational strategy and benefits management do receive attention in other project management approaches such as PRINCE2 and the APM PMBOK that includes a 'post-project evaluation' process (Morris 2007). Evaluation takes place throughout a project as well as at its end. Post-project evaluation provides a 'big-picture' overview that assesses the extent to which project aims have been achieved, from the viewpoint of certain stakeholders (Morris 2007); it also encourages organizations to learn from their experiences (Frame 2007) In such circumstances, evaluation is crucial to the concept of 'project success'.

These tensions are evident in evaluation of IS projects. Currently in IS there is "little agreement on the essential role of evaluation, a 'best way' to evaluate, on what and how to evaluate, whom to involve and within what paradigm to proceed" (Klecun and Cornford 2005: 229). Evaluation of IS projects to demonstrate effects and benefits are rarely undertaken (Jones and Hughes 2001; Klecun and Cornford 2005). When undertaken, evaluation tends to focus on technical aspects such as reliability, performance, usability and cost-benefits. Typically, the broader aspects of organisational value arising from IS projects are ignored. This may be because of practical difficulties such as identifying the breadth of costs and benefits beyond simplistic financial terms. Consequently, there has been interest in qualitative and interpretative evaluation approaches to examine the softer aspects of IS projects (Farbey, Land and Targett. 1999) as well as acknowledging temporal issues arising from users' appropriation of technology (Fidock, Carroll and Rynne 2008). Key dimensions of evaluation of project success can be derived from the five 'W's and H': who, what, when, where, why and how (Couger 1996:35). Thus evaluation may include:

- who evaluates and is involved in the evaluation process?;

- what is evaluated? If an information system is an ensemble of technology, people, processes and other resources (Kling and Scacchi 1982), then what aspects of this ensemble are evaluated?;

- when does evaluation occur: during, immediately at the end, or some time after the completion of the project? (Morris 2007);

- where does evaluation occur e.g. in a laboratory or in everyday use context?;

- why are we evaluating? What is the point of the evaluation and what will be done with the findings?; and

- how will the evaluation be undertaken, for example using what tools to produce quantitative, qualitative or both kinds of data?

Combinations of these dimensions can be applied to particular projects; for example, an important aspect of IS project success is user satisfaction (who) that relates to the usability of a system interface and the usefulness of the functionality provided by the system (what) (Davis 1989).

Thus, building on Figure 1, an IS project may be undertaken to provide business value ('benefit') as part of implementing corporate strategy and goals. The 'Project to deliver' arrow can be renamed as 'IS project to deliver' that requires effective project management including robust and targeted evaluation activities. This leads to IS Project Success that encompasses both developing the required product (system) and/or process change along with organizational learning (about the project, its outputs and impacts on organizational strategy). IS Project Success is a necessary part of achieving organizational benefit (from this project) and implementing corporate strategy and goals (from multiple projects), as shown in Figure 2. This paper argues that it is appropriate evaluation activities that link the IS project to the wider organizational environment and so ensures that the value or benefit to the organization is identified.

| IS Project to deliver | = | Effective Project Management including Evaluation | → | IS Project Success: •Product/process change •Organisational learning | → | Organisational benefit Implementation of corporate strategy & goals |
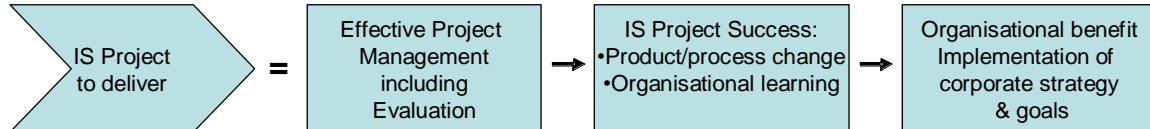
Figure 2 'Projects to deliver' decomposed for IS projects

CONTEXT OF THE PROJECT

Cooke-Davies (2008) indicates that multiple projects may work together to implement strategy. The case described in this paper is such a project: it is one part of an overall organisational strategy to update the organisation through, among other initiatives, a focus on knowledge management. The organisation involved is the Australian Army. The context of the army's core business, warfare, has changed from state-on-state warfare to new strategic contexts and priorities, driven in part by enemies such as terrorists and militia who are not readily identifiable and employ unconventional weapons and tactics (Fidock et al. 2008). Change is therefore necessary but can be difficult to implement in highly hierarchical organisations such as armies (Macredie and Sandom 1999).

The Australian Army is responding to these challenges by investing in new technologies, introducing substantial structural and cultural reforms and further developing its people (The Australian Army 2005). A series of initiatives is underway to identify more effective ways of managing knowledge as part of shifting the Army to a learning organisation. Such a shift involves changes in culture as well as processes, technical infrastructure and tools. The development of a technology-based knowledge domain was proposed as a way of providing improved access to and sharing of knowledge within the army (The Australian Army 2007).

The ultimate aim is to bring distributed knowledge sources into a central domain, to be known as the Army Knowledge Domain portal. The vision is for a configurable portal that can be tailored for individual users' needs and preferences; the portal will provide access to the internet, internal defence networks and overseas knowledge sources (such as from defence forces of allies). It is acknowledged that this is a long-term vision. A Proof of Concept trial

was proposed that focused on one area of army knowledge called Doctrine that is the Army's explicit, more-enduring and higher-level knowledge that has been formally evaluated and is currently provided in hard-copy form (The Army Learning Model 1 August 2006). A project for the Future of Doctrine (FOD) trial commenced in June 2006 to support modernisation of Doctrine (its development. production and dissemination). The trial aimed to refine requirements, systems and concepts relating to knowledge management in the army and so reduce the risk of a full-scale implementation of the Army Knowledge Domain (AKD). The project to develop an AKD prototype portal – also known as the FOD trial – specified major tasks were creating a classification or ontology of knowledge elements, resolving any technical issues, production of multimedia and simulation content and change management initiatives. Technical risks were believed to be low (because portals are well-proven in commercial contexts and existing technologies (including COTS) can be used). In contrast, non-technical risks were high because the project entailed significant culture change. The FOD trial would be Phase 1 of the implementation of the Army Knowledge Domain, ongoing until the end of 2012.

A project team was created. The project manager was an officer with 10 years background in instructional systems design/training development. Due to the posting cycle of the Australian Army, the project manager and project sponsor were due for new postings towards the end of 2007, so the project had a hard end-date that was not negotiable. The budget was set. The project manager was supported by a project assistant and an IT team comprising civilian technology specialists. The head of the IT team had 25 years experience in IT and was supported by two long-term IT workers, an ex-librarian who is a 'content custodian' of knowledge sources and a young technical assistant. All except the project manager worked part-time on this project. Initially much work was undertaken on the ontology of knowledge elements that was later abandoned. A range of issues arising from the breadth of project scope, diversity of systems that are knowledge sources as well as political issues presented by the IT workers meant that the scope of the project was progressively reduced.

The AKD prototype portal was developed using a combination of open source software (AJAX) and commercial off-the-shelf technology. The in-house IT team used AJAX to develop a web portal that would accept feeds from various repositories. The search technology was provided via a commercial search interface called Retina, developed by Autonomy who specialise in 'meaning based computing'. Such an approach is valuable for knowledge management, particularly searching unstructured data. Thus the AKD prototype was composed of two distinct components accessed via a web browser: the prototype portal (developed in-house, that provides access to stored data) and Retina (for search and information retrieval). Two separate knowledge sources, the Army Doctrine Electronic Library (ADEL) and Army Knowledge Online (AKO), were accessed by these two prototype components. ADEL provides access to Doctrine and the AKO to less formalised content.

EVALUATION

Conceptual model

This paper reports on the evaluation undertaken at the end of the project; the evaluation report produced by the authors was one of the final project activities, submitted in November 2007. The project was completed on time and to budget. The FOD trial aimed to develop a prototype web-based portal and changes to the Doctrine knowledge processes to support learning in the Army. Given the significant culture change involved in the organisational strategy, gaining user acceptance of the AKD prototype in terms of usability and usefulness (Davis 1989) was especially important. The authors constructed an evaluation framework composed of four main elements as shown in Figure 3:

- Interface. A user interacts firstly with the graphical user interface (GUI) that represents the functionality provided by the system to the user. It is traditionally evaluated through the concept of usability (Preece, Rogers and Sharp 2002). The GUI of the AKD prototype should enable users to "access, search and retrieve data in a simple and logical manner" (Preliminary use case specification March 2007). For some users, access to the portal was likely to be sporadic, while undertaking a course or updating knowledge, and so usability is important; others, such as instructors and doctrine staff are likely to access it on an ongoing basis. However, the GUI is only the gateway to the required data: the user looks through the GIU to the other prototype components.

- Search. The key functionality provided by the prototype relates to the facility of the search engine that is reflected in the speed, relevance and completeness of the data retrieved and the way it is presented in the GUI. Together, the Search functionality and data constitute the main elements of usefulness for users.

- Data. The prototype portal was required to bring together some of Army's disparate range of knowledge sources into one place. The requirements were developed in the context of existing systems that provide stove-piped access to Army's knowledge. That knowledge is primarily drawn on to support training and education. Thus, both access to these data and the quality of the data retrieved are important (e.g. the most up-to-date Doctrine).

- Knowledge processes. The data are the outcome of a complex series of knowledge processes where lessons are collected (e.g. from sites of warfare), analysed and added to Doctrine. Changes to knowledge processes are part of the overall organisational change strategy. However, initial aims to deliver new technology and cultural change were adapted given limited time and resources allocated to the project so that, in the end, only the success of the technological change was evaluated, although participants in evaluation activities provided valuable input to possible avenues for process and ultimately cultural change.
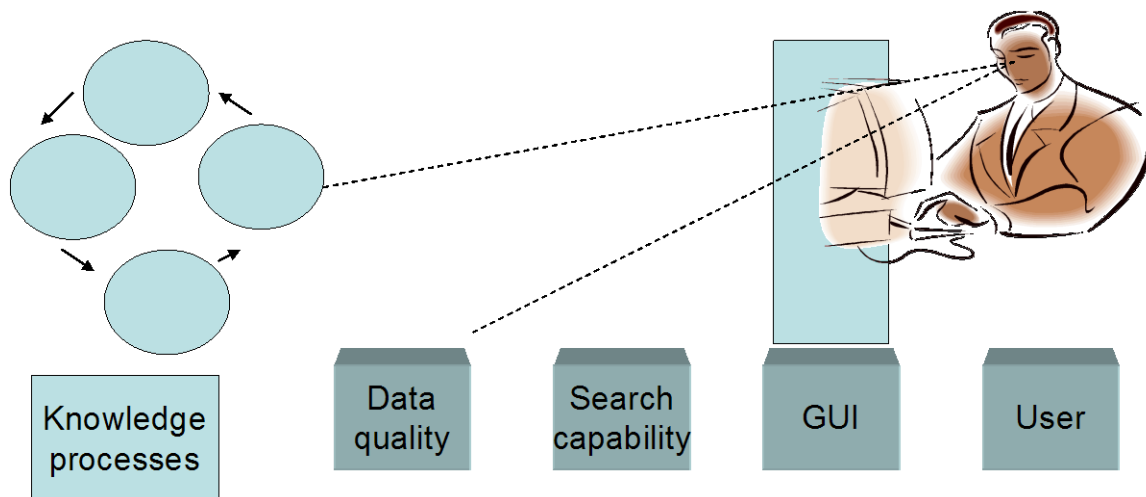
Figure 3 The evaluation framework

Evaluation process

A multi-method approach was employed that included contextual interviews, group discussions, questionnaires, workshops, laboratory experiments, observations, video screen capture of system usage, notes from discussions and documentary evidence (Fidock et al. 2008). This paper reports on the three evaluation activities.

Two evaluation workshops were held in 2007, each lasting for two days and involving a total of 15 participants. These workshops were designed to give participants an opportunity to explore the prototype and to compare this to existing systems. Participants used the AKD prototype to complete a series of tasks typical of those undertaken as part of learning and work-related activities. ADEL, an existing system, was the main point of comparison since it is used extensively by Army personnel to support their learning needs, and because the initial requirements for the AKD prototype had been influenced by this system.

GUI

The prototype interface provided access to Doctrine via a series of tabs along the top of the interface, as well as via a tree structure in the left frame (Figure 4). In addition, an XML viewer to support user access to selected content was included in the centre frame. The prototype also allowed users to click on words highlighted in italics to see the definition, presented in the right frame. The bottom frame was reserved for listing the 10 most related information sources as identified by enterprise search technology developed by Autonomy. However, this functionality was not enabled. Access to this search technology was provided via a dialogue box at the top of the page.
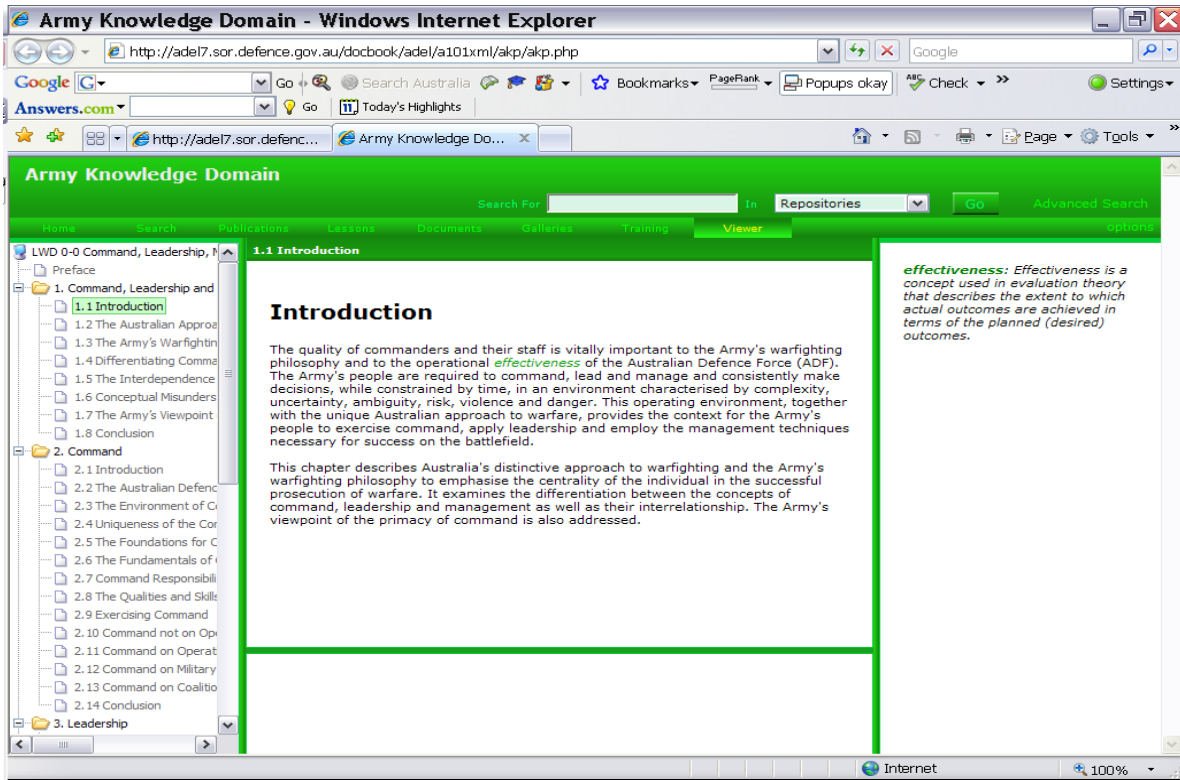
Figure 4 The prototype portal

Participants' impressions of the prototype's GUI were captured. The project manager demonstrated the prototype as well as five similar system so that participants could compare the AKD prototype GUI with other knowledge management systems. The other interfaces were Retina, an alternative screen design for the prototype portal that was mocked up by a professional designer, an American army portal, ADEL and the AKO. Participants were asked to rank order the different interfaces and provide comments relating to use of colour, layout, use of space, and so on. Table 1 shows that Retina was the highest ranked interface and ADEL the lowest ranked.

Interface	A sample of participants' comments	Average rank	Overall order
Retina	Simple interface; Good design and colour; Like the folder hierarchy; Nice layout; Front page boring	2.29	1
AKD prototype portal	Simple layout; Easy to use; More cluttered; Text too small; Colour poor; Different colour options; No borders on buttons	3.27	3
Mock-up for AKD prototype portal	Looks professional; Uncluttered; Better colours; Good layout; Don't like colour scheme, font [too] small	3.54	4
ADEL	Very busy; Cluttered, slow; Simple layout, easy to use; Good use of tabs at top; No abstracts with search results	4.11	6
AKO	Too busy, Info hard to read; Cluttered; Logical grouping; Hard to search; Good colour	4.10	5
US system	Access to email and other info sources; One central portal; Cluttered; Nice, crisp; Good colour	3.18	2

Table 1. Interface comparison

Most participants commented favourably on Retina's search capability and the way the search results were presented and grouped into thematic folders (see left frame of Figure 5, below the search query box). For the prototype portal,

there were minimal concerns raised, other than comments about the colour scheme, and difficulties in differentiating tab buttons.

Figure 5 The Retina interface

Search Capability and Data

Participants' used the AKD prototype to complete a range of set tasks. This enabled evaluation of the search capability and data (i.e. usefulness of the prototype). This activity aimed to actively engage participants in using the prototype for typical tasks that would be undertaken by future users of the AKD, such as preparation prior to attending a formal training course.

Participants completed two sets of 22 questions that required access to Doctrine. They were divided into two groups. One group used existing systems (primarily ADEL) to answer the first question set, then used the AKD prototype to answer the second question set. The second group used the AKD prototype on question set one, and existing systems on question set two. Both the prototype portal and Retina provided access to different knowledge sources via a single point of entry, via presentation in a structured form (the prototype portal), or via search returns (Retina).

The results suggest that the AKD prototype (primarily Retina) was more effective than existing systems, with an average of 7.79 questions completed correctly compared with 4.71 (F=4.02, p=0.066). Additional feedback was collected through observation during the tasks. Many negative comments were made by participants who started with the AKD then switched to the existing system (ADEL). Several participants expressed very high levels of frustration when using ADEL. They found it difficult moving from the fast, multi-functional and sophisticated search facility provided by the prototype back to the inefficient and ineffective search and cluttered interface of ADEL. Retina was preferred not just because it was much faster in returning search results, but also because it was perceived to provide superior search results that provided greater support in completing the tasks correctly. One of the commissioned participants said: "Even though it is still under development, I'll get the URL address for Retina, because you can get the information [you need], even if it's in an area I don't know anything about." Participants' choices and associated comments showed a strong preference for Retina over the prototype portal.

Knowledge Processes

The knowledge processes that underpin Doctrine and other Army knowledge sources were examined through group discussions. The portal prototype has acted as a catalyst for consideration of a range of computer-based tools to enhance knowledge processes, and also surfaced issues that need attention for achieving longer-term Army strategy, such as archiving, version control, ownership of content and responsibility for its currency and the technology infrastructure. One participant noted that: "Learning is not in a vacuum. [It is affected by] structures, culture, access to appropriate technologies." Participants stated that access to computers varies depending on location, rank and tasking, and some do not have regular access. Also, there are variable degrees of computer literacy (across all age groups). They are aware that the knowledge processes that underpin Doctrine itself need to be updated. Participants believed that this trial offered possibilities, including provision of information in digital form as input to (not just output from) the knowledge processes. Thus Doctrine would become an on-line resource, up-to-date and accessible. Finally, participants suggested that a discussion forum—open to all but facilitated for content and accuracy—could be added to the AKD to encourage sharing of information.

DISCUSSION

Figure 2 suggests that an 'IS project to deliver' requires effective project management including appropriate evaluation activities in order to provide IS project success, comprising products and/or process change along with organizational learning in order to gain organizational benefit and ultimately enact corporate strategy and goals. The FOD trial project was delivered on time and to cost but with limited scope. Did it provide organizational benefit and contribute to corporate strategy?

This project was one in a series of projects designed to improve Army's knowledge processes. Although evaluation was undertaken at the individual level, the findings had various organisational impacts. Firstly, the intention was to develop an in-house web-based client for the AKD prototype (the portal, see Figure 4), including the provision of search results via this interface rather than via Retina. This was partly driven by a strong preference for open-source solutions amongst the IT team, an approach they had also employed previously in developing and supporting ADEL.

The outcomes from evaluating the GUI and the task performances with the two systems (search capability and data) changed this. The project manager decided to continue to evaluate Retina and to include other commercial applications (e.g. comparing the portal's XML viewer with PDF viewers). This decision shifted the focus from developing a bespoke prototype. By presenting participants with an opportunity to explore a range of interfaces and functionality from a variety of different systems, the project led to a shift in requirements for the next stage in developing the AKD.

Secondly, the findings in relation to ADEL, the existing system, were important. They provided evidence of shortcomings of ADEL that had hitherto been ignored. For the participants, use of the prototype surfaced shortcomings of the functionality and performance of ADEL. ADEL is the corporately-sanctioned source for an important class of Army's codified knowledge and much-used by participants to support training and work. The workshops encouraged people to re-evaluate it. If given a choice, the participants would now reject ADEL in favour of the prototype. ADEL's lack of responsiveness and poor search functionality meant that as soon as a viable alternative was presented, participants were eager to explore and use the alternative. This has political implications related to the power of the IT team who had directed the technology agenda towards developing bespoke systems such as ADEL.

Thirdly, a crucial aspect of the evaluation involved the knowledge processes; changing these processes is an integral part of the organisational strategy to provide timely access to accurate and relevant information. However, limited resources (time, money and full-time staff) meant that this aspect of the project was removed from the scope of the project and shifted to future projects that will take the refined requirements for a knowledge portal from prototype to a full-blown system. However, the group discussion raised several suggestions for improving knowledge processes in the army. The project manager is aware that the technology is a small part of the knowledge process and that, for the AKD to work, it needs to be effectively positioned in its environment (in relation to the overall Army learning and knowledge processes, its people and the existing technologies). She sees that the AKD will be an 'eco-system' where technology provides the front end of the larger knowledge concept, the people and the knowledge context; the task at present is shifting people to be more receptive to the concept of knowledge management.

The trial was judged a success on the grounds that access to knowledge sources was enhanced, with efficiency gains for users when engaged in learning and other work-related activities. The 'evaluation model' devised for the

evaluation (Figure 3) was valuable for assessing the usability and usefulness of the prototype from an individual viewpoint. However, while the technical aspects of the AKD concept was judged to be 'proved', the portal does not provide the full functionality expected of a portal—it is not yet a 'window of choice' for users—and no multimedia or simulation was available in time for the evaluation. More importantly, the changes in culture and processes (of collecting, analysing and sanctioning Doctrine) were not addressed by the trial and so the contribution of the FOD trial to the overall organisational strategy is only partial. The more difficult cultural and process changes must still be tackled by future projects.

CONCLUSION

This paper has argues that evaluation is an important aspect of IS project management, both in influencing project success and in contributing to overall organizational strategy and learning. This paper provides an overview of dimensions of evaluation (based on the '5Ws and H' of Couger 1996) that may be useful for IS projects. Selected dimensions were employed in the case study reported in this paper—'what' to evaluate and 'how' this might be done—that go beyond the traditional project management indicators of success. They are represented in an evaluation framework used to assess individual's perceptions of the usability and usefulness of a prototype portal as well as the knowledge processes that feed into the portal. This illustrates one approach to evaluating an IS project. The key dimensions forced us to examine 'who' would be involved in the evaluation, 'what' was to be evaluated and 'why' we were evaluating, particularly the ways that our evaluation report might be used within the organization. Constructing and applying the framework helped focus our evaluation efforts on all the key aspects of the portal prototype, not just the interface, as well as the overarching organisational strategy of changing knowledge processes.

The results of the evaluation had effects beyond assessing the success of the FOD trial project: they had implications for future projects that will work to enact the organizational strategy of implementing the AKD (with associated process change) by 2012.

The project was delivered on time and to budget, although its scope was reduced to include technological but not process change. The FOD trial project surfaced difficulties in achieving culture change along with technological change. Some of the project sponsors believed that a technological innovation could lead to desired changes in organisational culture. The project manager was more realistic about the significant time and energy needed to achieve such change. The project supported proof of the AKD portal concept, it highlighted shortcomings in existing knowledge systems such as ADEL and it provided a way forward for developing a fully-blown AKD portal. It did not address the long-term, complex and difficult task of achieving change in the army's knowledge processes. This is an area for further research that could fruitfully build on existing IS and project management knowledge.

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Threat-Balancing in Vendor Transition

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ABSTRACT

While many outsourcing contracts are expiring, and vendor transition is becoming an increasing concern, little research helps organizations manage vendor transition. This paper explores vendor transition across two case sites. In one case, the outgoing vendor cooperated with the client which resulted in the client distancing itself from interactions between vendors. In the second case, the outgoing vendor was openly hostile, with the result that the client allied with the incoming vendor to manage vendor transition. These findings mirror expectations from balance of threat theory, a political science theory about interactions between nations. Balance of threat theory predicts that outgoing vendor hostility and the capability of the client to mitigate hostility determine whether a client takes a hard or soft balancing strategy during vendor transition.

Keywords

Outsourcing, vendor transition, balance of threat, power

INTRODUCTION

Almost all of the substantial research on outsourcing explores the client's interaction with the initial vendor. However, IT outsourcing is now a mature industry, generating exchanges of over USD 200 billion in value (Whitten and Leidner, 2006). Given the field's maturity, one emerging trend is vendor transition, where client organizations switch from existing to new vendors. Studies suggest that between 35 and 47% of outsourced contracts are expected to be re-tendered (Willcocks and Lacity, 2006).

Vendor transition is a problem with many facets, including:

- *Transfer of physical and intellectual assets between transitioning vendors.* Being competitors, the transfer of resources between the outgoing (i.e., incumbent) and incoming (i.e., new) vendor presents a series of challenges not present in traditional outsourcing arrangements. Technologies, tools, business processes, intellectual properties and knowledge have to be transferred between vendors, not just between client and vendor. Pure monetary reward may encourage cooperation in traditional outsourcing; but in vendor transition, the outgoing vendor is reluctant to transfer assets to the incoming vendor. Such assets (eg. source code) often provide the outgoing vendor with competitive advantage in other contracts.

- *Transfer of personnel between transitioning vendors.* Knowledge of the client and the outsourced processes is often tacit, and resides with outgoing vendor personnel. A quick way to transfer such critical tacit knowledge is for the incoming vendor to hire staff from the outgoing vendor's team. However, the outgoing vendor is likely to block such transfers as it decreases the competitiveness of the outgoing vendor vis-à-vis the incoming one.

- *Outsourcing legacy.* Unlike in an initial outsourcing condition, there is a legacy between the outgoing vendor and client. First, there may be existing contractual obligations. Given that vendors are generally more savvy than first-time clients, the initial outsourcing contract tends heavily to favor the vendor (Saunders, et al., 1997). These contracts limit client behavior (Natovich, 2003). For example, source code developed to support client operations could be the intellectual property of the outgoing vendor.

  Second, the outgoing vendor often has privileged access. For example, the outgoing vendor may have access to sensitive client data (Adler, 2003). Given that ill-will is often present in vendor transitions (Kern and Blois, 2002), and the risk of vendor opportunism is high (Bahli and Rivard, 2003), this vulnerability is a risk the client must address.

- *Time Horizon.* Once the outgoing vendor's contract expires, the outgoing vendor leaves, regardless of whether the incoming vendor is prepared to take on the responsibility. During the period of vendor transition, the client must ensure business continuity is maintained even though proficient outgoing vendor employees are being replaced by unfamiliar incoming vendor ones.

- *Knowledge Transfer and Client Personnel Management.* Clients who are knowledgeable about outsourced business processes and operations can serve as a bridge between the transitioning vendors. However, the client has usually lost the knowledge and skills necessary to perform the outsourced operation and may no longer have the absorptive capacity to relearn knowledge and skills (Clark Jr., et al., 1995, Hancox and Hackney, 2000). The client often does not maintain sufficient engagement with the outsourced operations to retain necessary skills.

Vendor transition is therefore complex and poses very real problems. However, to our knowledge, no work has suggested strategies that managers should employ during the process of transitioning from one vendor to another. The objective of this research is *to explore and identify effective strategies client managers could employ during the vendor transition process*.

METHODOLOGY

Given the paucity of research, we adopted an exploratory cross-case approach. Exploratory case analysis allows one to obtain an in-depth understanding of a phenomenon. We selected two vendor transition projects as revelatory cases (Yin, 2003).

To our knowledge, no research has investigated the actual transition of vendors in an IT context, hence an exploratory approach involving revelatory cases is ideal. Both vendor transitions completed successfully. However, in one case, the outgoing vendor and client parted on amicable terms. In the second, the outgoing vendor was hostile to the client.

Case 1 involved a non-hostile outgoing vendor. The case focuses on the transition between vendors during a large enterprise resource planning system project in a large Asian logistics organization, Logistico. The company employed two separate vendors to be responsible for individual phases of implementation. The outgoing vendor performed analysis and design for three subsidiaries and implementation for one subsidiary. Due to resource constraints on the part of the outgoing vendor, and the client's desire to avoid lock-in, the implementation contract for the two remaining subsidiaries was opened to tender. The incoming vendor successfully implemented the system for the two remaining subsidiaries.

Case 2 was a high threat vendor transition context involving a public organization's (Publico) online portal and customer call center. The vendors shared a more adversarial relationship as the organization expressed dissatisfaction with the outgoing vendor and felt it was not sufficiently innovative in managing the portal. The client chose not to extend its contract with the incumbent, and opted for an open tender. Although the client was less familiar with the systems and processes than in case 1, the incoming vendor successfully took over the portal.

We obtained comprehensive access to written project documentation and conducted interviews with key stakeholders representing the client, incoming and outgoing vendor for both cases. Interviews were always conducted by multiple interviewers and transcribed within 24 hours. In keeping with Pettigrew's (1990) suggestions, we focused on identifying temporal relationships between actions. We specifically examined the client's perception of the outgoing vendor, the client's corresponding strategy, and the impact of the strategy on the five issues associated with vendor transition (i.e., transfer of physical and intellectual assets, transfer of personnel, outsourcing legacy, the time horizon, and knowledge transfer and client personnel management).

DATA

Case 1

This case revolved around a massive information system implemented to replace three separate systems developed for three subsidiaries (A, B and C) in Logistico. A major consulting firm was contracted to design the information system and implement it for subsidiary A. Near the end of the implementation for subsidiary A, senior management opened tender on the implementation for B and C. They reasoned that a change in vendor could protect Logistico against vendor lock-in and the implementation should be relatively effortless as the design was already completed, and *any vendor 'worth his salt'* could implement it.

Perception of outgoing vendor. The outgoing vendor had signed a contract valued in the hundreds of millions of dollars and had about 50 capable individuals full-time on site. These people had been on site for at least a year. Some had been on hand since the inception of the project two years before. Given the size of the contract and extent of vendor involvement with the project, the vendor had some capacity to disrupt vendor transition. However, Logistico was not overly concerned for two reasons. First, client personnel had worked closely with the vendor to draft requirements.

Second, the outgoing vendor's expressed intent had been positive. For example, according to the contract, the outgoing vendor's warranty clause ended in August. Vendor personnel stayed on site to help until November, despite the fact the outgoing vendor had lost the contract in April.

> *We're happy they stayed around to close issues even after being paid. And we all knew. [Outgoing vendor] did their job. [Outgoing vendor] stayed around until November. The warranty ran out end August.* (Logistico project manager)

Client Strategy. Given that the outgoing vendor was viewed as relatively benign, Logistico's strategy during vendor transition was to distance itself from vendor transition issues. In many instances, the client abrogated responsibility for decisions affecting both vendors. Instead of mandating a decision, the client desired vendors to resolve issues between themselves. Some cross-vendor disputes arose. For example, when the new vendor insisted that one of the processes designed by the outgoing vendor could not be implemented, the client brought third parties to arbitrate instead of directly intervening and resolving the issue itself.

The client sought to maintain a neutral stance between the vendors, even though one would naturally expect the client to be more concerned about the relationship with the incoming vendor. In fact, the relationship between the client and outgoing vendor was better than the relationship with the incoming vendor during the transition. The outgoing vendor had worked closely with the client during design and initial implementation, and so people on the ground had formed close bonds. The client and new vendor were still unfamiliar with each other.

> *In [first implementation] between [corporate IT] and [outgoing vendor], we had intense discussion but (it was) still (workable). It's quite cold between [corporate IT] and [incoming vendor].* (Logistico project manager)

Transfer of physical and intellectual assets. The outgoing vendor also was open to knowledge transfer, subject to the condition that the incoming vendor would not compromise on the outgoing vendor's rights and prerogatives. For example, the outgoing vendor's contract included a warranty clause. The outgoing vendor allowed the incoming vendor full access to the source code, so long as the incoming vendor did not tamper with it and therefore void the warranty.

Transfer of personnel. The client tried to respect the rights and prerogatives of the outgoing vendor, and made no attempt to "unfairly" obtain vendor personnel. For example, the incoming vendor wanted to hire some outgoing vendor staff as this provided immediate "grafting" of personalized knowledge. The outgoing vendor refused, because its staff had signed a non-competition clause. The client did not challenge the clause's legality.

Outsourcing Legacy. Perhaps because the client continued to deal with the outgoing vendor on friendly terms, the outgoing vendor made no attempt to invoke contract provisions beneficial to the outgoing vendor, or exploit its access to client data. Indeed, as mentioned earlier, the outgoing vendor provided extra support by helping to run and maintain the system during vendor transition. Logistico was grateful to the outgoing vendor, but was not too surprised. As one Logistico IT manager noted:

> *In the IT industry, the top level know one another. They really work on a co-opetition model. [They could be] competing on one project, but could be working together for another bid.*

Time Horizon. While vendor transition occurred successfully, the client's hands-off approach threatened the success of vendor transition. Several cross-vendor disputes were never satisfactorily resolved during the handover. For example, during the handover, project documentation was not in good shape. Many documents were not updated to reflect the current status of the system.

> *In preparation for upstream work, we realized the documentation was not in good shape. It was not organized. They had no strict document control, like a library, to keep track of key events. It was far from there.* (Incoming vendor project manager)

It should be emphasized that the poor documentation was not the sole fault of the outgoing vendor. Both the outgoing vendor and client were responsible for documentation, but documentation had been a low priority for both, as the focus had been on ensuring the system was successfully running for subsidiary A. However, the client never pushed the outgoing vendor strongly to update the documentation. As a result, the incoming vendor had to rely on source code to understand prior work.

Knowledge Transfer and Personnel Management. Knowledge transfer from outgoing vendor to client was not a significant issue as the client had involved itself heavily during all stages of the project during the outgoing vendor's implementation. The client was cognizant of the requirements, and was familiar with the design.

Post Vendor Transition. The incoming vendor completed implementation for subsidiaries B and C on time in April 2006 and 2007 respectively. The outgoing vendor left such a positive impression on the client that the client invited the outgoing vendor to bid on another project valued in the hundreds of millions of dollars. The outgoing vendor bid, and successfully won the contract.

Case 2

This case focused on vendor transition for an online portal maintenance contract. Vendor transition occurred because the client (Publico) was unhappy with the outgoing vendor's service. The outgoing vendor satisfied contract terms. However, the client wanted the vendor to be innovative and proactive with the website portal instead of only providing simple maintenance. The client acknowledged the contract did not drive such behavior:

> *We didn't have much control over the SLA [Service Level Agreement]...It was according to the minimum standards in the contract. [The analogy is like] If the light bulb is working and even though it's not very bright, you cannot ask [outgoing vendor] to change the light bulb because of that. It's not in the contract.* (PubliCo project member)

Perception of outgoing vendor. Publico perceived the outgoing vendor as a problem. The outgoing vendor had signed a contract of about 100 million dollars and had about 50 experienced individuals full-time on site. These individuals had been on site for up to five years. Furthermore, Publico considered this a strategic application, but possessed no in-house portal and call center management capabilities. Not surprisingly, Publico felt vulnerable. Management of the outgoing vendor also exhibited antagonistic intent. During the outgoing vendor's tenure, its staff performed the bare minimum associated with the SLA. When the contract came up for renewal, the outgoing vendor emphasized that moving to a new vendor would damage the client.

> *They tried to frighten us with the risk of transition, which they mean it would be a disaster if we switch vendor. They were so confident. But they asked for the price of a Mercedes Benz but delivered a Camry.* (User manager)

Furthermore, once the decision to switch vendors was announced, the outgoing vendor turned difficult and evasive. In many cases, the client would assert its rights to some service from the outgoing vendor. The outgoing vendor would present confounding factors, which forced the client to meet the outgoing vendor halfway. For example, the outgoing vendor did not attend the vendor transition project meetings, resulting in delay to the project handover schedule. PubliCo demanded an outgoing vendor presence in the project meetings, whereupon the outgoing vendor tried to identify schedule hurdles. PubliCo responded by adjusting meetings to the outgoing vendor's schedule.

Client Strategy. The client recognized the outgoing vendor was uncooperative, but that it would be difficult to switch. Thus, a year before contract expiry, the client began investigating ways of switching vendors. Once the client successfully switched vendors, the client allied very closely with the incoming vendor.

> *For other projects, it is like 'I-am-managing-the-vendor' type. Here, we worked closely as partners. We were very open with each other. If [PubliCo] couldn't do, we did, and vice versa. We didn't bring in*

contracts during meetings. The relationship is that – if you fail, I fail as well. (incoming vendor project director)

Transfer of physical and intellectual assets. The outgoing vendor laid claim to portal components including the portal domain name. The vendor registered the domain name on behalf of the client. However, the client had never paid back the vendor for this.   The vendor insisted on charging the client "*a seven-figure sum*" for the domain name.

The client refused to pay for the domain name, and instead purchased a new one. Unfortunately, customers did not know about the change, so Publico and the incoming vendor worked together to publicize that fact. A coordinated effort was made to send a physical letter to every customer. In addition, the change was advertised on radio, and a media blitz associated with football and karaoke (two activities strongly linked to the 18-30 year old, male demographic of most Publico customers) was conducted to increase awareness of the website change. The outgoing vendor converted the old portal to a "men's lifestyle" website similar in respects to those of mens' magazines.

Transfer of personnel. To transition successfully, the incoming vendor needed outgoing vendor call center personnel, since the client had little knowledge of the call center's processes.   The incoming vendor thus poached call center staff. The outgoing vendor complained about this poaching, but the client feigned ignorance.

> *[Outgoing vendor CEO] was complaining that [incoming vendor] was poaching their staff. [Incoming vendor] did go down to [outgoing vendor] for a road show. It was in an open manner and mainly for the call center staff ... All PubliCo wants is seamless transition* (PubliCo IT manager).

Outsourcing Legacy. The client contract with the outgoing vendor left a lot of room for improvement. For one, the contract did not specify contractual obligations on the outgoing vendor in the event of a transition.   Business continuity during the transition was thus in danger of disruption.

> *[Outgoing vendor] doesn't see itself having a significant flow of business from [PubliCo] from [when they lost the contract], so they don't need to leave a good impression. They were pulling out resources even from [existing portal].* (PubliCo IT manager)

Requests for maintenance during the transition process were generally denied. The lack of outgoing vendor support meant business continuity during the transition period could never be guaranteed. In fact, because the outgoing vendor laid claim to the source code, the incoming vendor had to redo the portal, essentially from scratch. Incoming vendor employees worked "*18 hour days,*" "*even coming back on Sundays*" to perform this task.

Also, both the client and outgoing vendor laid claim to the customer data. The final resolution held that the client owned the customer data since the client had supplied that. However, the outgoing vendor had ownership of the login IDs and passwords, as customers to the portal had provided those while creating portal accounts.

This caused two problems. First, all customers had to recreate their logins on the new portal when it launched. Second, the outgoing vendor used customer data to send newsletters about the revamped old website. Recall that the revamped website's content differed from that in the original portal.

> *[Customers] also came back about the [outgoing vendor] newsletters, so we have to tell them to unsubscribe from [old website], and [outgoing vendor] has to make it easy for them to do so.* (Publico IT manager)

Knowledge Transfer and Personnel Management. As the client no longer possessed sufficient knowledge of the business processes, they requested for the source code from the outgoing vendor. The incoming vendor needed the source code to determine requirements. The outgoing vendor laid claim to all source code and refused access. The client demanded access to the source code, whereupon the outgoing vendor responded that the incoming vendor would be allowed to read the code, but not bring any back to the client site.

Post Vendor Transition. Publico's portal is active today- the first two authors are customers. However, problems with vendor transition left many individuals in Publico bitter about the outgoing vendor. The client refused to consider the outgoing vendor for future contracts. Subsequently, the outgoing vendor lost other contracts with other dissatisfied customers and shut down.

DISCUSSION

Our exploratory study suggests the appropriate strategy a client organization should take during vendor transition depends on the attitude of the outgoing vendor when the transition takes place. An outgoing vendor can adopt two strategies. First, it can pursue a strategy of enlightened self-interest by cooperating with the incoming vendor. The client responds by taking a neutral stance in the vendor transition process to preserve the good relationship with the outgoing vendor. Alternately, the outgoing vendor can pursue a hostile strategy of being uncooperative. The client responds by allying with the incoming vendor to ensure vendor transition proceeds smoothly.

The behaviors of the outgoing vendor and clients in our study parallel the way nations establish alliances to ward against threats as modeled in balance of threat theory (Walt, 1994; Walt, 1996). Balance of threat theory is a realist theory, subscribing to the belief that nations try to survive in an anarchic environment (Waltz, 1979).

Like nations, vendors and clients operate in an anarchic environment. Vendors or clients could appeal to the law to remedy a wrong, just as nations could appeal to the United Nations. However, the process of appeal is so long, that by the time the case is heard, the transition process has ended. Thus, decisions by vendors or the client to respect laws or agreements are made based on strategic necessity, and not because of respect for the law. A vendor could break an agreement or deliberately drop its service levels. Similarly, a client could perform "unsavory" acts such as poaching vendor staff.

In Case 1, both the vendors and client held themselves up to "the law," because doing so met their strategic interests. The client could have attempted to poach outgoing vendor staff even though the outgoing vendor had non-competition clauses. Generally, non-competition clauses are difficult to enforce in law.

In Case 2, the outgoing vendor did not enact its contractual obligations. Service levels fell to unacceptable levels during the transition, and the vendor enacted barriers to inhibit knowledge transfer. Similarly, the client supported the poaching of vendor staff.

Balance of threat theory postulates that a nation's long term stability and survivability comes from its ability to achieve a balance of power against threats. Alliances are enacted to counter nations perceived as a threat. Threat perception is measured by three factors (Walt, 1996):

- *Aggressive Intent:* These are the actions of the other nation. A nation that has through words or behavior demonstrated hostility is viewed as having aggressive intent.

- *Aggregate Power*: This is the total capability of the other nation. It includes the population of the nation, its industrial level, arms expenditure, and other capabilities to fight a war or compromise another nation.

- *Offensive-Defensive Balance:* This is the ability of a nation to defend against attacks by a particular nation. Attacks need not require direct military confrontation, but could include propaganda, embargoes, or the severance of a key oil pipeline (Rose and Van Dusen, 2002). The offensive-defensive balance takes into account such factors as geographical features, distance between the nations, and the relative composition of a nation's military portfolio (Walt, 1994; Walt, 1996).

Within the context of vendor transition, we translate aggressive intent as the actions of the outgoing vendor. In case 1, the vendor exhibited no aggressive intent. In fact, the vendor remained onsite to support client operations without pay. In case 2, the outgoing vendor exhibited aggressive intent.

Next, aggregate power in vendor transition refers to the overall capabilities of the outgoing vendor. In both cases, the outgoing vendor had about 50 individuals on site. In Case 1, the contract was in the hundreds of millions of dollars, while in Case 2, the amount approached a hundred million dollars. Both vendors thus had high aggregate power.

Finally, the offensive-defensive balance considers the effect on the client if the vendor turns hostile. In Case 1, the effect was moderate. Client employees had worked with the vendor to create the design, and the source code was available on the client machines. In case 2, the effect was large. Client employees did not know anything about portal operations and the vendor held licenses to critical third party tools (e.g., the underlying RDBMS). Furthermore, the vendor held critical intellectual property necessary to the portal such as the domain name and ownership of the source code.

A nation enacts one of three strategies in response to its total assessment of the three factors identified by Waltz. First, if it perceives low threat, the nation will soft balance all other nations against each other. Soft balancing refers to non-confrontational and indirect strategies such as reliance on international institutions like the United Nations to counter threats. In soft balancing, a nation attempts to reduce the ability of another nation to harm it, without directly attacking the source of the other nation's power. As one illustration, the United States maintains the status quo in the Middle East by providing foreign aid to multiple Middle Eastern nations and groups (Kinsella, 1994).

Case 1 is an illustration of soft balancing in vendor transition. We observed three aspects to the strategy: (1) The client elected not to directly intervene in disputes between the two vendors. Indeed, when pressed to mediate, the client instead recruited a third vendor to arbitrate. (2) The client consciously maintained good relationships with the outgoing vendor. For example, the client did not press for updated documentation, demonstrating a spirit of give and take that recognized that the outgoing vendor had gone the extra mile in other areas such as staying on beyond the warranty period. (3) The client provided incentives for the outgoing vendor to behave well, by inviting them to bid on another major contract.

If a nation perceives another nation as a high threat, and perceives that there are actions it can take to block the threat, the nation will hard balance against the threatening nation. Hard balancing involves two practices: (1) building internal capabilities and (2) forming alliances with other nations. The goal of hard balancing is to destroy or reduce the source of the threatening nation's power.

Case 2 provides an example of hard balancing. The client developed internal capabilities by pulling in users, increasing its staffing, and getting senior management attention. The alliance with the incoming vendor was also close. The client helped the incoming vendor overcome obstacles by the outgoing vendor. For example, the client escorted the incoming vendor to the outgoing vendor's site to view source code.

The final strategy, called bandwagoning, occurs when a nation perceives another nation as a high threat, but perceives that there is nothing it can do to mitigate the threat. The nation allies with the high threat nation, ceding to it concessions out of proportion with the benefit from the alliance (Walt, 1994). The classic example of bandwagoning in vendor transition is where the client renews the vendor contract despite dissatisfaction with vendor performance. In case 2, a small amount of bandwagoning occurred, since the client renewed the outgoing vendor's contract on a short-term basis to allow vendor transition to proceed.

CONCLUSION

This research is an attempt to uncover client strategies to orchestrate a successful vendor transition, which is an increasingly common phenomenon as global outsourcing matures. We contrast two cases of successful vendor transition in an attempt to understand and develop theory to help manage the phenomenon. Our study reveals that a contingency-based strategy founded on balance of threat theory is one possible way of successfully transitioning vendors. If a vendor transition is feasible, then in the event that the outgoing vendor is a threat, the client should actively court an alliance with the incoming vendor. However, in the event where the outgoing vendor is not a threat, the client should disengage from the vendor transition process so as to maintain a positive relationship with the outgoing vendor in the future.

While we believe the study has provided a constructive approach to client management of vendor transitions, further research is needed of vendor transitions in other organizations. Additional data will enable assessment of the extent to which client perception of the overall level of threat influences their choice of hard or soft balancing strategies. Further research is also needed to articulate the range of specific tactics that make up each strategy.

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A Study of Loose Budgetary Control in ISD Projects

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ABSTRACT

This paper investigates the tightness of budgetary control over projects in a large systems development multinational. This represents a case of extreme ISD failure en mass, where all but 2 of the 22 projects in a business unit went over budget, causing senior executives to refocus their strategic priorities and cancel all current and potential projects that followed. This study focuses specifically on the two best performing (12% and 4% under-budget) and worst performing (223% and 320% over budget) of these projects. Using a framework drawn from control systems theory, this study examines the 'tightness' of budgetary control that was exerted over each project, and what was done or could have been done to avert such failure. The study then identifies a set of emerging factors affecting tight budgetary control in ISD.

BACKGROUND TO THE STUDY

It is well known that the majority of information systems development (ISD) projects run drastically over-budget or fail altogether. Various studies have found that between 40% and 60% of ISD projects fails to meet budget estimates and that the degree of overspend can exceed 200% (Robey and Keil, 2001, Keil et al., 2000, Goldfinch, 2007, Whittaker, 1999, Chiang and Mookerjee, 2004, Bartis and Mitev, 2008). Such failures are not restricted to certain industry sectors or project types; rather they occur with some regularity in systems development projects and organisations of all types and sizes (Ewusi-Mensah and Przasnyski, 1991, Ewusi-Mensah, 2001, Park et al., 2008) in both the private and public sector (Goldfinch, 2007, Whittaker, 1999).

Despite the fact that overspending is such a concern, little research has focused specifically on how budgeting or other general management accounting techniques are being used in ISD. An analysis of the relevant ISD literature shows that blame is attributed to the developers, managers or customers; the development method or process was flawed, inappropriate or obsolete, the team were not managed, directed and monitored sufficiently, or requirements were poorly elicited because the customers did not know their own business. Rarely if ever is the budget target itself ever questioned. Studies that highlight these disastrous overruns provide little or no information on the budget process, and in particular the tightness of budgetary control over ISD projects, which is somewhat surprising given the prevalence of unacceptable budgetary performance throughout the field.

Given that there has been little research on budgetary control in ISD projects, and none specifically on the tightness of these controls, we sought in this study to identify the factors affecting tight budgetary control in ISD projects. Our research objective is thus:

'*To investigate and identify the factors affecting tight budgetary control in ISD projects.*'

The next sections of the paper summarise the pertinent literature and describes the theoretical basis and research approach adopted in this study. The findings from four 'revelatory' case studies is then presented, showing that budgetary control of all four projects was very loose. These findings are then discussed and through further analysis, a theoretical model of the factors affecting tight budgetary control is then presented. The paper concludes with a discussion of the implications of the study and possible avenues for future research.

THEORETICAL BACKGROUND

Project Management Control

Both the APMBOK (AssociationforProjectManagement, 2000) and PMBOK (ProjectManagementInstitute, 2009) contain major segments which address the issue of project control. In the former, a dedicated section includes many of the tools traditionally associated with control. In the latter, control forms part of many different Knowledge Areas such as 'cost control' within 'project cost management' and 'schedule control' under 'project time management'. The importance of effective project control has been highlighted, both in general (Rozenes et al., 2006, Avison et al.,

2001, Cicmil, 1997), and specifically in ISD projects (Kirsch, 1997, Henderson and Lee, 1992, Choudhury and Sabherwal, 2003, Schmit et al., 2001, Whittaker, 1999, Chiang and Mookerjee, 2004, Chow and Cao, 2008, Kirsch et al., 2002), and has been shown to "play a major role as the cause of project failures" (De Falco and Macchiaroli, 1998).

There are many ways to implement project control, and most use a combination of many input-oriented, process-oriented and output-oriented controls also referred to by Merchant (1998) as result, action and personnel controls. The focus of the control also varies, and is almost always multi-dimensional (Rozenes et al., 2006). In most projects, control is exerted over the three main axes of project management, namely time, cost, and scope (ProjectManagementInstitute, 2009, Rozenes et al., 2006, AssociationforProjectManagement, 2000). While this is not applicable in every industry and project type, this is inevitably the case where ISD projects are concerned (Chapman and Ward, 2002, DeMarco, 1982, Jurison, 1999). The three are inexorably intertwined, and an impact on one usually has an impact on the others. However, cost is often regarded as the most important and powerful control system in most organizations and projects (Armstrong et al., 1996, Ekholm and Wallin, 2000, Merchant, 1985, Merchant, 1981, Merchant, 1998, Hansen and van der Stede, 2004, van der Stede, 2001). Given the prevalence of poor budgetary performance in ISD projects as discussed earlier, the remainder of this paper focuses on this one aspect of control; issues regarding scope and schedule control are outside the scope of this paper.

Measuring 'Tight Budgetary Control'

Van der Stede (2001) highlights a general lack of agreement as to what defines and constitutes 'tight budgetary control'. His study identifies one of the earliest, and at the time most commonly used interpretations of the term (Merchant, 1985), and then illustrates how subsequent research adapted and extended it (Anthony and Govindarajan, 1998, Simons, 1995, Merchant, 1998). He contributes to the literature by constructing a measurement instrument to capture tight budgetary control. His original research instrument contained five subcomponents, namely *low tolerance for interim budget deviations*, *detailed line-item follow-ups*, *intense discussions of budgeting results*, *emphasis on meeting short-run budget targets*, and *level of tolerance for budget revisions during the year*. While he found that the first four were all indicative of tight budgetary control, he found no support for the level of tolerance for budget revisions during the year. The resulting measure is presented in Figure 1.
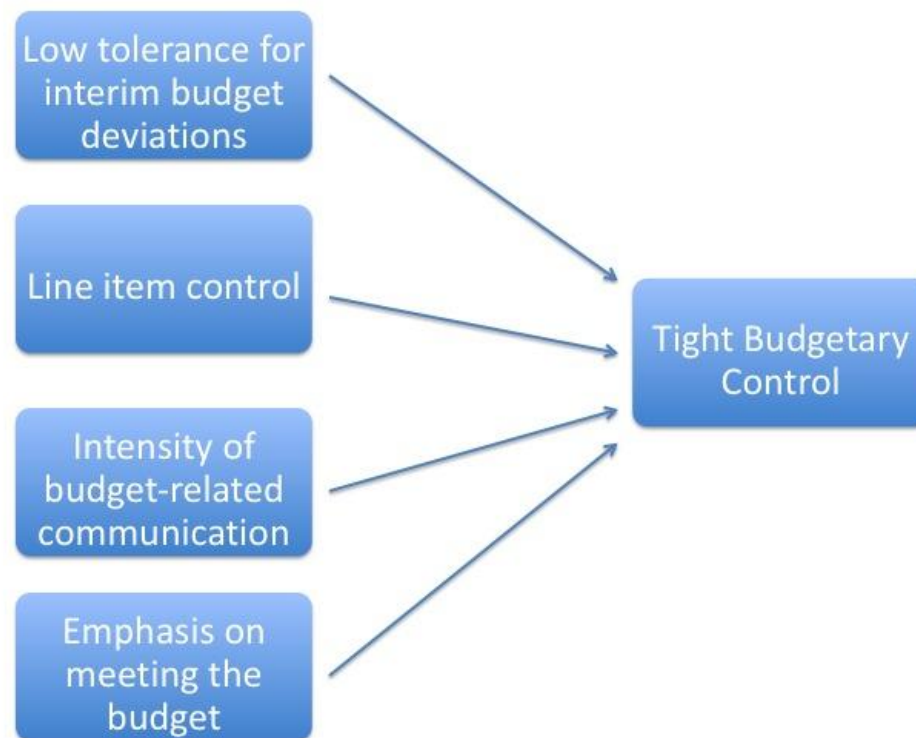
Figure 1: Attributes of Tight Budgetary Control (adapted from van der Stede, 2001)

- *Tolerance for interim budget deviations:* In a loose control environment, corporate management do not routinely inspect deviations at all, or do so only if there is "something clearly amiss" (van der Stede, 2001). In a very tightly controlled environment, a deviation immediately triggers corporate reviews or other forms of intervention, and the manager is often required to report the causes of the deviation and the corrective action taken.

- *Line item control:* In some cases, senior management only analyse adherence to the overall budget, commonly referred to as the 'bottom-line' figure. This gives the manager a lot of freedom as they can offset positive and negative line-item variances but still achieve the overall budget target. If tighter control is exerted, a manager may be required to submit line-by-line deviation reports, and their performance evaluation may take these more detailed variances into account.

- *Intensity of budget-related communication:* This attribute of tight budgetary control covers a range of issues. Contributing items listed by van der Stede include (i) high frequency of budget-related communication between manager and corporate superiors; (ii) face-to-face meetings between manager and corporate representatives; (iii) the formation of a team to discuss budget matters comprising the manager, the manager's corporate superiors, and the manager's sub-ordinates; (iv) budget-related communication regardless of whether there is no negative deviations; and (v) consultation between manager and superiors as to ways of achieving the budget.

- *Emphasis on meeting the budget:* This attribute considers the importance corporate superiors attach to meeting the budget. Contributing items van der Stede suggest include the extent to which the manager's performance and promotion prospects are judged on meeting the budget, and the extent to which meeting the budget equates to success. In addition a key item of budget emphasis is the extent to which superiors consider meeting short-term budgets essential.

There were a number of reasons for basing this study on van der Stede's interpretation and measure of tight budgetary control. Firstly, other studies of budgetary control measures tend to focus at an operational level or certainly at some level within a particular business unit or function (e.g. Brownell, 1985, Hopwood, 1972, Merchant, 1981). Perhaps the most important motivation behind the use of van der Stede's model is that it contains items relevant to "the junction between corporate management and business unit managers" (van der Stede, 2001), which is appropriate given that the objective of this study is to determine the extent to which ISD project managers are tightly controlled in terms of budget. The rigor and general quality of the measure is also evidenced by its use in a number of subsequent seminal studies in the management accounting domain (e.g. Marginson and Ogden, 2005, Hansen and van der Stede, 2004, Tayles et al., 2007, Bisbe et al., 2007). In fact, many subsequent researchers have directly commented on the quality of the paper. Noeverman, Koene et al (2005) believed it to be a rare example in the whole area of Reliance on Accounting Performance Measures (RAPM) that "seems to be free of validity and reliability problems". In their call for higher precision in the specification of management accounting concepts Bisbe et al. (2007) cite van der Stede's model as one of a few good examples to follow.

RESEARCH DESIGN

Research Site

This study explores the tightness of budgetary control exerted over four systems development projects. These projects were based in one large multinational organization, were part of the same business unit, and were purposively selected for this study. Firstly, the business unit within which the four projects reside was terminated solely due to poor budgetary performance (only 2 of 22 projects were completed within budget). All non-critical projects and projects in the pipeline were cancelled with immediate effect in February 2007. Tight budgetary control is unnecessary and occasionally counterproductive if meeting the budget is not considered very important by any of the stakeholders involved (Merchant and van der Stede, 2007), and so indicators of budget importance were critical when choosing cases for this study. The fact that the entire business unit was disbanded due to budgetary problems is a strong indicator that meeting the budget was very important in these cases. The two best performing projects (12% and 4% under-budget) and worst performing projects (223% and 320% over budget) were chosen as 'revelatory cases' (Yin, 2003) to allow effective comparison and contrast between projects and identify interesting insights. This choice helps distinguish between what may be an organizational or business unit problem (across all projects) and what may be problem at the project or team level.

In terms of governance, each project was lead by a single senior manager with a number of sub-ordinate managers reporting to him or her. Within the accounting function, an account manager was assigned to each project to deal with monitoring and control of the budget and any related issues. All time and expense reports were submitted fortnightly to the accounting system, but the audit manager's formal role includes ongoing communication with the senior project manager. An audit team was also in place to conduct random interim assessments of selected projects. A steering committee was in place, comprised of senior management executives within the region. This committee evaluated and approved project proposals in line with a governing strategy emanating from corporate headquarters in the U.S.

It is clear that the four projects under scrutiny are different in many ways, varying according to team size (failed are larger), team composition (failed projects have significantly less team leads), managerial experience, use of development method, project type and location. Any, and perhaps all of these variables may have affected the degree to which each project was over or under budget. In addition, one can question the value of analyzing the budget deviations, given that poor estimation may have resulted in the budget target itself may have been inappropriate from the outset. From a methodological point of view, however, the extent of the budget deviations, the cause of the deviations, or the accuracy of the original estimations are not a significant concern, as this study does not seek to determine whether budgetary control, or indeed any other variable, influenced the final budget deviation. Rather the objective is simply to determine what factors affected the tightness of that budgetary control.

	Project A	Project B	Project C	Project D
Budget deviation at project end[1]	12% under	4% under	223% over	320% over
Project duration	19 months	30 months	32 months	19 months
Annualised budget deviation	-7.58%	-1.6%	83.63%	202.1%
Random audit	Yes, after 18 months	No	Yes, after 4 months	No
Team size	20	24	31	29
Team composition	1 senior manager 2 managers 2 team leads 11 developers 4 testers	1 senior manager 3 managers 4 team leads 19 developers/testers	1 senior manager 5 managers 0 team leads 26 developers 4 testers	1 senior manager 3 managers 1 team lead 20 developer/testers
Location	Same building	Collocated in an open office space	Collocated in an open office space	Distributed across 3 countries and 2 continents
Development method	Scrum/XP	Scrum/XP	MethodABC[2]	MethodABC
Senior manager management experience	4 years	3.5 years	3 years	3 years
Type of system developed	Commercial product	Commercial product	Organisational intranet	System for project management accounting & reporting
Customer type	External	External	Internal	Internal
Personnel interviewed for this study (2 phases)	1 senior manager 2 managers	1 senior manager 3 managers	1 senior manager 5 managers	1 senior manager 3 managers

Figure 2: Profile of the Four Cases

Data Collection & Analysis

Data was collected over a 6 month period from March to August 2007. Data collection was primarily personal face-to-face interviews, a technique well suited to case study data collection, and particularly for exploratory research such as this because it allows expansive discussions which illuminate factors of importance (Yin, 2003, Oppenheim, 1992). The information gathered is likely to be more accurate than information collected by other methods since the interviewer can avoid inaccurate or incomplete answers by explaining the questions to the interviewee (Oppenheim, 1992). The interviews lasted between 50 and 120 minutes. The questions were largely open-ended, allowing respondents freedom to convey their experiences and views, and expression of the socially complex contexts that underpin ISD (Yin, 2003, Oppenheim, 1992). The interviews were conducted in a responsive (Rubin and Rubin, 2005, Wengraf, 2001), or reflexive (Trauth and O'Connor, 1991) manner, allowing the researcher to follow up on insights uncovered mid-interview, and adjust the content and schedule of the interview accordingly. In order to aid analysis of the data after the interviews, all were recorded with each interviewee's consent, and were subsequently transcribed, proof-read and annotated by the researcher. In any cases of ambiguity, clarification was sought from the corresponding interviewee, either via telephone or e-mail. Supplementary documentation was also collected, including project management plans, budgets and budget reports, meeting minutes and relevant e-mail communications.

Data analysis used Strauss & Corbin's (1998) *open coding* and *axial coding* techniques. Open coding is "the process of breaking down, examining, comparing, conceptualizing, and categorizing data" (Strauss and Corbin, 1998). Glaser (1992) argues that codes and categories should emerge from the data, while with Strauss & Corbin's approach (1998) these are selected prior to analysis. The approach adopted in this study is more akin to the latter, where the interview questions and subsequent analysis was based on van der Stede's (2001) model of tight

---

[1] Approximately 70% of the 223% overspend on Project C was due to increased scope, with 153% due to 'poor estimation/control/ general management. In the case of Project D, this was 150% and 170% respectively. This is based on an analysis of requirements documents, project management documents and verification by project managers.

[2] MethodABC is the psudonym accorded to ABC's in-house method.

budgetary control, and specifically its four underlying constructs (*tolerance for interim budget deviations*, *line-item control*, *intensity of budget-related communication* and *emphasis on meeting the budget*). These provided a list of "intellectual bins" or "seed categories" (Miles and Huberman, 1999) to structure the data collection and the open coding stage of data analysis. A sample of open coding data is shown in Appendix A.

The second phase of analysis used axial coding. Axial coding is defined by Strauss and Corbin (1998) as a set of procedures whereby data are put back together in new ways after open coding; whereas open coding fractures the data into categories, axial coding puts the data back together by making connections between the categories and sub-categories. As the data was coded, theoretical questions, hypotheses and code summaries arose. These were documented in analytic *memos* (Miles and Huberman, 1999) to aid understanding of the concepts being studied and to refine further data collection. Miles and Huberman (1999 p. 72-74) offer advice on effective analytic memos, and these practices were followed where possible.

As categories emerged follow-up interviews were arranged to elicit further, richer, more focused information. This was done to confirms, extends, and sharpens the evolving list of categories. As categories became integrated, further data collection did not tend to cause any additional categories to emerge, but rather reinforced those already in existence. At this point, the categories were deemed to be "theoretically saturated" (Strauss and Corbin, 1998), and data collection ended.

FINDINGS

In this section, the results of the four case studies are presented and discussed. Firstly, the tightness of budgetary control over each project is discussed, in accordance with the four measures of control in the conceptual framework adopted in this study. The factors affecting tightness of budgetary control, which emerged from the axial coding phase of the analysis, are then presented and further illustrated with quotes from the interviews.

Tolerance for Interim Budget Deviations

While we know that projects A and B completed under budget while projects C and D's eventually performed very poorly, this does not necessarily mean that the interim budget figures followed similar trends. One single event near the end could have brought a trend of overspending back on target, and likewise may send a previously well-managed project spiraling out of budgetary control. However, Figure 3 shows that this was not the case in any of these projects. Project A and B never went over budget at any stage, and it is also clear that in the case of C and D, signs of the eventual overruns were evident from an early stage in the project, and this trend continued consistently throughout both projects. As A and B experienced no significant interim deviations it is difficult to determine from Figure 3 alone whether tolerance would have been low or high. The early and continuous overruns on Project C and D suggest that tolerance was high. However, this is by no means conclusive; all that is evident from this data is that corporate superiors did not terminate either project prior to its completion.
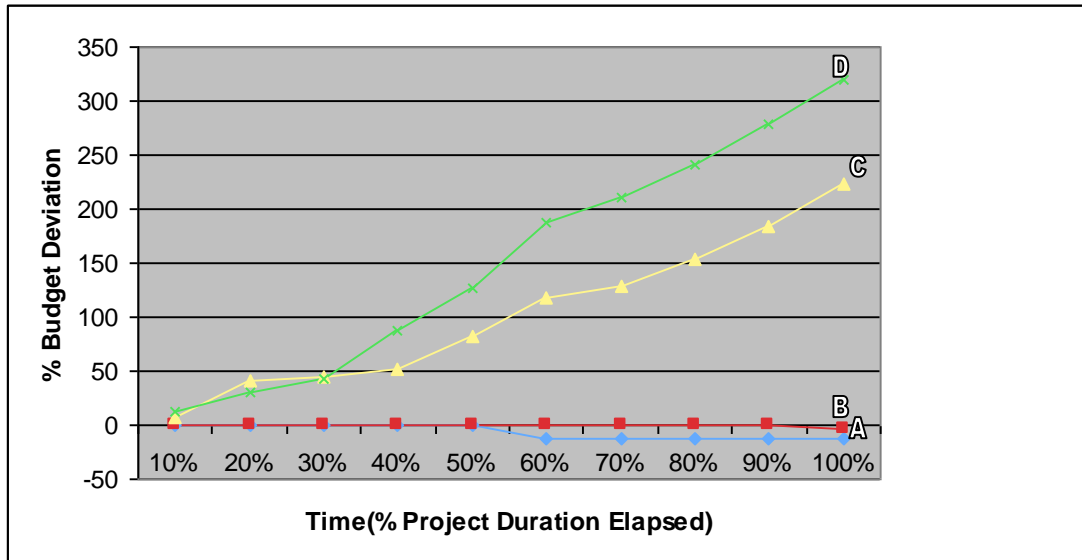
Figure 3: Interim Budget Deviations Across Projects

An analysis of the underlying sub-constructs within the tolerance for interim budget deviations reveals more conclusively that the projects were loosely controlled in this regard. In a tightly controlled environment, the project manager is required to explain (i) causes for interim deviations and (ii) corrective action that will be taken to correct or address the deviation. At the time of the interviews, the formal organizational procedures in ABC required all project managers to submit a monthly status report. This was a very rudimentary, one page document where each project was flagged as green, amber or red, signifying increasing levels of concern, ranging from 'no issues' to 'show-stopper' issues. This document did include a field for explanation of variances and details of any corrective action to be taken. However, according to all four managers, the norm in the organization was that all managers tick the green, amber or red status box, but never complete the explanation or corrective action columns. Regardless of whether managers did or did not complete this document, there was evidence to suggest this document was not effectively used as a mechanism for tight budgetary control. For example, 15 of the 19 reports submitted by Project Manager D had his project statues set to red, yet there was no subsequent query or action taken as a result. Project Manager B never submitted any of these reports throughout his 30 month project, and while an automatically generated reminder was issued, there was no subsequent follow-on query or action taken by the accounting function.

Line Item Control

Apart from Project C where travel spending was restricted to 11% of the overall project budget, there was no evidence of control at the budget line item level across any of the four projects. The control reports did not have to explain budget variances on a line-by-line basis. The project managers all stated that corporate superiors were only interested in the bottom line budget figure. Regardless of the managers' opinions, it was also clear from the interim management accounts that corporate superiors did not investigate budgets on a line-by-line basis. The line items on the Project A, B, and C interim account reports were all incorrectly aligned to some degree. One monthly report of Project C's budget provides an illustrative example (Figure 4).

As the account was set up incorrectly, all labour expenses were being allocated as 'travel'. Therefore the travel spend was reported as being over by more than 600%, when in actual fact very little had been spent. Also £150,990 of regular, in-house developer labour was incorrectly labeled as a subcontractor cost, a line item which had a zero budget allocation. £87,460 was spent but reported simply as 'other costs'. All three of these issues had a significant material affect on the budget and caused three line items to incorrectly appear grossly over budget. The interesting issue here, however, is that none of these adverse figures triggered a query from corporate head office, showing that line item control was not just loose but non-existent.

BUSINESS UNIT: SERVICE GROUP: CLIENT: PROJECT CODE:	Budget	Actual To Date	Commited	Budget % Remaining
	£	£	£	
PRE-CONTRACT				
LABOUR – BUSINESS UNIT	625,123	0	0	100.0%
LABOUR – NON-BUSINESS UNIT	0	0	0	0
LABOUR – SUBCONTRACTOR	0	150,990	0	-
TRAVEL	122,000	523,280	190,140	-601.16%
DURABLES	50,413	40,117	0	20.42%
TRAINING	221,818	0	0	100.0%
SERVICES	0	0	0	
OVERHEAD	0	0	0	100.0%
OTHER	0	87,460	0	-
.	8,455	0	0	
TOTAL EXPENDITURE	8,455	0	0	100.0%

Figure 4: Example of Line Item Discrepancies – Project C Interim Budget Status

It must be noted in the analysis that detailed, line-by-line budgeting was not particularly relevant in Projects A and B. Developer time accounted for 97% and 94% of these projects' original budgets respectively, and so other costs were insignificant and not worthy of detailed monitoring and reporting; essentially there was only one line item on each project, and so was more or less equivalent to the bottom line figure. This was not the case with Project C and D where line-by-line budgeting was very relevant. In the case of Project C, significant line items included not just developer time (62%) but also training (22%), travel (11%) and materials (5%). Part of Project D was outsourced, causing an external consultants line item of 41%. Due to the distributed nature of the project, costs included travel (13%) and accommodation/subsistence (17%). In addition to the regular line item of developer time (29%), this meant that Project D's budget was dispersed across many significant line items.

Intensity of Budget-related Communication

Formal budget-related communication between the project manager and corporate superiors was low across all four projects. One formal meeting was 34rganized by the managing partners every six months and was attended by the project managers of each of the 22 IS development projects. While the meeting did focus on budgeting issues it was minimal, and consisted of approximately five minutes discussion around a slide which ranked the projects in terms of budget performance.

According to the managers, these meetings simply highlighted which projects were underachieving, but did not focus on constructive ways of rectifying the situations and achieving the budgets, something recommended by van der Stede.

> *"I wasn't that enthralled by my project being listed as an underperformer, but I was still looking forward to this meeting. I expected to get great feedback from these executives, with point-by-point recommendations drawn on their vast experiences of projects across the globe. Maybe it was just me but I didn't take anything away from this meeting."*   Project Manager C

The only other communication initiated by corporate superiors was with the managers of Project A and B. Ironically, both of these queries related to the reasons for the budget underspend. According to van der Stede's model, face-to-face meetings to discuss budget deviations are the strongest indicator of budget-related communication intensity. However, none of the four managers were called to discuss budget deviations face-to-face.

This is despite the fact that three of the four managers (A, B and D) were located in the same building as their managing partners and both the financial accounting and management accounting functions.

Van der Stede's model advocates the creation of a team comprising a project manager, his superiors and his subordinates to discuss and solve budgeting matters. No meeting involving all three parties took place at any stage in any of the four projects. While this form of corporate superior controller was non-existent, according to all four managers, budget-related communication between the managers and their respective subordinates was very frequent and intensive.

Emphasis on Meeting the Budget

According to all four project managers, meeting the budget was certainly a factor when their end-of-year performance was assessed. However, all felt that the budget attainment was a much lower priority criterion than the quality of the system, customer satisfaction and the extent to which it is eventually used.

> *"Going over budget is never a problem at all here. The key issue is that when we inevitably seek more money after the first allocation runs out, and we always will have to seek money, we need to have a good rationale for the additional funds and how we are going to use it."*   Project Manager D

In van der Stede's model, a measure of budget emphasis is the extent to which unforeseen opportunities are considered more important than achieving the budget. Project Managers A stated that this was not the case on his project, and that while meeting the original budget wasn't mandatory, they did not believe they were in a position to go well beyond the budget simply to exploit new opportunities.

> *"I knew there was a comfort factor and that missing the budget wasn't a problem. I would draw a line between letting the budget slip because we simply fell behind versus letting it slip because we went after some large new piece of functionality. Something like that would be require renegotiation of the budget and the setting of a different target."*   Project Manager A

On the other projects however, a looser interpretation was clearly evident:

> *"We were adding in new specs all the time. I would say after a month the budget was nothing more than a nominal figure."*   Project Manager B

> *"We had a budget figure, but this wasn't tied to any set list of requirements. We were always looking for new opportunities to improve the system from the customer perspective and the budget was rarely considered."*
>
>   Project Manager C

> *"New opportunities we always chased. The budget was only an afterthought."*
>
>   Project Manager D

These comments suggest that there was not much emphasis on meeting the budget and thus is further evidence of loose budgetary control.

EMERGENT FACTORS AFFECTING TIGHT BUDGETARY CONTROL

It was clear from the first phase of data analysis that budgetary control was quite weak across all four projects. There was a high tolerance for interim budget deviations, there was little control at the budget line-item level, budget-related communication was largely non-existent and there was little emphasis on meeting the projects. As a result of the subsequent axial coding process, a number of core factors emerged across the four constructs. Table 2 shows which seed categories (the four measures on tight budgetary control list on the horizontal axis) informed each of the emergent categories (vertical axis), according to the empirical data. An "X" denotes each of these linkages i.e. where it is evident that a emergent factor affected one of the constructs of tight budgetary control. Relevant quotes are then presented to further illustrate each of these factors.

	Tolerance for interim budget deviations	Line item control	Intensity of budget-related communication	Emphasis on meeting the budget
Development Context:				
System Type	X	X		
Organisational Culture	X		X	X
Project Culture	X		X	X
Customer Type	X	X	X	X
Accounting staff familiarity with ISD context	X	X	X	X
ISD Method Factors:				
Personnel involved in budgeting process	X	X	X	X
Transparency of budget progress	X	X	X	X
Length of iteration		X	X	
Customer involvement	X		X	X

Table 2: Emergent Factors Influencing Tight Budgetary Control in Systems Development

Development Context Factors

The *type of system* being built did affect the ability to exert tight control. For example, Project A involved the simple creation of a web-based version of an existing system. Therefore requirements were clear and unambiguous and much of the work was simple and repetitive. Project C and D involved the development of completely new systems, both of which were highly complex, involved emerging, untested technology and requirements were very abstract and vague. Budgeting and measuring progress against a budget in this turbulent environment proved very difficult.

Culture was also an issue, according to Project Manager C, who claimed that in his previous organization, budget overruns were openly discussed among managers "around the water cooler" and that even if the accounts office tolerated it, poor budgetary performance would informally be the talking point of every managerial conversation. In contrast, within the current organisation "I don't think anybody else even knows whether my project is over or under" (Project Manager C). It was also clear that this cultural issue was not just an organizational variable, but that *project culture* was also a distinguishing factor. A team lead on Project A stated that her manager "instilled a belief in meeting the budget, whether it was important or not", while on projects C and D this was clearly not the case.

The *type of customer* also influenced the tightness of control applied. The managers of Project A and B raised the point that, as their systems were for external, commercial sale i.e. for profit, there was an expectation that the profitability of the project would be assessed at some stage in the future. All four managers agreed that an internal project is not so critical I terms of profitability and that functionality and adoption are much more vital metrics of project success.

It became clear from the interviews that it was not just a lack of accounting skills among developers that caused the breakdown in communication. According to the managers, a *lack of familiarity among the accounting function staff* also contributed:

> *"HQ accountants don't really understand what we do here (in the ISD group) and that is why they don't drill down on the variances on our projects".*
> Project Manager D

These claims are supported by a report (Table 3) listing the acceptable deviation bands for every project in Britain[3]. This shows the extent to which a budget can deviate before trigger a query from the accounting function. The most restrictive of the 22 ISD projects was 15%, and in 19 of the projects there were no variance controls at all. This compares to the other types of project, many of which were allowed zero deviation; even the most restrictive trigger was 7%. This shows that the accounting function did treat ISD projects differently to the others. This eliminates the possibility that such loose control as discussed earlier is simply prevalent across the organization and all project types, and not just ISD.

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[3] Managers must seek corporate permission to get access to other project details. In this instance, normal procedure was followed, and access was only granted to projects in the service line and geographic area within which the 22 projects in this study reside.

Type of Project	Lowest variance allowed	Highest variance allowed	Mean variance allowed	Std. deviation of variances
IS Development *(n=22)*	15%	No limit	n/a	n/a
Administration/Process Reengineering *(n=7)*	0%	7%	6%	0.72%
Management & Strategy *(n=4)*	0%	0%	0%	0%
Accounting & Performance Evaluation *(n=41)*	0%	7%	5.7%	0.8%
Sales & Customer Relationship Management *(n=12)*	0%	7%	5.82%	0.8%

Table 3: ABC Consulting- Acceptable Interim Budget Variances by Project Type

ISD Method Factors

Developer involvement in the estimation and budgeting process was important in some of the cases studied. In Project A and B, the developers decided upon all estimates, recorded them, and tracked their own progress against them. According to both managers, this self-regulatory process resulted in "healthy competition" (Project Manager A) between the developers, "a sense of pride" (Project Manager B), and of particular relevance in this study "a heightened awareness of budget issues" (Project Manager B) and "a much tighter control over the budget than I could ever manage" (Project Manager A)

Transparency of budget progress also seemed to be a distinguishing factor, tightening budgetary control when present. For example, on projects A and B, peer-reviewed estimation, daily stand-up meetings, pair programming, and storyboards highlighted excess time spent on user stories the day they occurred.

> *"There was no opportunity for developers to hide delays. They would have to tell us at the 4pm stand up meeting, and if not the developer they were paired with would soon say something. If not we can also tell if their post-its are not moving across the storyboard".*
>
>   Project Manager B

> *"Every developer estimate was discussed by the team. Nobody would give bloated or overly safe estimates of their own work in front of their peers".*
>
>   Project Manager A

In Project C and D where the more plan-driven ABCMethod was used, it was clear that transparency was lower and was loosening control.

> *"We did have status meetings but some developers' work never saw the light of day until testing began. Only then would it become obvious that the work was sub-standard and that there would be budget implications to fix it.*
>
>   Project Manager D

The *length of iteration* was also an important factor. The contrast between Project A and C highlighted this issue:

> *"Each 2 week iteration highlighted any deviations incredibly quickly. We estimated how many hours or days it will take to complete each user story. At the end of each iteration we automatically know how many hours we are over budget."*
>
>   Project Manager A

> *"Major deliverables occurred every 4 – 6 months. It was only within the last week or so that we could start to say whether we would hit the budget target or not"*
>
>   Project Manager D

The level of *customer involvement* also played a role in the tightness of control. In the projects where a customer was continuously involved (A, B and C), the managers acknowledged that there was more emphasis on accurate estimation and progress against those estimates. According to Project Manager D, the lack of a customer presence meant the project "operated in a vacuum", and the team was not exposed to "the pressures of accountability

IMPLICATIONS & FURTHER RESEARCH

Despite the pervasiveness of ISD project failure, and that overspending in particular is such a concern, little research has focused specifically on how budgeting or other general management accounting techniques are being used in ISD. An analysis of relevant ISD literature shows that blame for poor budgetary performance is attributed in many different directions, but rarely if ever is the budget target or process itself ever questioned. In particular, attention has not focused on the tightness of budgetary control over ISD projects, which is somewhat surprising given the prevalence of unacceptable budgetary performance throughout the field.

This study describes an organization which where there was a distinct lack of emphasis on budgetary matters, and loose control throughout the projects studied, but then the projects in question, and in fact the whole division, were terminated solely due to poor budgetary performance. It is very significant that the problem did not seem to be symptomatic of poor control across the organization; relatively tight control was imposed on non-ISD projects (process re-engineering, management/strategy, accounting/performance evaluation, sales/CRM), and the problem seemed limited to ISD initiatives. Given the fact that so many ISD projects fail drastically in terms of budget, it is therefore worth questioning whether such loose control is prevalent across the field. Organisations who use cost as the primary determinant of success need to evaluate the extent to which they exert control over project budgets, particularly if they are prone to cancellation as was the case in this study. By no means does this study alone suggest that this apparent lack of control is prevalent across the ISD field; this was simply a revelatory case of four projects in a single organisation. However, it does provide one possible explanation as to why ISD projects perform so poorly, and merits further, more extensive research across a much greater number of these projects.

The primary objective of this paper was to investigate and identify the factors affecting tight budgetary control in ISD projects. The factors that emerged from this study are (i) system type, (ii) organizational culture, (iii) project culture, (iv) customer type, (v) the familiarity of accounting staff with ISD, (vi) the personnel involved in the budgeting process, (vii) transparency of the budget process, (viii) length of development iteration, and (ix) customer involvement. As far as we are aware, this makes a theoretical contribution to the field, as it is the first study that focuses on the tightness of budgetary control in ISD, and the first to identify a set of ISD-specific factors that can hinder such control.

These factors have significant implications for practice. Organisations can use the list of factors to determine if their projects are amenable to tight budgetary control, to identify potential shortcomings, and to determine mechanisms for overcoming these shortcomings. For example, the research showed that the familiarity of accounting staff with ISD projects can cause loosening of what would otherwise be tight budgetary control. To address this, senior management could provide accounting staff with ISD-specific training, or could increase exposure to these projects by requiring face-to-face meetings between the ISD manager and the accounting staff, as opposed to the standard uploading of monthly reports. They could also 'lock' the control measures to ensure that ISD projects are forced to comply with the same limits and rules as any other project type, which was not the case in the projects studied as part of this research. The factors above can be used as the structural basis for an action plan to increase amenability to tight budgetary control e.g. justification to provide new managers with project accounting training.

In terms of limitations of the study, it should be noted that while budgets are a key mechanism for exerting tight control, they are by no means the only mechanism; see Merchant and Otley (2007), Merchant and van der Stede (2007) and Anthony and Govindarajan (1998) for extensive discussions of other control mechanisms. Organisations should ensure that budgetary control is considered within this wider portfolio. Furthermore, it should not be assumed that tightening budgetary control is always a good thing; while tight budgetary control is often positively co-related to budgetary performance, this is not always the case, and overly restrictive budgetary control can stifle a project and increase the chance of failure (Simons, 1995, Widener, 2007). Therefore, before measuring the tightness of budgetary control over an organization or project, assessing the factors affecting that control, or taking any corrective action, it is important to determine whether meeting the budget is the most important dimension of success in that instance.

The study also identifies opportunities for future research efforts. This study identifies potential factors affecting tight budgetary control that were evident in the four cases studied. We suggest that further research could elaborate this list and seek to derive measurable hypotheses. Also, while this study identifies emergent factors, there is no attempt to show how these factors relate to one another and to develop a resulting theoretical model. This could be addressed by future research. Given that some of the blame in this study was attributed to the accounting function overseeing these projects, interesting insights could also be gained by studying the perception of people in that role.

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APPENDIX A: EXAMPLES OF OPEN CODING

Quote	Key codes
"Going over budget is never a problem at all here."	Budget_Emphasis / Loose_Control
"New opportunities we always chased. The budget was only an afterthought."	Budget_Emphasis / Loose_Control
"I expected to get great feedback from these executives, with point-by-point recommendations drawn on their vast experiences of projects across the globe. Maybe it was just me but I didn't take anything away from this meeting."	Intensity_of_Communication / Loose_Control
"I knew there was a comfort factor and that missing the budget wasn't a problem.	Budget_Emphasis / Loose_Control

APPENDIX B: EXAMPLES OF AXIAL CODING (EMERGING FACTORS)

Quote	Key codes
"There was no opportunity for developers to hide delays. They would have to tell us at the 4pm stand up meeting, and if not the developer they were paired with would soon say something. If not we can also tell if their post-its are not moving across the storyboard."	Emerging_Factors/Method_Factors/Transparency
"Each 2 week iteration highlighted any deviations incredibly quickly."	Emerging_Factors/Method_Factors/Length_of_Iteration
"HQ accountants don't really understand what we do here"	Emerging_Factors/Decelopment_Context_Factors/Lack_of_ISD_Familiarity
"Every developer estimate was discussed by the team. Nobody would give bloated or overly safe estimates of their own work in front of their peers".	Emerging_Factors/Method_Factors/Transparency
"I don't think anybody else even knows whether my project is over or under"	Emerging_Factors/Decelopment_Context_Factors/Culture

IT Project Management from a Systems Thinking Perspective: A Position Paper

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ABSTRACT

We proposes a Systems Thinking approach to the study of IT project management and show how this approach helps project managers in controlling their projects. To illustrate our proposal, we present an example model of the dynamics of IT outsourcing projects. The example model explains these dynamics in terms of feedback loops consisting of causal relations reported in the literature. The model provides insight in how coordination, trust, information exchange and possibilities for opportunistic behaviour influence each other and together influence delivery quality, which in turn influences trust. The integration of these insights provided by applying the Systems Thinking perspective helps project managers to reason about how their choices influence project outcome. The Systems Thinking perspective can serve as an additional tool in the academic study of IT project management. Applying the Systems Thinking perspective also calls for additional research in which this perspective is itself the object of study.

Keywords

Systems Thinking, Systems Dynamics, IT Project Management, IT Outsourcing, Coordination, Trust

INTRODUCTION

Many IT projects fail in one way or another: while the exact percentage depends on the definition of failure and way of measuring, failure rates reported are usually higher than 50% (Gemino et al., 2007). In this paper, we define IT projects as projects in which some desired IT functionality is created for an internal, non-commercial or external, commercial customer organization. This can be in the form of in-house software development by software engineering or in the form of outsourcing to an external organization.

IT projects are complex systems that consist of different kinds of components, such as stakeholders, work products, procedures, and project controls. The interaction of these components determines the outcome of the project. Similar to van Ekris (2008), we use a broad definition of project outcome: project outcome is any change in the material or mental state of the customer caused by the project. Project outcome is not determined at a single moment in time, but by a process consisting of multiple interactions with members of the customer organization. These interactions include the delivery of partial project results, consultations with members of the customer organization, and delivery of progress reports. In other words, the project outcome is governed by the dynamics of a complex system, which IT project management aims to control.

The dynamics of a complex system emerges from the interactions between the components of the system, and can often be explained by feedback loops within the system. For instance, consider a project in which partial project results have been rejected by users because they found that the results do not fit their way of working. This may lead to a decrease in trust in the project, which may lead to a decrease in knowledge sharing between the project and the (disappointed) project users, which in turn leads to subsequent project results that fit even less.

In other words, dynamics cannot be fully explained by isolated correlations between two variables, as this neglects feedback loops. However, current research in the Information Systems area mainly focuses on such isolated correlations, for instance the impact of top management support (independent variable) on project success (dependent variable). Therefore, a holistic approach that studies parts of the system not in isolation, but as the parts of a greater whole has the potential to extend current research insights in a way that practitioners need to successfully manage projects.

Systems Thinking (Sterman, 2000; Maani and Cavana, 2000) is an approach to problem solving based on a holistic view in which a problem is explained as emerging from the dynamics of the underlying system. The contribution of this paper is a proposal to apply Systems Thinking in the area of IT project Management, providing a way to capture the dynamics of IT projects. Using an application in the area of outsourcing projects as an example, we show how applying Systems Thinking in IT project management helps project managers to understand how their decisions influence project success, which in turn helps them to stay in control.

SYSTEMS THINKING: BACKGROUND AND RELATED WORK

The history of Systems Thinking can be traced back to research in general (mathematical) systems theory as developed in the mid of the previous century. Systems Thinking grew out of Forrester's work in which he applied general systems theory to organizational systems in business. Two paradigms can be distinguished in Systems Thinking: Systems Dynamics and Soft Systems Methodology (SSM). Systems Dynamics (the paradigm pioneered by Forrester) focuses on modelling feedback loops consisting of cause-and-effect relations between system components and on computer simulations to study system dynamics. Systems Dynamics primarily deals with quantitative models, but as early as 1983 qualitative approaches have been proposed (Wolstenholme and Coyle, 1983; Wolstenholme, 1983). Other examples of qualitative applications have been presented by Dangerfield (1999), and by Swart and Powell (2006). This paper follows the tradition of qualitative Systems Dynamics.

The Systems Dynamics approach is what Pollack (2007) calls a 'hard' approach to Systems Thinking. According to Maani and Cavana (2000), in the 'hard' approaches the systems model is seen as a representation of the real world. Further assumptions are that stakeholders agree on a "clear and single dimensional (single objective)" problem definition (Maani and Cavana, 2000). Maani and Cavana (2000) also note that in the 'hard' approaches, organizational and people issues are not taken into account, and data is usually quantitative. Wolstenholme (1993) puts this into perspective: while his approach is 'hard' in the sense that his model is seen as an objective representation of the real world and there is a clear and single-dimensional problem definition, data is qualitative and organizational issues are taken into account. We concur with Wolstenholme (1993) and Pollack (2007) and assume that in 'hard' approaches, data is objective and based on empirical observations, but not necessarily quantitative.

According to Maani and Cavana (2000) and Pollack (2007), in 'soft' approaches (of which Peter Checkland's Soft Systems Methodology (Checkland, 1981) is probably the best-known example), the dynamic model is not seen as an objective representation of the real world, but as "a way of generating debate and insight about the real world" (Maani and Cavana, 2000). Thus, in the 'soft' approaches, a model is subjective and this reflects that different stakeholders may have different perceptions about how the real world behaves, and also about what the problem actually is.

In fact, both 'hard' and 'soft' approaches have a place in IT project management. A 'soft' approach has been used by Johnstone et al. (2006) to develop a holistic framework of conflict and conflict resolution in IT projects. Their framework appears to contain one (short) feedback loop: governance provides process adjustments to resolve conflicts, and observes whether this helps. The results of Johnstone et al. can be the starting point for a subsequent 'hard' approach that further explains the behaviour of the system-to-be-controlled in terms of internal feedback loops.

Mutschler et al. (2007) use a 'hard' approach to model the factors that influence implementation costs of what they call 'process-aware information systems'. The authors present quantitative, mathematical models of a large number of cost factors and use simulation to explain dynamic behaviour such as costs that rise exponentially over time, or costs that fluctuate around a certain level. Their work shows how a 'hard', quantitative approach can be used to model one aspect of project management (management of cost).

A SYSTEMS THINKING PERSPECTIVE ON IT PROJECT MANAGEMENT

Applying Systems Thinking to reason about (a problematic phenomena of) a system involves creating a model of the system. Sterman (2000) proposes a five-step, iterative process to do so. This process consists of the following steps: (i) problem articulation, (ii) formulation of the dynamic hypothesis, (iii) formulation of a simulation model, (iv) testing and (v) policy design and evaluation. These steps are conducted by problem stakeholders, possibly together with a consultant trained in Systems Dynamics. The hypothesis formulated in the second step is a conjecture of how

feedback loops in the system explain the behaviour of the system. These feedback loops are essential: without them, a general causal model is obtained that cannot describe dynamics. In quantitative systems dynamics, this hypothesis is then tested (step iv) using quantitative simulation techniques determined in step (iii) to assess the robustness to boundary cases, and to do sensitivity analysis. In qualitative Systems Dynamics, the hypothesis is validated using techniques such as obtaining expert feedback.

In this paper, we focus on what Sterman (2000) calls the dynamics hypothesis. This hypothesis explains the behaviour of the system in terms of interactions between its components and is usually formulated using some diagramming technique such as causal loop diagrams or stock and flow diagrams (Sterman, 2000; Maani and Cavana, 2000). A causal loop diagram (and also a stock and flow diagram, which is an extension of a causal loop diagram) consists of a number of variables and causal relations between them. A variable either describes some property of the system as a whole, or some part of it.

The position of this paper is that we propose to apply Systems Thinking to IT project management. This means that we propose to focus on the dynamic behaviour of a project: the behaviour of (everything in) a project changes over time, and IT project management is about proactively controlling this. Project managers do so by identifying feedback loops, creating causal models of the project and choosing control actions based on this model, similar to the process outlined above. We illustrate the kind of insight that this creates in the next section.

A CAUSAL MODEL OF IT OUTSOURCING PROJECT SUCCESS

In this section, we present, as an illustration of the Systems Thinking perspective, a causal model of dynamics in an IT outsourcing project. Our model, which is depicted in Figure 1, is based on the following vision of success of outsourcing projects. Outsourcing creates a relation between two economically independent actors (the outsourcer and the insourcer). The fact that the two actors are economically independent creates forces and tensions between them that in turn influence *delivery quality* as depicted in the model (words in italics refer to variables in Figure 1). During the project, both employ *information flows* to *coordinate* their activities. This information exchange, however, is influenced by the *trust* that they have in each other, which in turn is influenced by the *perception* of the outsourcer of the extent to which the insourcer is capable of *delivery*. As both actors are economically independent, we have to assume that each is self-interested and not unwilling to act in a way that advances its own interest in a way that is detrimental to the other (*possibilities for opportunistic behaviour*).
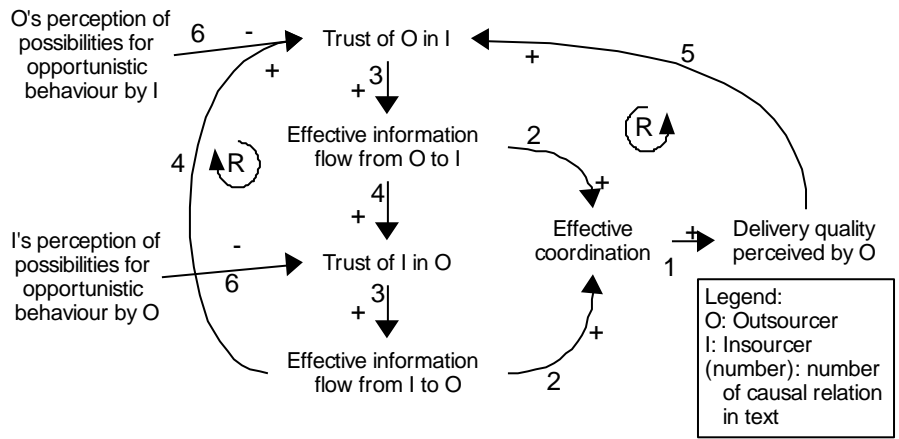
Figure 5: Operational success of outsourcing: causal model. A '+' indicates that an increase in one variable causes an increase in the other. A '-' indicates that an increase in one variable causes a decrease in the other. Two 'reinforcing' (letter 'R') feedback loops are indicated.

We claim that in outsourcing, there are at least two positive, or reinforcing, feedback loops which explains why outsourcing projects have a tendency to get out of control: for instance, if trust erodes, parties become less open in their communication, which affects delivery, which in turn further erodes trust, and so on. Of course, the feedback loop can also work in the opposite direction. The point is that the feedback loops make the dynamic aspects of the

project explicit. This is the distinguishing feature and primary benefit of applying the Systems Thinking perspective. The next subsections systematically describe the variables in the model as well as the relations between them.

Delivery quality: Operational success of IT outsourcing projects

With operational success, we mean that the project results in delivery of a solution, within time and within budget, that according to the customer has the quality agreed upon beforehand. Similar to van Ekris (2008), we view operational success as more than only delivering the right result on time.

Delivery quality as perceived by the outsourcer is in the model because it is the ultimate goal of at least the outsourcer and most probably also of the insourcer to deliver intermediate and ultimate project results that are perceived as quality results by the outsourcer. The precise operationalisation of delivery quality is case-specific. Thomas and Fernandez (2008) report results of a survey among 36 Australian companies with the aim to understand how these companies define project success. They found that project success is a multi-dimensional construct and identify several success criteria in three categories ('project management', e.g. on-time and on-budget, 'technical', e.g. system quality, and 'business', e.g. delivery of benefits).

Coordination

We follow Malone and Crowston (1994) and define coordination as "managing dependencies between activities." In the context of the current illustration, 'activities' are the common activities in software development, such as requirements engineering, programming, testing, and delivering the resulting software product. There are dependencies between these activities: certain activities can only start when others have finished, or certain activities may need access to the same resource. Coordination consists of all mechanisms employed and actions taken to ensure that these dependencies do not hamper the project.

Causal Relation 1 An increase in effective coordination causes an increase in delivery quality as perceived by the outsourcer.

We concur with Kraut and Streeter (1995) and mention that successful coordination is an important determinant of project success. Moreover, coordination is an area that is amendable to managerial control: project managers can choose coordination mechanisms in the project setup phase and can monitor whether coordination is successful when the project is carried out and intervene in a relatively easy way. Mirani (2007), in a recent paper, examines the relation between what he calls procedural coordination in offshore "software tasks" in two case studies.

Information exchange

In our model, successful coordination is in turn influenced by the effectiveness of information exchange between the insourcer and the outsourcer. We take the position that what Thompson (1967) calls 'reciprocal dependence' is the dominant type of dependence in the interaction between outsourcer and insourcer. Every project milestone in which (part of) the final product is delivered is an opportunity for the outsourcer to provide the insourcers with feedback concerning the quality of the product, which in turn enables the insourcer to create a new version, which is another opportunity for the outsourcer to provide feedback, and so on. The appropriate coordination mechanism according to Thompson is mutual adjustment based on information exchanged between the outsourcer and the insourcer. This works better when the information exchanges is of better quality, which justifies the inclusion of the following causal relation in the model:

Causal Relation 2 An increase in the quality of information (regarding the project) exchanged between the insourcer and outsourcer causes an increase in effective coordination.

Relations between information exchange and coordination are numerous in the scientific research literature. Many observations made by Mirani (2007) boil down to information exchange; for instance, the author observed that coordination improved when the offshoring company started to use a 'dedicated multi-tier Telecom infrastructure'.

Like in the area of coordination, it is relatively easy for project managers to install control mechanisms that facilitate effective information exchange across the whole spectrum from facilitating direct human-to-human communication to formalized document flows in the project. Managers can invest in modern communication technology to facilitate

meetings between stakeholders, increase travel budgets, place employees at each other's sites, or invest in tools such as shared workspaces for document exchange, workflow management systems, and bug trackers.

Trust

Although it is possible to facilitate information exchange by a vast number of social and technical means, whether the actors in an outsourcing relation actually use these means is influenced by the trust they have in each other. We follow Lewicki et al. (1998) and define trust of an actor *X* in another actor *Y* as the "confident positive expectations" that *X* has of the conduct of *Y*.

Trust is a dynamic concept: the amount of trust that one actor has in another may change over time. Lewicki and Bunker (1996) distinguish three types of trust (calculus-based, knowledge-based and identification-based trust) and describe the "stepwise evolution of trust" over time. It is thus possible to speak of the increase or decrease of trust, which allows us to include the following causal relations.

Causal Relation 3 An increase in the trust that an actor *X* has in actor *Y* causes an increase in the effectiveness of information transmission from *X* to *Y*.

Causal Relation 4 An increase of the effectiveness of information transmission from an actor *X* to an actor *Y* causes an increase in the trust that *Y* has in *X*.

Causal Relation 5 An increase in delivery quality as perceived by the outsourcer causes an increase in the trust that the outsourcer has in the insourcer.

Lewicki and Bunker (1996) discuss several mechanisms that play a role in trust development. These mechanisms also can be viewed as support for the causal relations. For instance, Lewicki and Bunker state that regular (and, presumably, effective) communication is key in developing knowledge-based trust. Lander et al. (2004) report similar findings. In particular, they state that "The importance of communication as a trust-building mechanism had the highest overall rating as the most important of the ten mechanisms examined. Study participants identified communication as a trust-building mechanism more frequently than any other mechanism." (Lander et al., 2004, p. 517). Nicolaou and McKnight (2006) investigated trust in what they call inter-organizational systems and found that an increase in perceived quality of information exchange results in an increase in trust.

Trust plays a central role in the causal model; it is the linking pin that connects all other variables. Trust can be manipulated by project managers via various means. As our model indicates, one way is to increase delivery quality. The literature on outsourcing discusses many other ways. Jarvenpaa and Leidner (1998), for instance, discuss how trust can be influenced on the inter-personal level (by making sure that project members meet face-to-face, etc.)

Perception of possibilities for opportunistic behaviour

The possibility that either, or both, of the actors involved in an outsourcing relation behaves opportunistically follows from Transaction Costs Analysis (TCA), an economic theory proposed by Coase (1937) and extended by Williamson (1981). Transaction Costs Analysis is rooted in a economic view of the world in which economic actors have bounded rationality and are not inherently 'good': economic actors are willing to bend the rules, breach contract, cheat, or engage in any other activity that advances them toward their goal, even if this harms other economic actors. Williamson calls this 'opportunism' (Williamson, 1993). The extent to which an economic actor has the possibility to act opportunistically differs for each relation that the actor engages in. This influences the amount of trust that one economic actor has in the other. We therefore include in our model a negative causal relation between possibilities for opportunistic behaviour and trust:

Causal Relation 6 An increase in the possibilities for opportunistic behaviour by an actor *X* as perceived by another actor *Y* causes a decrease of trust of *Y* in *X*.

The perception of the possibilities for opportunistic behaviour can be controlled by project managers, for example by making sure that such possibilities are covered by the contract governing the relation. In our model, this is currently the only way to balance the forces of the feedback loops that involve trust.

Discussion

In this section, we illustrated how the Systems Thinking perspective reveals feedback loops that explain the behaviour of an outsourcing project over time. The variables of the model indicate which control actions a project manager can take, and provide insight in why the project behaves as it does. Thus, the dynamic model provides a means for project managers to reason about their projects as a starting point for decision making.

The causal model presented in this section is not the only possible model that explains the dynamics of an outsourcing project. We are aware of several (almost obvious) possible extensions, which we discuss next. In fact, from the perspective of Systems Thinking methodology, this is of minor importance. Our model is a consolidation of the experience that we gained in studying outsourcing and inter-organizational systems development with several industrial partners. Thus, the model is not specific for one particular IT outsourcing project. When Systems Thinking is applied in a specific project context, completeness of the model is tested for that specific context as part of the process outlined before.

Possible extensions of the model include adding more variables. The literature on outsourcing and offshoring provides numerous suggestions, see Dibbern et al. (2004) for a comprehensive survey. For instance, especially in the case of offshore outsourcing, cultural issues are important factors in the success of an outsourcing relation. Also knowledge is a factor: the outcome of an outsourced IT project is influenced by the knowledge the insourcer has of the project context at the outsourcer. Knowledge is related to two variables that are present in our model: information exchange (as a way to 'build' knowledge) and trust (Levin and Cross, 2004).

CONCLUSION

Implications for research

Systems Thinking has been developed as a problem solving approach and not as a scientific research method. The question then is: Can IT project management from a Systems Thinking perspective result in scientific knowledge? In this section, we discuss two roles that we see for academic research in the area of Systems Thinking and IT project management.

In this first role, Systems Thinking is a tool in the academic study of IT project management. While Systems Thinking is not itself a scientific method, it contains elements that are related to scientific methodology. In our opinion, generalization of results obtained by applying Systems Thinking to a specific IT project management case can follow several different routes. One route is to apply the same causal model to a different case. This is what Lee and Baskervile (2003) call TE-generalization (from Theory to Empirical description): "generalizing a theory, confirmed in one setting, to descriptions of other settings". This route requires testing the model in the context of this different case as outlined by the process described before. The model thus becomes a kind of reference model that practitioners use as a starting point in the hypothesis formulation step.

The other route is to regard a causal model that is validated in a particular case as a representation of an empirical fact and derive from this a theory. This type of generalization underpins the case study research methodology of Yin (2003). Lee and Baskervile (2003) call this type of generalization ET (from Empirical description to Theory): generalization from description to theory. This type of generalization requires that the researcher carefully documents how the idiosyncrasies of the particular case are interpreted as instances of more general phenomena (Klein and Myers, 1999). We think that Systems Thinking is particularly useful for this: models such as causal loop diagrams describe the causal mechanism that explains the observed empirical fact.

The second role that we propose for academic research takes Systems Thinking itself as the object of study. In this role, academic research studies the application of Systems Thinking to IT project management with the aim to develop knowledge about best practices, and to develop new methods and tools that help practitioners to apply Systems Thinking in this context.

Implications for practice

We have illustrated how the Systems Thinking perspective on IT project management helps project managers to understand and reason about the causal mechanisms that explain project dynamics. Project managers can use this to decide which interventions to conduct to keep their projects under control. The Systems Thinking perspective

extends existing knowledge about IT project management that is of a more static nature, such as knowledge of success factors and risks.

This practical implication applies to the phase in which the project is running and managers have to exercise control by using the control mechanisms that the project provides. We see a second practical implication in the setup phase of the project: the Systems Thinking perspective supports design of project control mechanisms. In the setup phase, stakeholders have to decide on which mechanisms to use to control the project. These mechanisms form a system, which is an artefact that needs to be designed by the project stakeholders. One step in design is identifying solution alternatives and choosing the one(s) that can be expected to reach the goal of the design. Designers base this expectation on knowledge of the behaviour of each solution alternative. The Systems Thinking perspective equips project stakeholders with the tools to obtain this knowledge: the dynamic models explain how the different control mechanisms interact. Thus, the Systems Thinking perspective on IT project management not only allows project managers to control their projects, but also to design the set of control mechanisms that they employ to exercise control.

ACKNOWLEDGMENTS

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Mediators between Conflict Resolution and ISD Program Performance

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ABSTRACT

Program teams can greatly facilitate the successful implementation of client ISD programs. We examined the effects of conflict resolution on ISD program performance. A total of 88 responses from IS program managers from 35 IS offshore outsourcing vendors were solicited, obtained, and analyzed. The results indicated that conflict resolution can enhance the level of communication, mutual support and effort among IS program members. The results further suggested that program performance was improved by increasing communication, promoting mutual supportiveness among program members and augmenting effort towards each other's projects. Directions for management practice and future research are discussed.

Keywords

Program management, conflict resolution, communication, mutual support, effort, program performance.

INTRODUCTION

There is a transition in the criterion for the decision to outsource from a cost savings perspective to a strategic perspective. Subsequently, there has been a shift in the management of projects from operational focus to strategic focus for the information systems (IS) outsourcing vendors. IS vendor organizations are increasingly using program management teams to manage complex and interdependent projects (Gierra 2004). Programs are groups of projects, managed together to obtain benefits not available from managing them individually (Maylor, 2003). There are three kinds of IS vendor programs, development, maintenance and implementation (Iyengar, 2003). In this paper we focus on information systems development (ISD) programs. The interdependencies between the projects may lead to conflicts among project managers due to different perceptions of the same situation, goal incongruency, or asymmetry of information, resulting in rework and emergence of crisis (Kazanjian et al. 2000) and supplemental development costs due to delays (Dutoit and Bruegge 1998). At the same time, it is widely recognized that diverse interests and perspectives are inevitable when members from different projects and functional areas work together in the program due to their varied orientations toward goals, interpersonal relations and important external stakeholders (Lawrence and Lorsch 1986). Some of the obstacles which program teams encounter are 1) competition for resources, 2) intra-team disputes for one-upmanship, 3) personality clashes, 4) lack of cooperation, 5) conflicting goals (Iyengar 2003; Tang and Walters 2006). Unresolved conflict can strain relationships and trust between parties (Gill and Butler 2003), could lead to the development of further conflict (Kezsbom 1992), have strong, negative effect on overall software product success and customer satisfaction (Gobeli et al. 1998). Therefore, conflict resolution between the project teams represents one of the key issues in successful management and implementation of programs (Crawford 2002).

Past research has focused primarily on antecedents, mechanisms and outcomes of conflict resolution. Conflict resolution mechanisms are addressed in the broader area of conflict management. Rahim (2001) highlighted the difference between conflict resolution (which "implies reduction, elimination or termination of conflict") and conflict management (which "involves designing effective strategies to minimize the dysfunctions and maximize the constructive functions of conflict"). Robey and Farrow (1982) examined the influence of the participatory dynamic on conflict and its resolution during IS development and observed that intensity of conflict was negatively associated with conflict resolution. They also detected that through user participation; user influence can be enhanced, which in turn results in conflict resolution and project success. Conflict resolution was noticed to be solely determined by user influence (Barki and Hartwick 1991). Conflict resolution was correlated positively with

user participation, while negatively with the two conflict potentials: substantive dissension and emotional hostility (Yeh and Tsai 2001).

Most empirical studies, have attempted to establish a direct link between conflict resolution and performance outcomes. While previous research has made important contributions to our understanding of the direct relationships between conflict resolution and team performance, research on the mechanisms through which conflict resolution affects performance are lacking. Additionally conflict resolution has not been the subject of extensive study in the IS program management literature. We attempted to answer the question:

   How does conflict resolution affect the performance of ISD programs?

The purpose of this study is to build on previous research by developing and testing a path analytic framework which includes three outcomes of conflict resolution, that appear to mediate the effect of conflict resolution on program outcomes. The research methodology utilized survey data from 88 program teams in 35 IS outsourcing vendors.

BACKGROUND

Conflict resolution does not imply that one party forces a solution on another party (Robey et al. 1989). As Weitz and Jap (1995) argue, constructive conflict leads to amicable resolutions that "often act as a source of novelty for the relationship, forcing it into new terrain that, if handled successfully, can strengthen the interpersonal relationship and cultivate greater trust, communication and relationship satisfaction, stability, and personal growth" (p.315). Sheth (1973), in an industrial buying setting, states that conflicts resolved in a rational manner should lead to final joint decisions that must also be rational. Pondy (1967)'s model of organizational conflict conceptualizes conflict as a series of episodes with each episode including stages of latency, feeling, perception, manifestation, and aftermath. These episodes constitute the crux of relationship among participants. If the conflict is fairly resolved to the satisfaction of all participants, then the foundation for a more cooperative relationship may be established; or the participants, may focus on latent conflicts not previously perceived and dealt with. Conversely, if the conflict is subdued but not resolved, then there is a possibility of conflict becoming aggravated and culminate in severe form until they are rectified or until the relationship dissolves. Deutsch (1969) proposed that conflict could have two consequences to a relationship. On the one hand, it could aggravate and become destructive, resulting in serious consequences such as the dissolution of the relationship. On the other hand, resolution of the conflict could be used as a mechanism for bringing differences of opinion and dissatisfactions to the attention of the other party, allowing for some sort of mutual adjustment of the relationship in a constructive or functional way that improves the quality of the relationship.

Promotive interaction is considered vital in building positive and supportive relationships among the diverse parties (Johnson and Johnson 1998; Johnson and Johnson 2005). Promotive interaction is the verbal promotion and facilitation of each other's learning through effective support and encouragement, exchanging information, clarification of ideas, providing feedback, and challenging each other's reasoning and conclusions (Johnson et al. 2000). Examples of promotive interaction behaviors from Johnson and Johnson (2005) include 1) Providing group members with efficient and effective help and assistance, 2) Exchanging needed resources, such as information and materials, and processing information more efficiently and effectively, 3) Providing group members with feedback to improve the subsequent performance of assigned tasks and responsibilities 4) Challenging group member's conclusions and reasoning to promote higher quality decision making and greater insight into problems 5) Advocating the exertion of effort to achieve mutual goals 6) Influencing each other's efforts to achieve the group's goals 7) Acting in trusting and trustworthy ways 8) Being motivated to strive for mutual benefit. These behaviors are a basic component of cooperation among groups (Johnson and Johnson 1998). Based upon the examples, we have conceptualized and broadly specify promotive interaction as consisting of three core behaviors, communication (which provides a means for the exchange of information among team members), mutual support (display mutual respect, grant assistance when needed, and develop other team members' ideas and contributions) and effort (workload sharing and prioritizing of the team's task over other obligations). These behaviors form an essential part of the cooperation process (Johnson and Johnson 1998). It is widely agreed upon in the literature that the flow of communication within teams influences the success of innovative projects (Griffin and Hauser 1992). It is extensively acknowledged in literature that team support will improve team performance (Bishop et al. 2000; West 2004). The effort that team members exert on their common task influences the success of the project (Hackman 1987).

The chain of relationships suggested by the literature provided the basis for our research model; this is shown in Fig. 1.
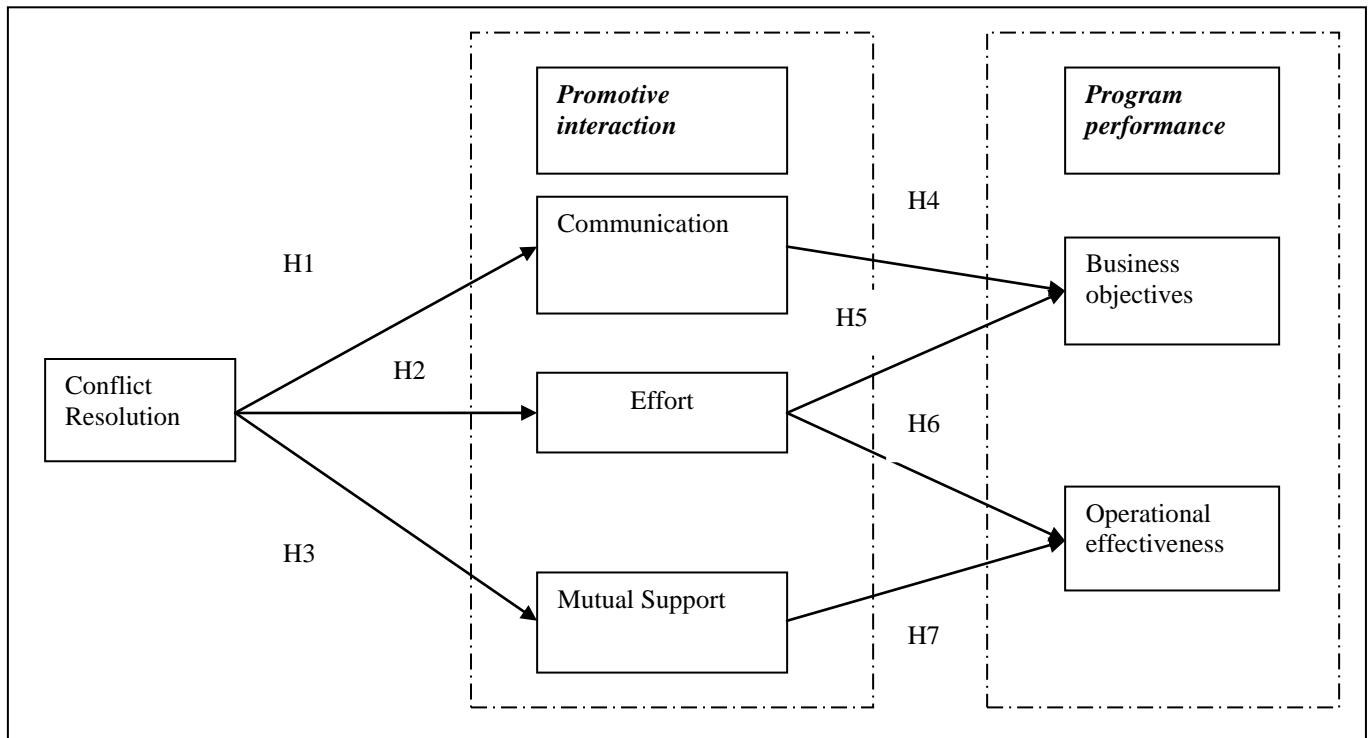
Figure 1: Research model

HYPOTHESES

Program teams are heterogeneous like cross functional teams in the sense that team members belong to different projects in the program (Lovelace et al. 2001). Should conflict be badly managed, and a consensus not reached, ill-feelings may fester, ambiguity over the requirements may increase and the ability to communicate openly may be inhibited (Robey et al. 1989; Sawyer 2001; Walz et al. 1993). Similarly, others argue that where there are barriers to communication, this can create confusion, misunderstanding, and reduce the opportunity for healthy constructive discussion (Barclay 1991; Menon and Varadarajan 1992).Hence we believe that,

H1: Conflict resolution will positively improve communication among program members.

Organizational conflict is defined as interference in goal achievement efforts (Schmidt and Kochan 1972). When people work in a conflict-free environment, they are more likely able to concentrate on the job (Chan et al. 2003). Patterns of poor conflict management encourage people to not contribute to the team's effort (Sawyer 2001). According to cooperative learning theory, constructive conflict resolution enhances the effectiveness of cooperative efforts (Johnson and Johnson 1998). Constructive conflict management would use the differing perspectives among participants to improve the shared understanding of the issues, leading to improved team efforts (Pondy 1967; Robey et al. 1989). Hence this leads us to believe,

H2: Conflict resolution will positively improve effort among program members.

Constructive conflict resolution makes for genuine commitment among team members (Vries 2005). Positive feelings, attitudes, and perceptions of workplace peers, subordinates, and supervisors may facilitate an environment more conducive to individual willingness and openness for organizational change involvement and supportiveness (Madsen et al. 2005). Conflicts arise in team when differing perspectives are not integrated and team members engage in personal accusations that stifle mutual support (Aritzeta et al. 2005). Team-oriented groups are more

likely to behave synergistically and in supportive ways which reduce conflict and create a comfortable interpersonal climate within a team (Jehn 1997). Just as mutual support builds a more functional relationship, the way parties interact in the relationship building process will impact supportiveness. Perceptions of fair treatment and constructive conflict management will encourage team members to support joint actions and participate in teamwork. Hence,

H3: Conflict resolution will positively improve mutual support among program members.

The importance of communication for the successful implementation of programs (Cline 2000) and across different business functions and departments is well documented. Substantial academic research directed on new product success emphasizes the need for efficient communication among departments, particularly between R & D and marketing (Song and Parry 1997). In the context of IT project management, communication is the binding factor that 'keeps everything working properly' (Schwalbe 2000). Fricke et al. (2000) observed that management support in the form of communication is one of the key program success factors. This support can be seen in terms of implementing the reasonable amount of projects, allocating resources suitably, setting clear goals and project priority, and assigning project manager properly. Hence,

H4: Communication among program members will positively improve the achievement of business objectives.

Team effort has long been considered important in new product development programs (Cooper and Kleinschmidt 1993; de Brentani 1995; de Brentani and Cooper 1992). The individual and collective effort that members put forth on their assignment is critical to success of cross functional sourcing teams (Trent 1998). The difference between successful and unsuccessful project performance can be attributed to the effectiveness of the project team in terms of its team effort (Crawford 2002). This proposition reflects the fundamental assumption that, independent of other factors such as task-relevant knowledge and skills, the level of effort brought to bear on a task influences performance (Hoegl and Gemuenden 2001). In a study conducted by Weingart (1992), results from data of 56 student groups indicate that effort, among other variables such as planning and coordinating of tasks, has a significant influence on team performance. Hence,

H5: Program members' effort will positively improve the achievement of business objectives.

H6: Program members' effort will positively improve the operational effectiveness of the program.

Past research has shown that when implementing decisions, the support of executive peers is highly desirable (Korsgaard et al. 1995). At the executive level, the lack of peer support on key issues may lead to decision paralysis, missed opportunities, or implementation failures (Enns and McFarlin 2003). Team support has been empirically associated with an improvement in team performance (Bishop et al. 2000). Previous research demonstrated that behavior such as sharing ideas and information (Durham et al. 1997), providing instrumental assistance (Janz et al. 1997), and emotionally supporting each other (Bishop et al. 2000) raised team performance.

H7: Program members' support will positively improve the operational effectiveness of the program.

Variables	Categories	#	%
Gender	**For program manager**		
	Male	87	98.8
	Female	1	1.13
	For project managers		
	Male	85	96.5
	Female	4	4.54
Job position	**For program managers**	47	53.40
	Program managers	35	39.77
	Account managers	1	1.13
	Delivery managers	1	1.13
	Program director	2	2.26
	Senior manager	1	1.13
	Technical director	1	1.13
	For project managers		
	Project managers	80	90.9
	Project leader	8	9.09
# of employees	>100,00	3	3.40
	50, 000 – 100,000	3	3.40
	25,000-50,000	2	2.27
	<10,000	20	22.72
	<1000	10	11.36
Average program team size	>25	1	1.13
	10-25	18	20.45
	5-10	33	37.5
	<5	30	34.09
Program duration	5-8 years	13	14.772
	3-5 years	36	40.90
	1-3 years	1	1.13
	<1 year	38	43.18
No of projects in the program	50-100	2	2.27
	25-50	5	5.68
	5-25	45	51.13
	<5	36	40.90

Table 1: Organization and Program Characteristics

METHODOLOGY

To empirically validate our hypotheses, we collected data from 35 IT outsourcing vendors located in India. The vendors have proficiency in information systems development and maintenance of complex systems for their clients. Most of the vendors have headquarters in India while a few have offshore development centers in India. Since collecting paired data at managerial level was challenging, we collected multiple sets of data from same firm where ever possible. There was a single set of respondents from 11 firms, 2 sets respondents from 12 firms, 3 sets respondents from 8 firms, 4 sets of respondents from 4 firms and 8 sets of respondents from 1 firm. The vendors have adopted program and project management practices and most have been assessed at Capability Maturity Model (CMM) level 5. The organizational policies with respect to program management are thus perceived to be flexible yet measurable. The data are from 88 IT outsourcing programs executed between 2002 and 2007 and involve a pair of program manager and project manager/leader from each program to avoid common method bias. The data includes survey data which was collected through multiple means. The firms were identified from a large database of IT firms compiled by National Association of Software and Services Companies (NASSCOM). Personal contacts of the author were utilized to approach program managers in 20 prominent firms (CMM level 5) in the database. A part of the responses were obtained by personally handing a questionnaire to the respondent which was collected after few days while others were collected by conducting personal and phone interview consisting of questions from the questionnaire. We contacted HR departments of 30 firms in the NASSCOM database and solicited their assistance for our study. 16 firms agreed to our requested and provided the contact of program managers. 20 program managers were contacted on social networking sites and couple of them agreed to participate.

The questionnaire consisted of items measured on a on a 5-point Likert-scale ranging from 'totally disagree' to 'totally agree'. After the collection of responses from programs manager, we asked the program manager to identify a project manager/leader managing a key project in the program. The project managers were later interviewed to collect their response.

Constructs and Measurement

Conflict resolution refers to program member's attitude toward the possibilities of resolving conflicts with the other program members was assessed by three items modified from (Frazier and Rody, 1991). A sample item included the following statement, "The discussions I have with program members on areas of disagreement are usually very productive".

Communication refers to program member's perception of exchange of information among team members was assessed by six items modified from (Hoegl and Gemuenden, 2001). A sample item included the following statement, "There was frequent communication within the program".

Mutual support refers to program member's perception of display of mutual respect, granting of assistance when required, and development of other team members' ideas and contributions was assessed by five items modified from (Hoegl and Gemuenden, 2001). A sample item included the following statement, "Program members helped and supported each other as best they could".

Effort refers to program member's perception of workload sharing and prioritizing of the team's task over other obligations was assessed by three items modified from (Hoegl and Gemuenden, 2001). A sample item included the following statement, "Every program member fully pushed the program".

Since there were no known measures of *program performance* from the vendor perspective in the context of ISD program, we modified the scale for this construct from new product development (NPD) programs. To differentiate between successful and unsuccessful programs, it was essential to first define "performance" in this context. Performance of a program pertains to the operational effectiveness of the projects (Kerssens-van Drongelen and de Weerd-Nederhof, 1999, Chen et al., 2006); and the realization of business objectives (Chen et al., 2006). We measured *program performance* as perceived by the program manager through the following indicators:
- Level of the operational effectiveness of the projects the program (5 items);
    - A sample item included the following statement, "The program was completed within budget".
- Level of contribution of the program to the vendor's business objectives (4 items)
    - A sample item included the following statement, "The program was aligned with business strategy".

Measurement model

In this study, PLS-Graph Version 3.01 (Chin, 1994) was used to verify the measurement and test hypotheses. PLS is a latent structural equation modeling technique that uses a component-based approach to estimation that involves two steps. The first step is to examine the measurement model and the second step is to assess the structural model.

Item reliability, convergent validity, and discriminant validity test were used to test the measurement model in PLS. Individual item reliability is examined by observing the factor loading of each item. All items have loadings higher than the cutting point (0.5). Convergent validity can be examined by testing composite reliability of constructs, and variance extracted by constructs (AVE) (Fornell and Larcker, 1981, Kerlinger, 1986). The convergent validity is assured since, for each construct, the AVE is larger than 0.5, the composite reliability is more than 0.7. Finally, discriminant validity was assessed by testing whether the correlation between pairs of construct are below the threshold value of 0.90 (Bagozzi et al., 1991) and whether the square root of AVE is larger than correlation coefficients (Fornell and Larcker, 1981, Chin, 1998).

With regards to sample size, Gefen et al. (2000) advise that the minimum sample size for a PLS analysis should be the larger of (i)10 times the number of items for the most complex construct; or (ii) 10 times the largest number of independent variables impacting a dependent variable. In our model, the most complex construct has 6 items and the

largest number of independent variables estimated for a dependent variable is only two. Thus, our sample size of 88 is more than adequate for PLS estimation procedures.

Factors	Items	Factor Loading	Composite Reliability	Variance Extracted
Conflict resolution	CR1 CR3 CR4	0.83 0.67 0.88	0.85	0.64
Effort	EF1 EF2 EF3	0.84 0.82 0.88	0.88	0.72
Communication	COMM1 COMM2 COMM3 COMM7 COMM8 COMM10	0.83 0.80 0.63 0.68 0.65 0.71	0.86	0.52
Support	SUPP1 SUPP2 SUPP3 SUPP4 SUPP5	0.84 0.67 0.82 0.80 0.74	0.88	0.61
Business objectives	BO1 BO2 BO3 BO4	0.84 0.68 0.77 0.81	0.86	0.61
Operational effectiveness	PROGEF1 PROGEF2 PROGEF3 PROGEF4	0.86 0.58 0.78 0.80	0.84	0.58

Table 2: Validity and Reliability

Basic Information					Correlation Matrix					
	Mean	Std. Dev.	M3	M4	1	2	3	4	5	6
1 CONFRES	3.93	0.71	-1.65	3.92	**0.80**					
2 EFFORT	3.77	0.75	-0.46	0.56	0.40	**0.84**				
3 SUPPORT	3.87	0.62	-0.55	0.95	0.62	0.51	**0.78**			
4 COMM	3.75	0.63	-1.36	2.42	0.67	0.59	0.72	**0.70**		
5 BUS OBJ	4.15	0.56	-0.27	-0.42	0.44	0.47	0.37	0.46	**0.78**	
6 OP EFFEC	3.93	0.59	-0.83	0.98	0.39	0.48	0.58	0.53	0.65	**0.76**

M3: Skewness; M4: Kurtosis

The diagonal line of correlation matrix represents the square root of AVE

Table 3: Basic Information & Correlation Table
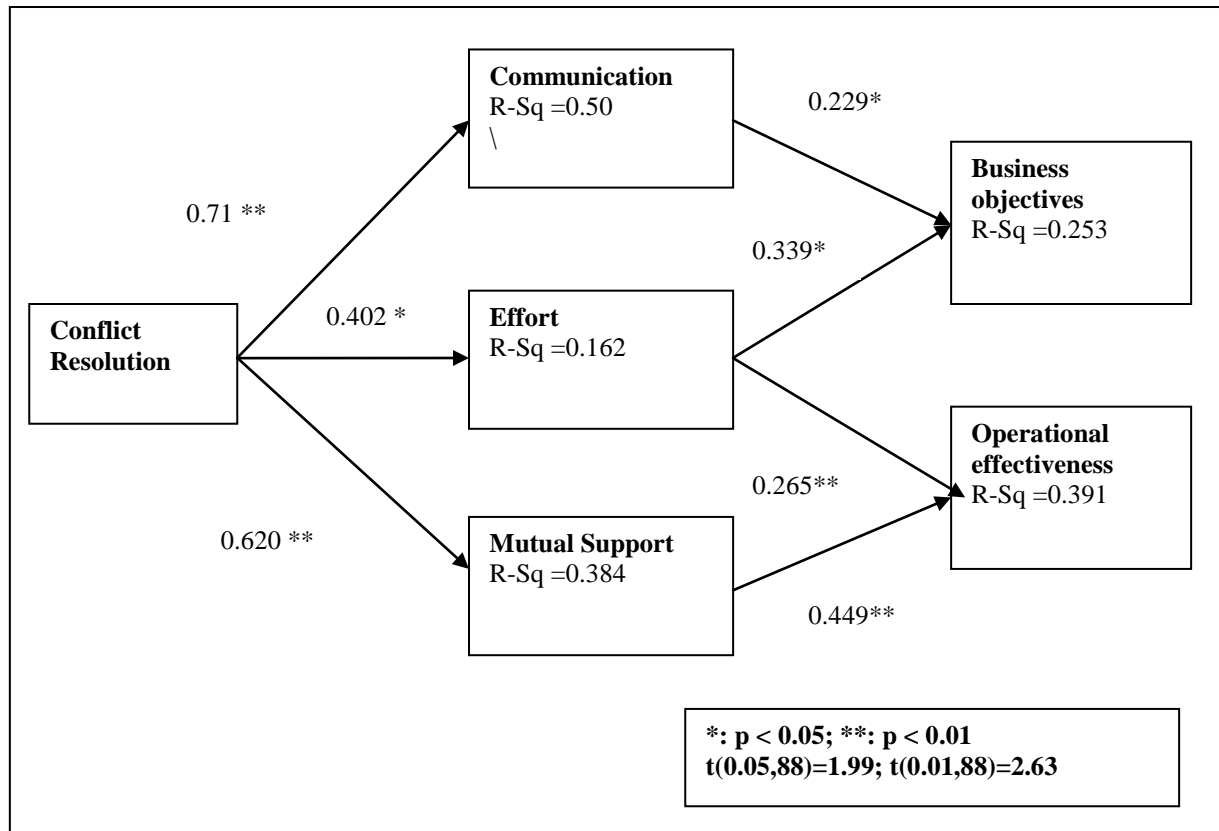
Figure 2: Path analysis

Data Analysis

As shown in Fig 2, all hypotheses are supported. Promotive interaction (communication, effort and mutual support) fully mediated the effects of conflict resolution on two dimensions of program performance.

The purpose of our study was to examine and document the effects of conflict resolution mechanism in outsourced ISD programs. As predicted, conflict resolution was observed to produce improvement in communication, mutual support and effort among program members. This is consistent with previous research. Conflict resolution explained 49.9% of variance in communication, 16.1% of variance in effort and 38.4% of variance in mutual support. Low explanation of variance in effort towards other program member projects could be explained by the fact that projects in outsourced ISD programs has fairly independent goals. Resource interdependence partly explained variance (4%) in effort. Communication and effort explained 25.3% of variance in achievement of business objectives. Effort and mutual support explained 39.1% variance in operational effectiveness.

Findings from the empirical study indicate that an IS outsourcing program team can improve its performance by resolving conflicts; encouraging communication and effort among program members and promoting mutual supportiveness to each other's projects.

DISCUSSION

Contribution to Theory

Theoretical underpinnings of this study was based upon Pondy (1967)'s organizational model of conflict which postulated the development of cooperative relationships among participants as a result of conflict resolution. Further

theoretical support was derived from a dialectical view of conflict (Zeitz, 1980) and cooperative organizational relationships (Ring and Van de Ven, 1994) which highlight cooperation as an outcome of conflict resolution initiatives. Through this study, we extend the organizational model of conflict by specifying intermediate promotive interaction mechanisms (communication, mutual support and effort) which lead to cooperation. Further, we empirically illustrate the relationships.

The results of the path analysis revealed several important findings. First, conflict resolution is an important antecedent condition and explains significantly the presence of promotive interaction variables of communication, mutual support and effort. Second, theoretical perspectives on conflict aftermath were found to reasonably predict these outcomes of conflict resolution. Past research has highlighted the positive impact of conflict resolution but the mechanisms through which conflict resolution impacted performance were lacking. We have mentioned about the absence of literature dealing with this topic in IS project and program teams. The relevance of research findings in this area is hence justified. All relationships presented in this research were significant, although the details of their significance were not exactly in the terms of our hypotheses.

Managerial Implications

A limitation of this study is the generalizability of data to other contexts. Even though the data is collected from India, majority of the firms are multinational corporations with development centers distributed globally. This suggests limited generalizability of results and hence we recommend future research in other settings. Another limitation of this study is that data was collected from a convenience sample. In addition to developing theoretical understanding, support for the hypotheses may have important practical implications for structuring IS program teams. Reward structures could be based in part on how groups want to resolve their conflicts for mutual benefit (Hanlon et al., 1994). Program members work to resolve the conflict so that both benefit, not just their individual projects, and combine the best ideas to implement a solution that promotes mutual program goals.

Conflict resolution is of greater importance in program environment. Since program members consist primarily of project managers, and have significant work experience, there are possibilities for development of conflicts such as inadequate allocation of resource to some members, ego and personality differences. Performance of own project is of primary importance for the program member while contribution to other member's project is of secondary importance. Unless conflicts are resolved program members do not feel a need to participate in promotive activities. At any rate, what has appeared here is the importance of conflict resolution in explaining promotive behavior among program team members. Conflict management training programs or formal dispute resolution consultation is required to train and assist program members. Since program environment is different from project environment, program managers need to take responsibility for securing and providing training in conflict prevention and resolution techniques to program team members.

Promotive interaction can be improved by requiring certain levels of cross-project training, or structuring groups. Program managers must be able to assign projects to project managers who possess the requisite skills, attributes, and behaviors that facilitate effective promotive interaction. Performance parameters for program members should include assessments of conflict resolution skills in addition to social and project management expertise.

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Examining Knowledge Sharing in IS Development Projects: A Social Interdependence Perspective

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ABSTRACT

Information system development involves the coordinated application of business and information technology (IT) professionals' expertise. However, knowledge sharing between these two groups can be challenging. The problem is even more pronounced for projects involving external IT consultants with whom the business professionals have no prior collaboration. While previous research has studied various antecedents of knowledge sharing such as source, recipient, communication, and relational characteristics, it is often not clear how they may be manipulated to facilitate sharing. For this purpose, this paper studies the phenomenon from the social interdependence perspective, which suggests that goal, task, and reward interdependencies affect the extent of knowledge sharing in ISD project teams. Findings from a survey of 95 project teams indicate that goal, task, and reward interdependence are significant in determining knowledge sharing, which in turn influence project performance. Additionally, task interdependence partially mediates the relationship between goal interdependence and knowledge sharing. These results thus help to identify antecedents that are more tenable to managerial intervention. Implications of these findings for research and practice are discussed.

Keywords

Knowledge sharing, information system development, social interdependence theory, project performance.

INTRODUCTION

Information system development (ISD) involves the analysis, design, and implementation of IS applications or systems to support business activities in organizations (Xia and Lee, 2005). It is a knowledge-intensive activity requiring coordinated application of diverse expertise. Two types of knowledge critical to the success of ISD projects are business domain knowledge and information technology (IT) knowledge (Rus and Lindvall, 2002). These knowledge are shared between the IT and business professionals during the ISD process. For example, business domain knowledge is typically contributed by the business professionals during requirement analysis, and relevant IT knowledge is transferred from the IT consultants to business professionals during user training. Therefore, effective sharing and integration of IT and business knowledge are important to the success of ISD. Indeed, knowledge sharing has been found to have significant impact on project outcomes such as creativity (Tiwana and McLean, 2005) and system quality (Nelson and Cooprider, 1996).

To manage the complexity of developing IS, compensate for the lack of in-house expertise, and keep up with rapidly changing technology, many organizations engage external IT consultants or vendors (e.g., Accenture, IBM, and SAP) to assist in ISD (Ko, Kirsch and King, 2005). The worldwide IT services market is large, totaling US\$699 billion in 2006 (Savvas, 2007). The rationale behind employing external IT consultants is to harness the benefits of specialization. In this set up, IT consultants are often bounded by service level agreement and a black box approach is sometimes followed, where the external IT consultants rely on the formal requirement specification created by the business professionals to develop an IT solution in isolation. However, the lack of interaction between IT and business professionals in such an approach has been found to lead to poor project outcomes, especially in complex projects where boundaries of different expertise need to be spanned to tackle novel problems (Carlile, 2004). Hence, it is important to foster the coordination and cooperation between external IT consultants and business professionals during ISD. In this study, external IT consultants include employees of consulting agencies or IT vendors assigned to an ISD project. They are also collectively referred to as the IT subgroup. The business professionals include

business managers and users representing the client organization in the project and they are referred to as the business subgroup.

Even when the need for the subgroups of IT consultants and business professionals to share knowledge with each other is clear, it can be hard to achieve as their thought worlds differ[4]. The problem is even more pronounced for project teams involving external IT consultants with whom the business professionals had little prior collaboration history. Existing studies on knowledge sharing in ISD projects (e.g., Faraj and Sproull, 2000; Ko et al., 2005) have focused on the attributes of knowledge source (e.g., source credibility) and recipient (e.g., absorptive capacity), characteristics of communication channel (e.g., channel richness), and social relationship (e.g., trust). These aspects are either difficult to manipulate (except sometimes the communication channel) or require time to develop naturally. For this purpose, this study examines knowledge sharing between the subgroups of business professionals representing the client organization and external IT professionals from the social interdependence perspective (Deutsch, 1949), which suggests that the extent to which the two subgroups' goals, tasks, and rewards are interdependent determines how they cooperate with each other in ISD. Specifically, we seek answers to the research question: *How do the various forms of social interdependencies affect knowledge sharing between the IT and business subgroups during ISD?* Examining the effect of social interdependencies on knowledge sharing is valuable because they can be designed in project planning to encourage knowledge sharing during ISD.

This study seeks to contribute to research and practice in several ways. For research, this study enhances existing theoretical understanding of the phenomenon of knowledge sharing in ISD by viewing it from the lens of social interdependence. It also adds to the limited group-level knowledge management research by understanding the antecedents of knowledge sharing between business and IT professionals in ISD project teams. By empirically assessing the proposed research model and determining the relative importance of different types of social interdependence, results of this study are also useful to managers in designing effective mechanisms to promote knowledge sharing between IT and business professionals in ISD.

CONCEPTUAL BACKGROUND

Knowledge Sharing in IS Development

Knowledge sharing is defined as the communication of knowledge from a source so that it is learned and applied by a recipient (Ko et al., 2005). In the context of ISD, various antecedents of knowledge sharing between IT and business professionals have been identified. They can be categorized into attributes of recipient and source, characteristics of communication, characteristics of social relationship, and motivational factors (see Table 1). Among them, attributes of recipient and source, characteristics of communication, and characteristics of social relationship outline the circumstances that can affect knowledge sharing. However, they provide little understanding about participants' underlying motivations. As knowledge resides within individuals and remains unrecognized unless the owner is willing to make it available by codifying and sharing it, knowledge sharing can only be encouraged and facilitated but not compelled. Therefore, it is imperative to understand the motivations of knowledge sharers (Argote et al., 2003). A few studies have attempted to investigate this problem by examining the intrinsic and extrinsic motivations of IT consultants and client representatives in ERP projects (Ko et al., 2005). However, a view that is lacking in the literature is how interdependence between the subgroups can motivate knowledge sharing. This study suggests that perceived social interdependence can motivate the IT and business subgroups to cooperate by sharing knowledge with each other during ISD. The theory of social interdependence is further described below.

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[4] *Member dispersion also adds to the challenge of knowledge sharing in IS development. However, this is outside the scope of the present study that focuses on knowledge sharing between business and IT subgroups in the same location (city).*

Type of Antecedents	Antecedents	Study
Attributes of recipient	Absorptive capacity	Ko et al. (2005), Tiwana and McLean (2005)
	Decoding competency	Ko et al. (2005)
Attributes of source	Encoding competency	Ko et al. (2005)
	Expertise	Faraj and Sproull (2000)
	Professional experience	Faraj and Sproull (2000)
	Source credibility	Ko et al. (2005)
Characteristics of communication	Channel richness	Lind and Zmud (1991)
	Frequency	Lind and Zmud (1991)
Characteristics of social relationship	Arduous relationship	Ko et al. (2005)
	Mutual influence	Nelson and Cooprider (1996)
	Mutual trust	Nelson and Cooprider (1996)
	Shared understanding	Ko et al. (2005)
Motivational factors	Extrinsic motivation	Ko et al. (2005)
	Intrinsic motivation	Ko et al. (2005)

Table 4. Review of Antecedents of Knowledge Sharing between IT and Business Professionals

Theory of Social Interdependence

The theory of social interdependence describes how individuals interact in cooperative work situations. It posits that interdependence among team members can determine the extent to which they promote the success of others by cooperating (Deutsch, 1949). Three types of interdependencies identified by the theory are goal, task, and reward interdependence. *Goal interdependence* refers to the extent to which members in a subgroup believe that their subgroup's goals can be achieved only when the goals of the other subgroup are also met (Deutsch, 1949). It goes beyond goal alignment in that it requires the subgroups' goals to be not only compatible but also reliant on the goal attainment of one another. In the context of ISD, IT subgroup's goals may include delivering a high quality IS. Business subgroup's goals may include completing the project within schedule and budget. When the subgroups' goals are deemed as interdependent, interaction is promoted as subgroups are likely to try to facilitate each other's effort to achieve their goals by exchanging resources and information, giving and receiving feedback, and challenging each other's reasoning (Deutsch, 1949).

Task interdependence refers to the extent to which a subgroup believes that they depend on the other subgroup for being able to carry out their job (Deutsch, 1949). In the context of ISD, task interdependence results from the division of labor between IT and business professionals who possess specific expertise and contribute differently to the project. For example, during the initial phases of ISD, subgroups' tasks may be interdependent in that the business professionals need to communicate business requirements so that the IT consultants can translate them into system design that meets the requirements. When subgroups' tasks are interdependent, task completion requires collective action and they are therefore more motivated to closely coordinate their actions and share resources.

Reward interdependence refers to the degree to which a subgroup believes that their rewards depend on the performance of the other subgroup (Wageman, 1995). Organizations typically implement performance-related pay systems, which explicitly link financial rewards to individual or group performance. These structures are often designed such that rewards of individuals or groups are interrelated. In the context of ISD, reward interdependence is likely to be present when each subgroup's reward is based upon the entire ISD project team's performance. In this case, the subgroups are likely to be motivated to cooperate in order to maximize their overall rewards.

In sum, the theory of social interdependence suggests that goal, task, and reward interdependencies affect the level of interaction and cooperation in teams. Construing knowledge sharing as a key manifestation of interaction and cooperation in ISD, we propose that these interdependencies may account for the extent of knowledge sharing between the subgroups of business professionals and external IT consultants in ISD. We consider the concept of knowledge sharing to better portray the process of interaction between the subgroups of business and IT professionals in ISD as ISD is a knowledge-intensive process requiring exchange of not just explicit data and information but also tacit knowledge and expertise to support creativity. The concept of social interdependence is also highly congruent with the phenomenon of IT-business interaction in ISD, which can be viewed as a form of joint work where subgroups work with each other to achieve project objectives (Sherif, 1966) while attempting to maximize their own goals. A knowledge source at one point (e.g., business subgroup during requirement

specification phase) can become a knowledge acquirer (e.g., business subgroup during training phase) at another and this creates various interdependencies whose effects may be explained by the theory. Hence, the theory has the potential to offer insights into an important aspect of team dynamics in ISD that has received less attention in prior research.

RESEARCH MODEL AND HYPOTHESES

The proposed model is presented in Figure 1. The model posits that goal, task, and reward interdependencies between the IT and business subgroups in an ISD project team affect the extent of knowledge sharing between them. Goal interdependence is also hypothesized to affect task interdependence. Knowledge sharing is in turn expected to influence project performance. The model also controls for the effects of prior collaboration history, team size, project complexity, and the extent of boundary bridging activity to foster relationships between the two subgroups.
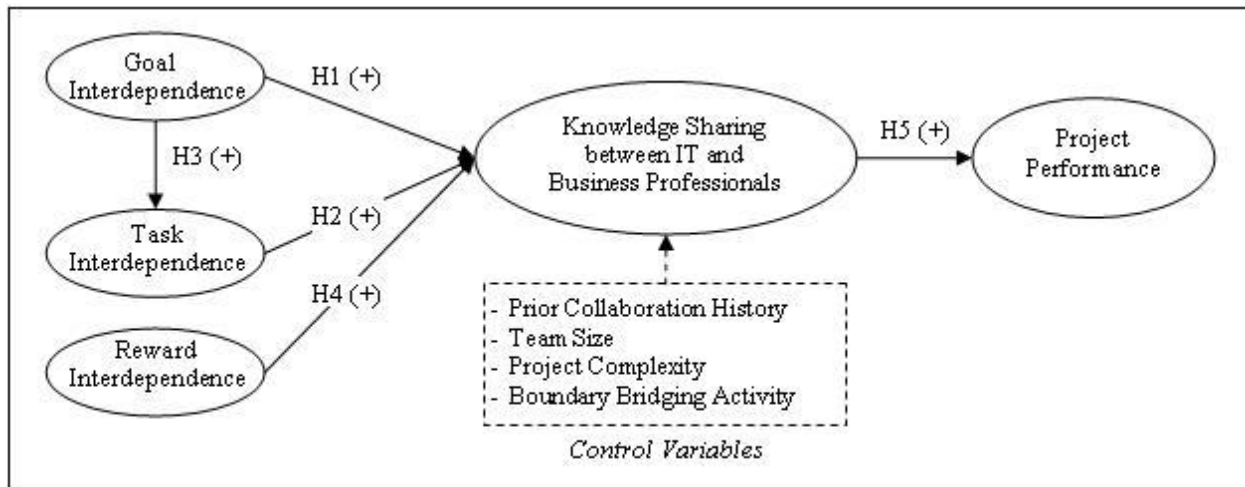
Figure 1. Research Model and Hypotheses

Goal Interdependence

With different background, expertise, and role in the project, the subgroups of business and IT professionals often have different goals of their own in addition to the project goals (Andres and Zmud, 2001-2002). When these subgroups' goals are interdependent, they tend to promote mutual goal attainment by coordinating and cooperating with each other (Deutsch, 1949). For example, a business subgroup may desire a system that can adequately address business needs and aim to complete the project within stipulated budget and time. On the other hand, the IT consultants may set a goal to implement a high quality system and explore and employ the latest technology where possible to diversify their portfolio. In this case, the first goals of both subgroups are largely interdependent as the business subgroup needs to count on the expertise of IT consultants to build the anticipated system and the IT subgroup relies on the judgment of business professionals in evaluating the quality of system. Awareness of this interdependence can induce the subgroups to work jointly to achieve their goals. Indeed, Amason and Schweiger (1997) have found that cooperative goals lead to more accurate information exchange. In contrast, the subgroups' second goals may be in conflict as new technology tends to be more expensive and require more time to learn, experiment, and apply, which may increase the time and cost of the project. If this conflict becomes a dominating concern, the subgroups may behave uncooperatively towards each other to prevent the other subgroup from achieving its goal since one's success is at the expense of the other. Therefore, we hypothesize that:

H1: The level of goal interdependence between the IT and business subgroups is positively related to the extent of knowledge sharing between them.

Task Interdependence

In ISD, knowledge sharing occurs through various phases including requirement analysis and system testing. During requirement analysis, business needs must be translated into preliminary system design. To facilitate this task, IT consultants depend on the business professionals to share their business knowledge while the business professionals

count on IT consultants' expertise to translate their requirements accurately into system design (Tiwana, Bharadwaj and Sambamurthy, 2003). During system testing, business professionals must rely on the IT consultants to impart their knowledge about the functionalities of the new IS to proceed with testing while IT consultants depend on the business users to provide feedback to facilitate further refinement. These task interdependencies create a situation of reciprocity whereby knowledge sharing is seen as a form of social exchange (Bock, Zmud, Kim and Lee, 2005). The knowledge contributing subgroup anticipates some future return for sharing their knowledge, most directly in the form of knowledge from the other subgroup that are relevant to their own tasks. High level of task interdependence has been found to stimulate exchange of knowledge on project requirements, task assignments, and implementation progress (Straus and McGrath, 1994). Accordingly, we hypothesize that:

H2: The level of task interdependence between the IT and business subgroups is positively related to the extent of knowledge sharing between them.

Goal and Task Interdependence

Previous studies have suggested that goal and task interdependence may be interrelated (e.g., Weldon and Weingart, 1993). When subgroups' goals are interdependent, the goal attainment of one subgroup relies on the goal attainment of the other subgroup. This motivates the subgroups to facilitate each other's goal achievement by working on tasks jointly when necessary. They may develop collaboration strategies to work on tasks that require expertise from both subgroups to maximize efficiency and goal accomplishment, in view of their aligned goal and common purpose (Mitchell and Silver, 1990). In contrast, when subgroups perceive that their goals are in conflict, they are likely to decouple their tasks and work on their own. They may be less concerned about the other subgroup and instead pay more attention on planning and executing their own tasks such that their own subgroup's goals are realized. Therefore, we hypothesize that:

H3: The level of goal interdependence is positively related to the level of task interdependence between the IT and business subgroups.

Reward Interdependence

In organizations, the structure of reward system provides a strong signal to employees about the type of behavior and outcome expected by the organization. Studies have shown that team-based rewards can foster team spirit and enhance members' willingness to contribute to the team's success (e.g., DeMatteo, Eby and Sundtrom, 1998). ISD projects can adopt team-based compensation system to encourage collaboration among members. For example, the IT and business subgroups may be rewarded based the overall quality of the resultant IS in addition to their individual contribution to the project (e.g., number of work hours). If the subgroups perceive that their reward is contingent upon the overall performance of the group, they are likely to adjust their efforts to maximize their collective rewards. Abdel-Hamid, Sengupta and Hardebeck (1994) have found that cooperative rewards can lead to greater interaction in software development projects. In contrast, if both subgroups perceive that their rewards are dependent on their own efforts and not on the other subgroup, they are unlikely to share knowledge. Accordingly, we hypothesize that:

H4: The level of reward interdependence between the IT and business subgroups is positively related to the extent of knowledge sharing between them.

Project Performance

In this study, project performance is defined in terms of efficiency and effectiveness. Efficiency of the ISD process refers to aspects such as productivity and adherence to schedule and budget. Effectiveness refers to the quality of outputs such as project deliverables and achievement of project objectives (Henderson and Lee, 1992). Studies have found that cross-unit knowledge sharing leads to innovative solutions as it promotes organizational learning by bridging different perspectives into juxtaposition, producing what Leonard-Barton (1995) called creative abrasion. Having shared, accurate, and complete software requirements is also fundamental for increasing ISD productivity and meeting users' needs, as work done during these early ISD stages affects the final outcome of the ISD project (Vessey and Conger, 1993). Therefore, we hypothesize that:

H5: The extent of knowledge sharing between the IT and business subgroups is positively related to project performance.

RESEARCH METHODOLOGY

The proposed model was assessed empirically with data collected through a survey. The step-by-step procedure recommended by Churchill (1979) was used to develop the survey instrument to maximize reliability. Content validity and construct validity were preliminary assessed during instrument development through sorting procedures proposed by Moore and Benbasat (1991).

Construct Operationalization

Most items used in the survey were adapted from scales developed in previous studies. Each of the interdependence (*goal, task*, and *reward*) constructs was measured with at least three items and operationalized with two types of measure (Nelson and Cooprider, 1996). The first type is a *general* measure where respondents are asked to assess the overall level of interdependence between the IT and business subgroups (e.g., "the extent to which the goal attainment of the business subgroup and the IT subgroup was highly interdependent"). The second type of measure is *multiplicative* where respondents are asked to assess the perceived dependency of their subgroup on the other subgroup and vice versa (e.g., "the extent to which the goal accomplishment of the *business subgroup* depended on the goal accomplishment of the *IT subgroup*" and "the degree to which the goal accomplishment of the *IT subgroup* depended on the goal accomplishment of the *business subgroup*"). The responses were then combined using multiplication based the conceptualization of fit as interaction (Venkatraman, 1989). Similar operationalization has been effectively applied to assess mutual trust, mutual influence (Nelson and Cooprider, 1996) and to measure shared understanding and arduous relationship between client and consultant in IS implementation (Ko et al., 2005).

Knowledge sharing was operationalized in terms of the extent to which the subgroups exchanged specialized knowledge with each other during the course of the project (e.g., "the business (IT) subgroup always shares its specialized knowledge and expertise with the IT (business) subgroup). *Project performance* was measured in terms of project efficiency and effectiveness. Dimensions of efficiency include productivity of team's operation and adherence to budget and schedule. Aspects of effectiveness include quality of project team's deliverables and attainment of project objectives.

For the control variables, *prior collaboration history* was assessed in terms of the number of members who had worked together before the project. *Team size* was measured by the number of IT and business professionals in the team. *Project complexity* was operationalized in terms of perceived novelty and difficulty of project (e.g., "the extent to which technology involved in developing the targeted IS is new to the project team"). *Boundary bridging activity* was measured in terms of the extent to which IT personnel from the client organization effectively coordinated activities and facilitated communication between the two subgroups (e.g., "the extent to which internal IT personnel have effectively coordinated activities between the subgroups"). The internal IT personnel were identified as the main boundary spanners because they are likely to be familiar with the business subgroup while sharing similar knowledge background with the IT subgroup.

Data Collection

The target population of this study is ISD projects involving external IT consultants. In sampling the respondents, we used a *matched-pair design* where both the IT and business subgroups in a project team were surveyed. To minimize recall error and ensure that the teams had enough opportunity to interact with each other at the time of survey, only ongoing projects that had completed at least one phase were included. Restricting the sample to ongoing projects was also necessary to avoid threats to internal validity as a result of maturation. In the survey, respondents were asked to answer all questions and report their project performance with respect to the last completed phase. Although final performance was not measured, intermediate/process project performance can reasonably be expected to indicate final performance as projects that experience cost and schedule overruns in one or more development phases are less likely to complete on time and within budget.

DATA ANALYSIS AND RESULTS

Out of the 105 project teams contacted, 95 teams responded yielding a response rate of 90.5%. This sample size exceeds the requirements suggested by Chin et al. (2003) for PLS analysis, which should be equal to the larger of

the following: (1) ten times the number of indicators in the largest formative construct, or (2) ten times the largest number of structural paths directed at a particular construct in the structural model. In our study, the largest formative constructs is project performance which has five items and the knowledge sharing construct has seven paths (including control variables) directed to it. This indicates that the minimum required sample size is 70 and our sample size is therefore considered sufficient for PLS analysis. Power analysis also indicates that the statistical power is 85%, which exceeds the recommended 80% threshold.

The characteristics of the sample are presented in Table 2. It can be observed that our sample includes projects in organizations of different sizes and industries and involves developing different types of IS.

Characteristic	Frequency	Percentage	Characteristic	Frequency	Percentage
Industry of Client Organization			**Scheduled Duration (Months)**		
Manufacturing	28	29.5	Less than 3	6	6.3
Finance: banking/insurance	18	18.9	3 to 6	21	22.1
Trade: wholesale/retail	3	3.2	7 to 12	40	42.1
Transportation services	4	4.2	13 to 23	21	22.1
Utilities and communications	14	14.7	24 or more	7	7.4
Construction and engineering	3	3.2	**Last Completed Project Phase**		
Education	1	1.1	System planning	15	15.8
Medical and legal services	1	1.1	Requirements analysis	12	12.6
Petroleum and chemical	5	5.3	System analysis and design	22	23.2
Others	18	18.9	Development and testing	21	22.1
Number of Employees in Client Organization			Rollout	25	26.3
Less than 500	16	16.8	**Project Team Size**		
500 to 999	15	15.8	Less than 10	20	21.1
1000 to 4999	33	34.7	10 to 49	58	61
5000 or more	30	31.6	50 to 99	10	10.5
Unspecified	1	1.1	100 or more	7	7.4
Type of Information System			**Number of Members in Business Subgroup**		
Document management system	5	5.3	Less than 10	50	52.6
Enterprise information system	18	18.9	10 to 49	40	42.1
Enterprise resource planning	36	37.9	50 to 99	3	3.2
Knowledge management system	6	6.3	100 or more	2	2.1
Transaction processing system	2	2.1	**Number of Members in IT Subgroup**		
Others	28	29.5	Less than 10	53	55.8
Type of Project Contract			10 to 49	32	33.7
Fixed-cost basis	78	82.1	50 to 99	5	5.3
Time-and-material basis	14	14.7	100 or more	5	5.3
Others	3	3.2	**Members with Prior Experience with the Other Subgroup**		
			0	36	37.9
			1 to 5	50	52.6
			6 to 9	2	2.1
			10 or more	6	6.3
			Unspecified	1	1.1

Table 5. Sample Characteristics

The proposed model was assessed using Partial Least Squares (PLS) analysis, which concurrently tests the psychometric property of each measurement scale and the strength and direction of relationships among constructs (Chin, Marcolin and Newsted, 1996). PLS analysis is also able to account for formative and reflective manifest variables that jointly occur in a single structural model. In our study, the interdependence and knowledge sharing constructs are considered reflective because they are uni-dimensional and exclusion of an item does not alter the meaning of construct. In contrast, the constructs project performance (measured in terms of project efficiency and effectiveness) and project complexity (measured in terms of perceived novelty and difficulty of project) are considered formative because the indicators compose and change the construct. All data was standardized before model testing as per PLS requirements.

Test of Measurement Model

Assessment of the measurement model includes evaluation of internal consistency, convergent validity, and discriminant validity of the instrument items. Reflective and formative constructs are to be treated differently because unlike reflective constructs, different dimensions of formative constructs are not expected to demonstrate internal consistency and correlations (Chin et al., 1996). To assess the relevance and level of contribution of each item to the formative constructs, the absolute values of item weight are to be examined instead. Prior collaboration history and team size are single-item measures and hence were not subjected to construct validity tests.

For reflective constructs, internal consistency was measured using Cronbach's alpha reliability coefficient. All reflective constructs in our models achieved scores above the recommended 0.70 (Nunnally, 1978). Convergent validity was assessed through item and composite reliability and average variance extracted (AVE). All reliabilities, item and composite, were above the recommended level of 0.70 and all AVEs were above 0.5 (Chin et al., 1996). Hence, convergent validity of the instrument was satisfactory.

Discriminant validity was assessed using factor analysis and item correlations. Five factors corresponding to the reflective constructs were extracted as expected and Kaiser-Meyer-Olkin measured 0.83 (which is well above the recommended value of 0.5) in factor analysis. All item loadings on stipulated constructs were greater than 0.5 and all eigenvalues were greater than one (Kaiser, 1974). The correlation matrix (see Table 3) showed that all the non-diagonal entries (construct correlation) did not exceed the diagonal entries (square root of AVE) for all constructs, indicating that measures of each construct correlated more highly with their own items than with items measuring other constructs (Fornell and Larcker, 1981). Thus, we concluded that the discriminant validity of all scales was adequate.

	GI	TI	RI	KS	PH	TS	BBA
Goal Interdependence (GI)	**0.89**						
Task Interdependence (TI)	0.44	**0.73**					
Reward Interdependence (RI)	0.53	0.41	**0.85**				
Knowledge Sharing (KS)	0.57	0.47	0.61	**0.86**			
Prior Collaboration History (PH)	0.01	0.02	0.11	-0.16	**N.A.***		
Team Size (TS)	0.00	0.10	0.04	0.10	-0.33	**N.A.***	
Boundary Bridging Activity (BBA)	0.48	0.37	0.53	0.57	-0.02	0.13	**0.96**

Table 3. Square Root of AVE vs. Correlation

* AVE is not applicable for single-item constructs

To assess the extent of multicollinearity, variance inflation factor (VIF) was calculated. Results indicated that VIF scores ranged from 1.08 to 1.55, which were well below the threshold value of 10 (Myers, 1990). Since data was collected from both the IT and business subgroups, common method variance as a result of single-source bias was unlikely.

For formative constructs, absolute value of item weight was examined to determine the relative contribution of items constituting each construct (Chin et al., 1996). Results indicated that productivity of project team's operation was the most significant aspect of project performance, and newness of technology involved in implementing the targeted system was the most salient aspect of project complexity. Since the measurement model was satisfactory, we proceeded to test the structural model.

Test of Structural Model

Results of structural model analysis are shown in Table 4 and Figure 2. It was found that all hypotheses were supported at 0.05 level. None of the control variables were significant. The model explained 47% of the variance in knowledge sharing and 52% of the variance in project performance.

Constructs	*Path Coefficient*	*T Value*	*Result*
Goal Interdependence (GI)	0.20*	1.89	H1 supported
Task Interdependence (TI)	0.20**	2.46	H2 supported
GI→TI	0.39***	5.03	H3 supported
Reward Interdependence	0.25*	2.27	H4 supported
Knowledge Sharing	0.72***	14.76	H5 supported
Prior Collaboration History	-0.13	0.92	Not significant
Team Size	-0.08	0.63	Not significant
Project Complexity	-0.18	0.82	Not significant
Boundary Bridging Activity	0.09	0.91	Not significant

Table 4. Test of Hypotheses

*p<0.05 (one-tailed T-value: 1.66); ** p<0.01 (one-tailed T-value: 2.37); *** p<0.001 (one-tailed T-value:

3.19);
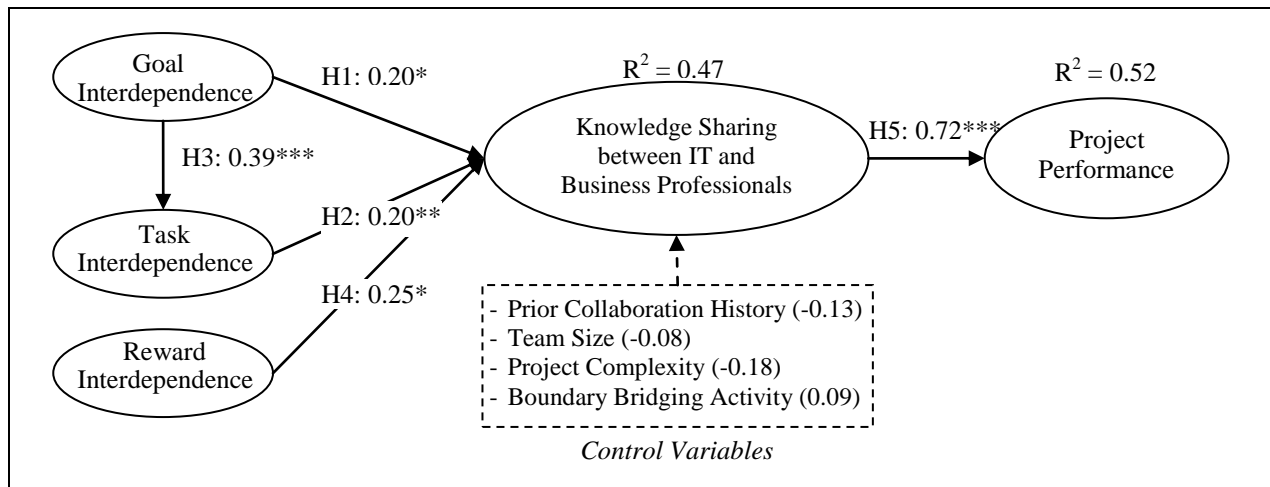
Figure 2. Test of Structural Model (*p<0.05; **p<0.01; ***p<0.001)

DISCUSSION AND IMPLICATIONS

The objective of this study was to investigate the effect of social interdependence on knowledge sharing in ISD. As hypothesized, we found that goal, task, and reward interdependencies significantly affected knowledge sharing, which in turn affected project performance. Goal interdependence is also found to be significantly related to task interdependence. Implications of these findings for research and practice are discussed below.

Implications for Research

For academics, the proposed model adds to existing research by putting forward a theory-based perspective to advance our understanding of knowledge sharing between business and IT experts in an ISD project. Our findings corroborate with previous knowledge management literature which emphasize the importance of considering social factors (e.g., Wasko and Faraj, 2005). Specifically, we have moved beyond the attributes of source or recipient and communication channel to consider social interdependencies between the source and recipient. Indeed, as a process requiring substantial teamwork, the significance of social interdependence factors deserves more attention in research.

Results of this study also contribute to literature on social interdependence by applying the theory in a novel context. Social interdependence theory has been studied most extensively in school education (Stanne, Johnson and Johnson, 1999), which has demonstrated that fostering cooperation can engage students in learning and help to achieve multiple educational goals. Our study extends existing work by demonstrating that the theory may also be effective in understanding cooperation beyond the education context, such as in the workplace.

The social interdependence theory has also helped to identify antecedents that are more tenable to managerial intervention for encouraging knowledge sharing in teams, as discussed below.

Implications for Practice

We found that goal interdependence has a positive effect on knowledge sharing. Thus, project managers should aim to establish goal interdependence between the two subgroups as early as possible. This can be achieved by clearly laying down the overall project goals and communicating them to both subgroups. Care should also be taken to align the goals of IT and business subgroups at the initial stages of the project (i.e., when the ISD project is being planned and the two subgroups are selected for the project). While it is possible for individual subgroups to have their own goals that may be in conflict, detecting the potential problem areas early and finding a middle ground can often prevent the conflicts from becoming insurmountable obstacles with negative outcomes.

Second, our results indicate that task interdependence encourages knowledge sharing between the subgroups. However, we do not suggest that task interdependence should be emphasized for all project tasks. Instead, focus

should be on tasks that require both IT and business knowledge to complete successfully (e.g., requirement analysis, system testing). Task interdependence can also be increased by setting interdependent goals for the subgroups, as shown by our findings. Working on various tasks jointly allow both subgroups to bring their expertise to bear in designing the system and this is likely to result in more realistic expectations of the resultant system.

Third, reward interdependence is also found to be effective in encouraging knowledge sharing. This suggests that the organizations should establish such interdependence between the subgroups by coordinating their rewards. For example, the rewards received by the IT subgroup can be tied to the quality of final system as judged by the business subgroup. At the same time, the rewards received by the business subgroup can be linked to their participation and quality of feedback. It should be noted that the two subgroups should not be made to compete for rewards from a fixed common pool. Rewards in the form of bonus given to the whole team are likely to be effective. To ensure that the subgroups are aware of their reward interdependencies, the reward structure should be clearly laid out and communicated.

Limitations and Future Research

Several opportunities for future research remain based on this study. First, as the data was collected in a cross-sectional survey, it did not allow us to draw conclusive evidence of causality, despite strong theoretical arguments and empirical support from past studies. Longitudinal studies are likely to provide stronger causal understanding of the proposed model. Second, the constructs were predominantly measured through subgroup self-reports and hence may be subjected to bias. To a certain extent, self-reporting is a suitable approach because the respondents are "insiders" who have unique perspectives concerning the kind of behaviors that were exhibited and hence were better able to make judgments. Nonetheless, validity can be improved by collecting more objective data, such as through observation of meetings, emails, and memos.

This study has operationalized and measured interdependence based on respondent's overall perception in the previous phase of the project. As conditions change in different phases of a project, the level of interdependence may vary, especially if the project spans a long period of time. With the role of interdependence being significant as evident in this study, it may be fruitful to further investigate how the level of interdependence fluctuates in different phases.

Overall, studies such as this can inform research and practice by improving our understanding of how knowledge sharing can be facilitated in ISD project teams towards enhancing their performance and decreasing project failure rates.

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Towards Information Systems Project Success: The Influence of Incentives on Project Managers' Drive and Participation

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ABSTRACT

Project managers' behavior has been found to positively influence project outcomes we explore the issue through the development of a two-stage model incorporating agency theory that examines the relationship between PM behavior and IS project success. We measure project success by delivery on time, within budget, and adhering to specification. A web-based survey was used to collect data and test the model using SEM. The two-stage model was supported, however, further analysis suggests that a combination of three factors *commitment*, *willingness*, and *motivation* would significantly improve the model fit by forming a higher-order factor we call *drive*. We found that PM's participation level is the most important factor influencing project success and is directly influenced by incentives and drive.

Keywords

Incentives, Project Management, Information Systems, Agency Theory, Success, Performance, Motivation, Commitment, Willingness, Drive.

INTRODUCTION

Critical to the future success of business activities and initiatives are information systems (IS) designed to meet the challenges of today's and tomorrow's business environment (Ba et al., 2001). As a result organizations continue to make large investments in and devote substantial resources to IS that are intended to deliver significant performance gains (Yetton et al., 2000). The major organizational benefits from successful IS projects will be reflected in: 1) reduction of costs associated with IS projects, 2) improvement of organizations' return on investment (ROI), 3) timely implementation of planned functionality, and 4) delivery of functionality designed to meet the needs.

IS project problems such as failures and overruns continue to exist and have changed little over the past three decades (IT Cortex, 2003; KPMG, 2003). To address these issues we draw our attention to project managers. Jiang et al. (2001) found the project manager role was critical for IS project success. Eisenhardt (1989) suggests linking performance to incentives as a way to improve project managers' performance.

We therefore explore the relationship between IS project managers and IS project outcomes by examining how the use of incentives in the project manager arena can improve the IS project success. We incorporate the work of Martisons and Chong (1999), and Yetton et al. (2000) and seek to answer the following research questions:

(1) What aspects of project managers' behavior are influenced by the use of incentives?

(2) What influence does that behavior have on the criteria for successful IS project outcomes?

We address our research questions by employing agency theory (AT) to examine incentives' influence on project managers' (PM) behavior. We develop a research model that relates the use of incentives to PM behavior and the impact of their behavior on IS project outcomes.

The remainder of this paper is organized as follows. First, we present the background of the study. Second, we develop the research model and propositions. Third, we present the research methodology employed. Fourth, we present the data analysis..Fifth, we discuss the research findings. Sixth, we present the contributions and limitations of this study, and highlight further research.

BACKGROUND TO THE STUDY

To address our research questions and develop an agency-based research model, we; 1) identify the factors leading to and criteria for IS project success; 2) understand the role of project managers in IS projects; and 3) understand the role of AT in improving current practices in IS projects.

Criteria for IS Project Success

Technical factors and the role of user's involvement in IS projects have been established among the most important factors influencing the IS development (Barki and Hartwick, 1994b). Further, problems in IS projects are linked to social, conceptual, or organizational factors such as, motivation, commitment, involvement, communication, and good project management (Guthrie and Hollensbe, 2004; Kim and Peterson, 2000; Shoniregun, 2004; Walsh and Schneider, 2002).

From existing literature, we found that time, cost, and adherence to specifications are the most cited performance criteria relevant to IS project success (KMPG 2003). Consistent with Banker and Kemerer's (1992) model for IS performance , we consider a "successful" IS project, a project delivered on time, within budget, and adhering to specifications.

Project Manager Role in IS Projects

Sound project management is essential to ensure greater probability of IS project success (Shoniregun, 2004). Jiang et al. (2001) highlight the important role of PM in IS projects and suggest that PM's performance has a direct relationship with the project outcomes. Shoniregun (2004) suggests PMs should rely more on their personal skills involvement rather than on automated project management tools. Therefore, we suggest that ways to improve the PM's contribution to project outcomes is through their personal skills and behavior.

Agency Theory

In recent years AT has emerged as a main theory guiding research on the pay-performance relationship (Eisenhardt, 1989). AT explains how to best organize a relationship in which one party (the principal) directs the work of another party (the agent).

AT argues that problems arise in an agency relationship when: 1) the desires or goals of the principal and agent are in conflict and 2) it is difficult or expensive for the principal to verify what the agent is actually doing. AT addresses these problems via contracts that provide incentives to agents with the purpose of motivating them to exert effort in directions that are aligned with the interests of the principals (McKenzie and Lee, 1998).

Agency Theory in IS Projects

In IS projects, Banker and Kemerer (1992) advocate that agency relationship consists of: 1) the owner of the project (the principal) who is concerned with the successful delivery of the IS project, and 2) the PM (the agent) who is responsible for the management of IS project. Mahaney and Lederer (2003) suggest that by introducing incentive contracts, PMs will give more attention and effort to controlling and monitoring the IS projects, hence they can contribute to a lower failure rate of IS projects. Provided that incentives are aligned positively with successful project outcomes it is likely the provision of incentives will result in a greater likelihood of project success (Sharma and Yetton, 2003).

RESEARCH MODEL AND PROPOSITIONS

We examined the behavioral literature and choose four factors of PM's behavior for inclusion in our research model (see Figure 1): *commitment*, *willingness to act*, *motivation* toward, and *participation* in IS project tasks.

We believe that AT explains how incentives are most likely to influence the PM's behavior, which in turn is likely to impact the IS project outcomes. Although, AT and use of incentives were addressed in the arena of employees in general, we extrapolate their use to PMs because we view PMs as a type of employee.
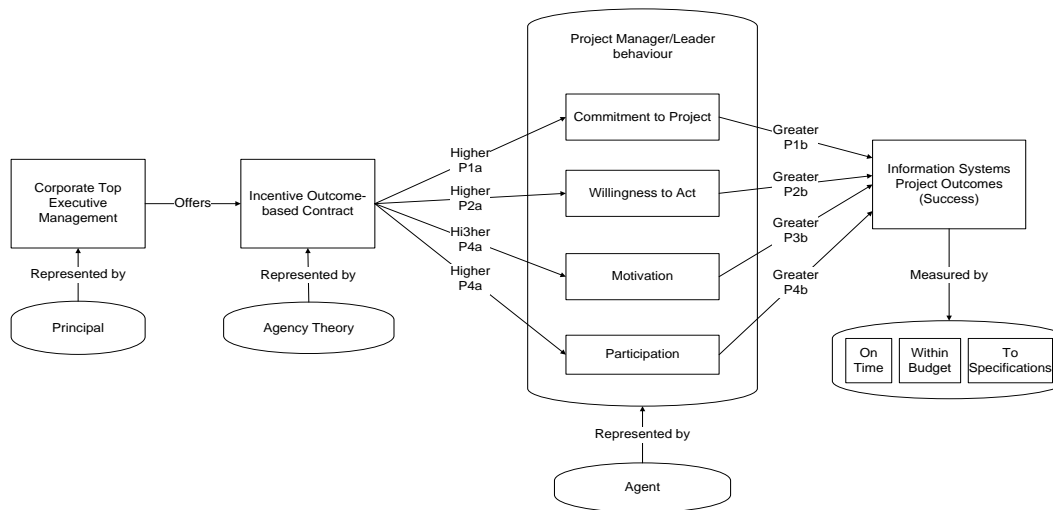
Figure 1. Agency-Based Research Model

Commitment and Willingness to Act

Butler and Fitzgerald (2001) propose that management *commitment* and *willingness to act* on project activities are among the key factors that impact on project success. Because these two factors are likely to influence work related performance, we include *commitment* and *willingness to act* as factors that might have a positive effect on project outcomes.

Commitment

Commitment can be defined as the sense of loyalty to an organization or a project (Jurison, 1999). Committed employees are willing to devote more of their time and energy to the project; hence a greater desire to contribute to the project success. Organizations seek to create committed employees by implementing incentive contracts (Moorman et al., 1998). Employees who benefit financially, will be more committed to the organization or project they work on (Klein et al., 2001). Therefore, we propose that:

> **Proposition 1a**: Higher levels of incentives will lead to higher level of PM's commitment toward an IS project.

Commitment to an IS project is an important factor in its successful completion (Mahaney and Lederer, 1999). Further, committed employees have a greater desire: 1) to perform better on their job, and 2) to do what is right for their organization or project (Klein et al., 2001). Therefore, we propose that:

>**Proposition 1b**: Higher levels of PM's commitment toward an IS project will lead to more successful IS project outcomes.

Willingness to Act

Employees that are identified with organizational goals or projects show a greater willingness to act and contribute meaningfully to the organization or project, thus performing better on the job (Moorman et al., 1998). Organizations develop and maintain employees' attachment to a project and goals by rewarding them via incentive contracts (Moorman et al., 1998). We therefore propose that:

>**Proposition 2a**: Higher levels of incentives will lead to a higher level of PM's willingness to act toward the activities related to an IS project.

Given the critical role in managing IS projects, PMs are expected to act positively on activities that affect the success or failure of an IS project. We therefore propose that:

>**Proposition 2b**: Higher levels of PM's willingness to act on activities that affect the success or failure of an IS project will lead to more successful IS project outcomes.

Motivation

Rasch and Tosi (1992) found *motivation* was an important factor in predicting software project staff performance. Motivated employees are expected to perform better in their jobs, hence we include *motivation* as a factor that will have a positive effect on project outcomes.

Organizations focus on creating favorable conditions that foster and maintain employees' motivation by offering incentive contracts (Frey and Osterloh, 2002). In turn, motivated employees put in a greater effort to produce more valuable results, such as increased work performance (Thomas, 2000). We therefore propose that:

>**Proposition 3a**: Higher levels of incentives will lead to higher level of PM's motivation toward an IS project.

AT suggests that offering incentives to PMs will induce greater effort and performance on their side, and their interests will become congruent to those of the owners of the IS project (Frey and Osterloh, 2002). Specifically, we suggest that when incentives are awarded with the goal of delivering the system on time, within budget, and satisfying user's demands, the PMs are expected to display higher motivation toward IS project tasks. We therefore propose that:

>**Proposition 3b**: Higher level of PM's motivation will lead to more successful IS project outcomes.

Participation

Cotton (1993) found having employees *participate* in work-related activities may result in improved productivity and job performance. Hartwick and Barki (1994) view *participati*on as the behavior, assignments, and activities that users or their representatives perform during the IS projects. Given the importance of *participation* in influencing an employee's behavior and work performance, we include *participation* in our study.

Cotton (1993) found that organizations attempt to increase employees' participation by introducing reward systems. Specifically rewards increase the level of participation and lead to improved task effectiveness and performance (Cotton, 1993). Given the critical role of PMs in managing IS projects, it is expected that by providing incentives to PMs, the PMs will increase their participation in monitoring and controlling the IS projects. We therefore propose that:

Proposition 4a: Higher levels of incentives will lead to higher level of project manager's participation throughout the IS project activities.

An individual will be motivated to perform an action if the probability of success of action (their expectation associated with the task) is expected to be high (Griffin, 1999). Invoking AT by setting up an incentive contract, the owner expects the delivery of a successful IS project. Thus when PMs perceive a high probability for a successful IS project, they will display a higher participation throughout the project activities; hence they are more likely to manage and lead an IS project to successful outcomes. We therefore propose that:

Proposition 4b: Higher levels of project manager's participation throughout IS project activities will lead to more successful IS project outcomes.

RESEARCH METHODOLOGY

Because we are concerned with PM's behavior, several alternative methods for testing the research model were considered, e.g., survey, in-depth interviews, project data analysis, etc. We chose a survey instrument because it allows for a rich assessment of the constructs and examines the statistical testing of direct relationships in a research model (Grover et al., 2002). We employed a web-based survey using items from previously validated instruments in the IS and organizational behavior fields.

Construct and Survey Instrument Development

Constructs from the literature were utilized where possible. We conducted a pilot test of the instrument for clarity, consistency, and validity with selected users from the IS field, as well as academics and experts in the IS research areas (Dinev and Hu, 2007). We identified minor issues that resulted in small changes to the final instrument.

The *Incentive* construct borrowed items from constructs used in the Lambert and Larcker (1993) compensation measurement instrument. We measured incentives using participants' involvement with incentive contracts, from no incentives to a high level of incentives. The remaining variables were captured by multiple items. The *Participation* construct was derived and measured using the Barki and Hartwick (1994a) instrument. The *Commitment* construct was measured by adapting research items from the instrument developed by Mowday et al. (1979). The *Motivation* and *Willingness to act* constructs were measured by adapting items from previously validated measurement instruments used in other fields (Hellman et al., 2006). The *Information Systems Success* construct was measured using items developed from Banker and Kemerer (1992). The survey items were captured using a 7-point Likert scale and are presented in Table 4.

Sample Profile and Descriptive Statistics

We targeted a cross-section of IS practitioners belonging to a national IS professionals society. We selected one of the society's state branches to limit the target population size to around 500 IS professionals. The exploratory stage of the study targeted mainly IS project managers. The demographic profile of our respondents is presented in Table 1.

Type	Category	Distribution (%)
Position	Project Manager	41.7
	Other	23.3
	Project Leader	15.5
	IT Manager Programmer	11.7
	Systems Manager	7.8
Industry	Government Agencies	21.4
	IS/IT Consulting	19.4
	Transportation, Communication, and Utilities	14.6
	Education	9.7
	Finance, banking, and Insurance	8.7
	Mining	8.7
	Wholesale and Retail	7.8
	Other	3.9
	Manufacturing and Processing	1.9
Experience with IS Projects	<6 years	35.9
	6-10 years	32.0
	11-15 years	14.6
	16-20 years	8.7
	>21 years	8.7
IS Projects Managed	<6 projects	55.3
	6-10 projects	15.5
	11-15 projects	9.7
	16-20 projects	1.7
	21-25 projects	1.9
	> 26 projects	5.8
Incentive Types	None	39.8
	Financial	39.8
	Non-financial	11.7
	Both	8.7
Involvement in Incentive-Based Projects	None	44.7
	1-5 projects	41.8
	6-10 projects	8.7
	11-25projects	3.9
	>25 projects	9.7

Table 1. Demographic Profile of the Survey Respondents

A total of 117 responses were collected for a response rate of approximately 20%, comparable with other similar surveys (Sohal and Ng, 1998). Fourteen surveys were disqualified for lack of completeness, leaving 103 usable for data analysis. As we had more than 100 responses, SEM is a reliable and appropriate technique to test our model (Sörbom and Jöreskog, 1982).

The demographic data were reviewed for the response bias of the population. Descriptive statistics indicate that the sample does not suffer from a non-response bias (Hair et al., 1998).

Table 2 details respondents' involvement in and perceptions of successful IS project outcomes. Note that all incentive-based projects were considered successful, while 80 percent of them were considered delivered on time, within budget, and adhering to specifications. We believe this is a first indicator that incentive-based projects are more efficiently and effectively managed and completed.

Type*	Number of Projects			
	None (%)	1-5 projects (%)	6-10 projects (%)	>10 projects (%)
Incentive-based IS projects finished within budget	8.8	78.9	8.8	3.5
Incentive-based IS projects finished on time	3.5	78.9	15.8	1.8
Incentive-based IS projects delivered to specifications	1.7	82.4	10.6	5.3
Incentive-based IS projects considered successful	0	84.2	10.5	5.3
* Based on 57 incentive-based projects				

Table 2: Respondents' Involvement in Incentive-Based Projects

Results and Analyses

We used LISREL, a Structural Equation Modelling (SEM) technique (Sörbom and Jöreskog, 1982) in two stages to: 1) assess the reliability and validity of the measurement model using Confirmatory Factor Analysis (CFA), and 2) assess the structural relationships of our model using Path Analysis. Our initial results indicated the need for a further stage in our analysis, that is, to re-specify and develop a second order CFA model (Fornell and Larcker, 1981).

Table 3 presents the descriptive statistics and actual range of the items used in this study. We checked the sample for existence of outliers and multicollinearity. No extreme cases were identified and a certain degree of multicollinearity is required in factor analysis, hence data did not display any anomalies (Hair et al., 1998).

Construct	Survey Item	Mean	Standard Deviation	Skewness	Kurtosis	Cronbach's α
Commitment	COMM1	4.30	1.35	-0.10	0.42	
	COMM2	4.55	1.27	-0.24	0.62	0.61
	COMM3	4.82	1.43	-0.39	0.41	
Incentive	INCENT	2.43	1.90	1.04	-0.10	1
Motivation	MOT1	4.77	1.31	-0.66	1.34	
	MOT2	4.67	1.38	-0.63	0.64	0.84
	MOT3	4.88	1.57	-0.69	0.26	
	MOT4	4.63	1.48	-0.10	0.42	
Participation	PART1	4.14	1.39	-0.38	0.87	
	PART2	4.09	1.25	-0.60	1.06	
	PART3	4.77	1.50	-0.62	0.21	0.90
	PART4	4.55	1.34	-0.45	0.89	
	PART5	4.57	1.31	-0.65	1.09	
IS Success	SUC1	3.99	1.28	-0.61	0.61	
	SUC2	3.74	1.28	0.10	0.52	0.91
	SUC3	4.27	1.11	-0.73	1.75	
Willingness to Act	WILL1	4.67	1.16	-0.13	1.45	
	WILL2	4.56	1.07	-0.17	1.99	
	WILL3	4.65	1.27	-0.64	1.40	0.85
	WILL4	4.87	1.43	-0.57	0.64	
	WILL5	4.69	1.28	-0.64	1.33	

Table 3: Descriptive Statistics for Survey Items

Due to the SEM sensitivity to sample size and departures from normality chi-square per degrees of freedom (χ^2/d.f.) is a more appropriate measure of a model fit. Chin (1998) recommends a ratio of χ^2/d.f. below 3:1. SEM provides three additional measures of model fit (GFI, AGFI, and Standardized RMR). The thresholds for a good overall model fit in IS research are above 0.90 for GFI, above 0.80 for AGFI, and below 0.05 for Standardized RMR (Chin, 1998).

Measurement Model Validation

We conducted a CFA of the original model comprising of 5 factors and 21 items (see Table 3). The original measurement model results showed a poor goodness of fit based on the above-mentioned threshold values for IS field (GFI = 0.635 and AGFI = 0.535).

Consistent with SEM techniques, we re-specified and re-estimated the model after we inspected carefully the modification indices and the residuals (Anderson and Gerbing, 1988). As a result, six items were discarded from further analysis, resulting in a revised model with 5 factors and 15 items (see Table 3).

The statistical results are detailed in the following sections, including all the required validity checks. The revised model and its items are presented in Table 4 showing the 5-factor solution. We start by addressing the validity checks in Table 4 and then briefly discuss the model goodness of fit.

The *content validity* of the new model needed to be established. The fact that all *t*-tests were statistically significant showed that all indicator variables provided good measures to their respective construct. With a GFI of 0.90 or above, all constructs are deemed *unidimensional*, hence they are reliable and valid (Sörbom and Jöreskog, 1982).

Further, all scales have a NFI of 0.90 or above, hence they have strong *convergent validity* and the model fits the underlying data well.

To test the *discriminant validity*, CFA was performed on a selected pair of scales, allowing for correlation between the two constructs. Checks on every pair of the five scales were performed, some of these tests showed chi-square differences statistically significant at $p \leq 0.01$. This result displays unsatisfactory separation of the 3 major constructs. We observed high correlations (see Table 4) between three of the factors in the model; that is, between Motivation, Willingness, and Commitment.

	Motivation	Willingness to Act	Commitment
Motivation	1.000		
Willingness to Act	0.969	1.000	
Commitment	0.919	0.912	1.000

Table 5: First Order Factors Correlations

The existence of high correlations between the factors suggests they measure the same higher-level structure or thing. Hence we introduced a higher-order factor (also known as second-order) model (Fornell and Larcker, 1981). We suggest that a second order factor consisting of Motivation, Willingness, and Commitment may exist. Due to space limitation below we only discuss the second order factor model.

Construct	Item Label	Survey Item Measured on 7-point Likert Scale	Factor Loading	*t*-value	Composite Reliability
IS Success	Suc1	Was/would the total cost of the project be more or less than the initial estimate?	0.94	11.73	
	Suc2	Was/would the actual duration of the project be more or less than the initial estimate?	0.82	9.926	0.88
	Suc3	Overall, was/would the final version of the project be completed with more or less than initial user specifications?	0.750	8.573	
Motivation	Mot1	I felt/would feel more enthusiastic to work on the project.	0.91	11.605	0.83
	Mot2	I spent/would spend more time thinking about the project while not at work.	0.78	9.16	
Willingness to Act	Will1	Did/would you lead the team more or less successfully towards project's objectives?	0.84	10.203	
	Will2	Did/would you contribute more or less to effective communication with all team-members during system development/implementation?	0.72	8.223	0.84
	Will3	Did/would you monitor more or less closely team-members' performance during system development/implementation?	0.7	7.948	
	Will4	Were/would you be willing to put in effort beyond that normally expected during system development/implementation?	0.8	9.64	
Commitment	Comm1	I felt/would feel more comfort and freedom working on the project.	0.71	7.913	0.76
	Comm2	The project had/would have more personal meaning for me.	0.87	10.208	
Participation	Part1	Your responsibility for estimating development costs of the IS project was/would be?	0.8	7.587	
	Part2	Your responsibility for the success of the IS project was/would be?	0.77	12.65	0.86
	Part3	Your responsibility for the development of project was/would be?	0.69	9.082	
Incentive	Incentive	Are or have you been involved in an incentive-scheme during the implementation of an IS project?			1

Table 4: Survey Items Used in Final Analysis and Construct Composite Reliability

Second-Order Factor Model

All residuals indicated that the Success 3 item shows very large residuals, potential common variance, and the lowest loading on its factor. Therefore the Success 3 item was discarded from further analysis, suggesting that it shares common variance with Success 1 and 2. The Success 3 item, measuring "the degree of initial specifications completeness," was considered not an appropriate measure of project success. .

Goodness of Fit Measures	RMR	GFI	AGFI	NFI	NNFI	CFI	RMSEA	χ^2/d.f.
IS Threshold values	<0.05	>0.9	>0.8	>0.9	>0.9	>0.9	(<0.05-0.08)	<3:1
Second-Order Measurement(CFA) Model	0.062	0.892	0.788	0.892	0.887	0.928	0.118	2.42
Structural (SEM) Model	0.071	0.885	0.802	0.888	0.901	0.929	0.112	2.28

Table 6: Second Order CFA and SEM Goodness of Fit Indices

We conducted a second-order CFA resulting in a new 3-factor structure (see Figure 2 and Table 6 for factor loadings). As noted, three of the first-order factors are actually sub-dimensions of a broader and more encompassing construct.
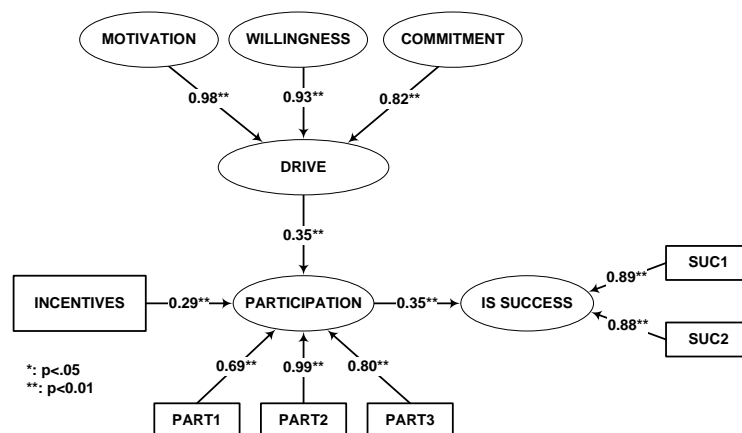
Figure 2: Second Order Factor Structural (SEM) Model (including loadings)

We turned out attention to the literature and found that Ajzen and Fishbein (1980) examined how to understand and predict behavior. According to the theory of reasoned action (TRA), the immediate determinant of a person's behavior is the person's intention to perform that behavior. The person's behavioral intentions are in turn said to be determined by the person's attitude and intentions concerning the behavior (Ajzen and Fishbein, 1980). Intentions are viewed as antecedent of active behavior, more specifically participation. Further, we found that Aladwani et al. (2000) viewed reward schemes as an intervention mechanism of some antecedent variables, i.e., intentions.

The three constructs that comprise the new factor seem to represent behavioral intentions, while participation is the actual active behavior. We can therefore suggest that if PMs display high levels of behavioral intentions, they will display higher participation in IS project tasks. We labeled the new factor "Drive."

We viewed "Drive" as an appropriate higher level construct with the overall meaning of "a motivating instinctual need, intention or desire, or effort determination leading to an affective state (Oxford Dictionary)." We developed the new construct "Drive" using a summated scales approach (average of item values in the scale) for the three original constructs, i.e., motivation, willingness, and commitment (Hair et al., 1998).

We tested the new model and all validity checks were within satisfactory limits. The new structural model produced a better overall goodness of fit; with all indices close to the recommended IS guidelines, as indicated in Figure 2 and Table 6.

In the new re-specified model all parameters were found significant except the path from Incentive to the new composite construct Drive and from Drive to Success. **P4a** was supported, as well as the expected impact of Drive to Participation. The overall conclusion is that the new underlying construct Drive is neither influenced directly by incentives, nor influencing directly IS success. However, Drive influences directly Participation. In other words, higher motivation, willingness to act, and commitment together as behavioral intentions lead to higher participation, which together with influence from Incentives leads to a higher rate of IS success.

We found that Success 3, the adherence to specifications, shares a high variance with the other two items of Success. We conclude that "meeting specifications" is somewhat problematic in IS development. We can further suggest that "on time" and "within budget" criteria for successful IS project outcomes impact on the "degree to which specifications" are met. We believe that because specifications are often changed during the development and implementation of an IS, measuring such a construct at one point in time does not reflect the changing nature over the entire period of time. If a project is finished on time or within budget it might be at the cost of functionality. Consequently we deemed the item inappropriate for inclusion in the final model.

DISCUSSION

Our model for testing the appropriateness and applicability of AT to the IS field found that participation was clearly influenced by incentives, as opposed to motivation, willingness to act, and commitment. Therefore we conclude that AT is applicable in the context of IS project management.

By undertaking a second order factor analysis, we suggest that our new construct "Drive" influences participation and can be considered or perceived as an antecedent of participation. Specifically, "Drive" is a more complex construct and embodies "behavioral intentions" as opposed to participation which is the "active" behavior. "Drive" further implies an element of "thoroughness" that seeks to continue the active behavior until a result is obtained. The implications are that IS managers must be determined to initially develop their intentions to participate, leading subsequently to their active participation until the result is obtained (successful IS project outcomes).

The lack of support for **P1a** may be explained by the type of incentives applied, financial verses non-financial incentives. Meyer and Allen found commitment was higher among employees who have been promoted, a non-financial incentive (Meyer and Allen, 1997). Because financial incentives were the most common incentive type in our study, this may explain the result in our analysis.

We did not find direct support for **P2a**; hence suggesting that PMs are not keen to dedicate more of their resources toward an incentive-based IS project. It follows that PMs do not perceive that incentives would impact on their project-related activities that can lead to successful IS projects.

Surprisingly, we did not find that motivation is directly influenced by incentives. Since our respondents were predominantly involved in financial incentive schemes, they are therefore not fulfilling the profile of "income maximisers." Prior literature found that IS professionals are mainly "achievers," thus motivated by non-financial incentives rather than financial ones (Trittmann et al., 2000). This might explain the lack of support for **P3a**. To solve this dilemma, in the light of our and prior research, other explanations should be sought in future research projects.

We found that **P4b**, higher participation leads to higher IS success, is strongly supported as indicated in Figure 2. We believe this is an important finding, because it partially supports the applicability of the AT in the IS field. AT is therefore supported for the participation construct. Willingness to act, commitment, and motivation failed to support the applicability of AT without influencing individually IS success in the context of this research. Our results lead to the conclusion that higher commitment, higher willingness to act in favor of an IS project did not directly lead to improved IS project success. However, together as behavioral intentions, they could lead to higher participation, which in turn lead to higher IS project outcomes. Further research is needed to support or validate the full applicability of AT in IS.

LIMITATIONS OF THE STUDY

There are certain limitations of the study that may also inform a number of potential avenues for future research. In our research external validity is limited by the relatively small sample size used in this study. Care should be taken with generalizing to the entire IS managers population as our sample is not fully representative of the PM population. he instrument should also be further tested and validated because we discarded certain items from analysis.

We would also like to acknowledge that this research did not aim to provide either an optimal incentive package that could ensure a successful IS project, nor determine what type of incentives should be used to motivate PMs to better perform and lead to successful IS project outcomes. Because our research was more exploratory in nature, we view the limitations as appropriate avenues for further research.

CONCLUSIONS

In this study we investigated the relevance and applicability of AT to the IS field. Specifically, we explored: 1) the relationship between the use of incentives and IS project managers' behavior; and 2) the relationship between PM's behavior and IS project success.

First, our theoretical contribution is the development of a model to apply AT to the IS field. The contribution emanates from our findings that PMs' participation in IS projects is positively influenced by an incentive-based project contract. High levels of participation in IS project-related activities were associated with high levels of IS project success. We also found that "Drive" played an antecedent role by increasing the level of participation in IS project activities, without being directly influenced by incentives. Second, by using SEM techniques in our analysis, we supported the view of introducing higher order constructs that cannot be directly measured and achieve an improvement in the overall fit of the research model.

From a practical perspective, we suggest that organizations should consider increasing PMs' participation by increasing their "Drive," i.e., their motivation, commitment, and willingness to act. AT principles could be applied to better manage projects in line with management expectations. Psychometric testing could help identify individuals that exhibit strong drive tendencies and they could be nurtured into a PM training program. Consequently, organizations should be in a better position to manage their IS projects, by increasing the rate of successful IS project outcomes, thus avoiding additional costs associated with IS project failures and/or overruns.

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Is It What You Know or Who You Know?

The Role of Social Capital in Information Technology Project Management

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ABSTRACT

Both anecdotal evidence and empirical studies have demonstrated the importance of a project manager's knowledge and experience as key success factors in information technology projects. What a project manager knows is certainly important and has been the subject of many research studies; however, who an information technology project manager knows is also important. In this paper, we introduce researchers to social capital theory, which has received some attention in the information systems literature, but not widespread notice in the information technology project management literature. To inform researchers about this theory, we offer suggestions as to how this theory has implications for both researchers and practitioners and provide suggestions for future research.

Keywords

Social capital theory, project management success, knowledge, experience

INTRODUCTION

Information technology (IT) project management is complex and knowledge-intensive. Considering this challenge, organizations prefer to rely on experienced IT project managers, particularly for their most critical and complex projects. For example, one study found that in 97% of successful IT projects, an experienced project manager was at the helm (Standish Group, 2001). The assumption is that these experienced project managers possess knowledge that inexperienced project managers lack.

One belief about the creation and development of knowledge is that individuals use experience for learning and developing knowledge (Nonaka, 1994) and connecting the past to the present (Davenport and Prusak, 2000). When individuals receive new information, the information is processed in light of one's past experience to understand the current situation and to create new knowledge (Davenport and Prusak, 2000). Because experience is an important component of knowledge, many organizations want personnel with experience rather than academic training alone (Davenport and Prusak, 2000).

Unfortunately, many organizations do not have the benefit of assigning "experienced" project managers to their IT projects. Many organizations then encourage their project managers to continue learning by leveraging different strategies to capture, store, and disseminate knowledge learned during projects. For example, organizations may capture and disseminate knowledge learned from projects using tools and techniques like post mortem analysis or knowledge management systems (Schindler and Eppler, 2003). However, some studies have shed doubt on the benefits of both experience and knowledge. A recent study examined how experienced project managers made decisions during a simulation and found that those managers with experience did not properly learn from their experience and even made serious mistakes in their management of projects (Sengupta, Abdel-Hamid and Van Wassenhove, 2008).

Other researchers have theorized that many individuals may rely on transactional memory for knowledge in which a person identifies other individuals that may possess needed knowledge (Wegner 1987). This belief suggests that the individual does not possess the knowledge themselves, but can access the needed knowledge from another person only when the content is needed. For a project manager that relies on the expertise of others within their project team (Faraj and Sproull, 2000) or other colleagues (Boh, 2003) as a source of knowledge, the project manager's knowledge is not only impacted by his/her own retention of information or by his/her own experiences, but also by his/her relationship to others. Research focusing on the knowledge management strategies of four organizations found that knowledge management systems were often not used as expected by IT project managers, but rather these individuals looked to their colleagues for information (Newell, 2004).

What these studies seem to suggest is that "what you know" may not be enough for a project manager to deliver projects on time, on budget, and with the required functionality and quality.

"What you know" is certainly important, but "who you know" may also have an important role in determining the success of a project manager. This idea, which is a key component to social capital theory, was originally developed with the sociology literature (Bourdieu, 1986; Coleman, 1988) and has also been used within the management and information systems literature (e.g., Kankanhalli, Tan and Wei, 2005; Wasko and Faraj, 2005). Social capital is defined as "the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit" (Nahapiet and Ghoshal, 1998, p. 243). This theory considers not only "what you know" but also "who you know and what they know." Therefore, this paper proposes that more research in IT project management consider the social capital of project managers when examining factors that predict a project manager's ability to manage IT projects successfully.

This paper is organized as follows. First, social capital theory is briefly introduced. Next, we provide a discussion of possibilities with which social capital theory could be useful to inform the IT project management literature. In this discussion, we offer some examples of implications to research and practice if this theory were embraced in the IT project management literature.

A BRIEF REVIEW OF SOCIAL CAPITAL THEORY[5]

Rather than focusing on what a person knows, researchers have proposed that who you know is more of a driving factor for creating knowledge within an organization (Nahapiet and Ghoshal, 1998). This theory, known as social capital theory, states that one's social networks (e.g. business, family, and other personal relationships) are resources that can be used for various aspects (e.g. career assistance, support, and work advice) of organizational knowledge (Adler and Kwon, 2002).

Social capital is comprised of three dimensions: structural, relational, and cognitive (Nahapiet and Ghoshal, 1998). These dimensions identify how social capital can generate new knowledge. It is possible for these different dimensions to relate to one another or to operate independently (Tsai and Ghoshal, 1998). Research has shown that social capital encourages the exchange of resources and ideas between people and units (Gabbay and Zuckerman, 1998; Tsai and Ghoshal, 1998), establishes intellectual capital (Nahapiet and Ghoshal, 1998), and improves overall team effectiveness (Rosenthal, 1997).

The structural dimension concerns the nature of the network and communication links among people within an organization. This dimension refers to the people a person knows or "the overall pattern of connections between actors – that is, who you reach and how you reach them" (Nahapiet and Ghoshal, 1998, p. 244). As people build relationships through social interactions, they begin to strengthen their social network. When a need for knowledge arises, individuals can consult members of their social network (i.e. friends, acquaintances, contacts) or referrals from members of their network (e.g. friends of friends) for assistance (Nahapiet and Ghoshal, 1998). This connection to the network requires a certain degree of maintenance to preserve social bonds and relationships (Adler and Kwon, 2002).

The relational dimension targets the interpersonal relationships among people that may influence their decisions and behavior. This dimension "focuses on the particular relations people have, such as respect and friendship, that influence behavior" (Nahapiet and Ghoshal, 1998, p. 244). Trust, expectations, and social norms all affect the relational dimension of social capital. Lack of trust, poor relationships, and organizational policies that discourage knowledge sharing are all detrimental to knowledge creation (Davenport and Prusak, 2000). This dimension suggests that while "who you know" is important for creating social capital, "what you think about who you know" plays a critical role as well.

The cognitive dimension describes a shared understanding and basis of interpretation amongst individuals. While diverse backgrounds among individuals can facilitate innovation, to share knowledge and develop social capital, people need to share a common language and vocabulary (Nahapiet and Ghoshal, 1998). The common language and vocabulary "reduces the

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[5] Social capital theory has been in existence from the 1980's and there are many different definitions, measures, and nomological networks for this theory partly because of its use in many domains including sociology, political science, and management. For the purposes of this paper, we have focused our discussion of the application of this theory to management and information systems. Furthermore, we have simplified the discussion of this rather complex topic and tried to focus our discussion on social capital theory using some of the seminal articles in this domain due to the constraints of a conference paper.

barriers of understanding between the partners because they have similar mental models and knowledge regarding the context" (Ye and Agarwal, 2003, p. 310). If people do not have a shared language, then stories, metaphors, and myths can be used to transfer knowledge and its context (Nahapiet and Ghoshal, 1998). Essentially this dimension examines "how you communicate what you know with who you know."

CONSIDERING SOCIAL CAPITAL THEORY IN IT PROJECT MANAGEMENT

Context affects social capital in terms of the networks used, the organization of groups and information, and the information shared among people (Widen-Wulff and Ginman, 2004). Within IT project management, there are several different types of interactions and uses of social capital that could be examined. For example, IT project managers may interact with one another to solve problems that may arise during a project (Newell, 2004). The project manager and members of the project team will share information and knowledge throughout the project. Project managers and team members will work with users to obtain the needed content to develop requirements and complete the project to the users' satisfaction (Kirsch, 1996). Each of these interactions between the IT project manager and different groups of people could impact project success.

In the following section, we offer several propositions and research questions as part of an expandable research agenda for more closely investigating the impact of social capital on IT project management. While many propositions and research questions are proposed, clearly many more propositions, research questions, and issues could be suggested. We limited our discussion to three topics. First, we explore potential extensions to social capital theory. Next, based on recent research by Kankanhalli et al. (2005), we provide propositions and research questions to explore the willingness of a project manager to share knowledge to build and use social capital. Third, considering the research of Wasko et al. (2005), we identify potential methods to study how IT project managers may benefit from communities of practice (which are often informally used by IT project managers (Newell 2004)) in establishing social capital.

Proposed Research Agenda

Because the dimensions of social capital are likely to differ across contexts, it is important to study how knowledge sharing is affected based on the characteristics of the social group and domain (Widen-Wulff, Ek, Ginman, Perttila, Sodergard and Totterman, 2008). In the context of IT project management, a study could use qualitative methods to understand the general role of social capital among IT project managers. Using methods that capture rich data and allow for probing of informants would be useful in answering many types of questions. When posed in the form of a proposition, one inquiry could take the following form to consider an IT project manager's conscious or unconscious process:

PROPOSITION 1: IT project managers consciously consider social capital when seeking or giving advice.

In a similar fashion as with financial capital which can be amassed and used, we consider how social capital can be amassed and used (Preece, 2002) and offer the following proposition:

PROPOSITION 2: IT project managers actively develop and spend social capital.

Quantitative methods may also be useful to determine how generalizable social capital theory is to the domain of IT project management. In studies examining the experience of IT project managers in terms of their ability to manage projects successfully, the network of the IT project manager could certainly have impacted their effectiveness as a manager. Access to knowledge seems to logically be important to predicting success. Quantitative measures of the different dimensions of social capital theory have been developed and used in contexts other than IT project management (Tsai and Ghoshal, 1998; Wasko and Faraj, 2005); these measures could be adopted and used to measure the social capital acquired and used by IT project managers. Therefore, studies could examine research questions in the form of the following propositions:

PROPOSITION 3: The use of social capital impacts the success of an IT project manager (as perceived by the organization, team members, or users).

PROPOSITION 4: The use of social capital by an IT project manager impacts the success of an IT project.

If a study is examining success of IT projects, the following is offered:

PROPOSITION 5: The social network of the project manager should be measured or controlled.

Studies examining these aspects would be useful to determine the salience, relevance, and importance of social capital in IT projects. If social capital is indeed important for IT project managers, then many other interesting avenues of research in this domain would be available for study.

Social Capital Theory Development

The management literature examines social capital theory associated with the development or creation of knowledge (Adler and Kwon, 2002; Nahapiet and Ghoshal, 1998). In IT projects, knowledge creation also occurs in a variety of situations. Some projects are highly innovative that push the state-of-the art. Some of these projects may require creativity and strong leadership to keep the project on course for budget, schedule, and functionality targets. In addition, satisfying customer and business needs may also be particularly challenging on these types of projects. In this scenario, the IT project manager may be developing new knowledge for themselves and the organization. It is likely that social capital can inspire and aid in the development of knowledge for these types of innovative projects. Thus, it is possible:

PROPOSITION 6: Increased social capital increases project innovation.

Although there are common themes that carry across IT projects (Cooper, Lyneis and Bryant, 2002), knowledge creation also occurs in IT projects when an IT project manager is trying to identify a solution to a problem that s/he (or the organization) has never experienced before. The problem may be technical in nature or may be related to motivating a team or dealing with a troublesome user. In this situation, the project manager may have little knowledge and there may be limited knowledge formally captured within the organization's knowledge management system so that person must look to others for help. It may be that it is not necessarily the creativity or the "know-how" of the IT project manager that determines success, but rather his /her social network, social capital, and ability to use the knowledge gained via social capital that is a determinant of the project manager's success. Perhaps the following is true:

PROPOSITION 7: An IT project manager's social capital has more impact on his/her success than project knowledge.

Another interesting extension to social capital theory could be to evaluate the use of social capital in the context of knowledge reuse. Most of the literature on social capital theory focuses on knowledge creation; therefore, the concept of applying previously-generated knowledge is outside the boundaries of the current theory. Since social capital theory focuses on creating knowledge, rather than reusing knowledge, this could be an important extension to the general theory. IT projects seem to be an ideal domain to study the effects of social capital in knowledge reuse. For example, in IT projects, knowledge reuse occurs in consulting organizations or large organizations performing multiple IT projects that experience similar problems. Knowledge reuse also arises when IT project managers seek technical or procedural knowledge for a project that is similar to one previously-conducted by the project manager, by the organization, or elsewhere. It is possible that while the IT project manager has never faced the problem before, a colleague (either inside or outside the organization) may have experienced the same or similar problem and has advice to share. Theoretically, it seems appropriate to assume that the dimensions of social capital (relational, structural, and cognitive) apply to knowledge creation as well as to knowledge reuse. However, maybe the importance of these dimensions varies or a new dimension is discovered in this context. These aspects may be examined through the following:

PROPOSITION 8: The relational, structural, and cognitive dimensions of social capital apply equally to knowledge reuse as they do to knowledge creation.

Knowledge Hoarding & Social Capital

Some individuals may choose to hoard or keep their knowledge rather than share it with others. This often occurs because the individual views their knowledge as a source of power, which is often reinforced by organizational norms (Davenport and Prusak, 2000). However, people do share knowledge if they perceive that their efforts will be reciprocated, if they want to improve their reputation, or out of altruism (Dixon, 2000).

For example, a study of ten organizations using electronic knowledge management systems found that regardless of the organizational norms, a need to retain knowledge to retain power did not impact the usage of the knowledge management system by contributors (Kankanhalli et al., 2005). In this same study, altruism was a common reason for people's willingness to contribute knowledge, reputation was not important, and reciprocity was only important if the organization had weak norms to support knowledge sharing.

This study and issue suggests several potential research questions associated with knowledge hoarding and social capital in IT projects that may take the form of the following propositions. Understanding these aspects may be useful in developing better ways to share knowledge:

PROPOSITION 9: Knowledge hoarding and power affect the willingness of IT project managers to share (or seek out) knowledge.

In considering the uniqueness of the findings of Kankanhalli et al., we offer:

RESEARCH QUESTION 1: Are the Kankanhalli et al. findings generalizable to the context of IT projects?

RESEARCH QUESTION 2: What is the motivation for IT project managers to share their knowledge with others: reciprocity, reputation, or altruism?

Interactions & Social Capital

People attain social networks through a variety of methods including communities of practice, professional organizations, conferences, former colleagues, friends, and family members. Research can be conducted to examine the types of interactions that IT project managers have and their effects on social capital.

For example, communities of practice are defined by Lave and Wenger (1990) as a cohesive group of individuals that work together, interact with one another, and solve problems. The authors suggest these groups are typically collocated (as opposed to virtual or geographically dispersed) and have a high sense of reciprocity. The characteristics of these groups suggest that there should be strong relational, structural, and cognitive dimensions, and social capital would be important and salient in these groups. Studies could examine the role of social capital in communities of practice, which could be useful in helping to develop, grow, and heighten the impact of these communities. Thus, we offer:

PROPOSITION 10: Social capital has measurable importance to communities of practice.

Many organizations may not be large enough to have a community of practice for IT project managers. Therefore, research could also examine other forms of interactions. For example, "networks of practice" were defined by Brown and Duguid (2001) as a group of people across organizations that develop relationships through professional groups and conferences. These networks are not as cohesive as communities of practice and may never actually meet face-to-face, but there is still great potential for knowledge sharing in these groups. However, these groups have weaker structural and relational dimensions and may have a more difficult time developing and leveraging social capital (Wasko and Faraj, 2005). Therefore, we may consider the following:

PROPOSITION 11: Social capital has measurable importance to networks of practice.

PROPOSITION 12: Social capital has less importance to networks of practice than to communities of practice.

Wasko and Faraj (2005) examined similar dimensions in a study of law professionals interacting in an online community of practice. In their research, they found that developing a reputation was a primary factor in terms of why individuals shared their knowledge. Reciprocity was not as important in these types of interactions. This study also found that a critical mass was necessary to encourage contributions, because those central to the group tend to contribute more to the group (Wasko and Faraj, 2005). These findings suggest that an organization has the potential to benefit from individuals accessing a network of practice. These employees are able to access a large amount of knowledge for a very small cost. There is a need for organizations to not inhibit (and possibly promote) this type of interaction for their employees (Wasko and Faraj, 2005).

PROPOSITION 13: The ability to access a network of practice positively impacts organizations.

This study and consideration of networks of practice suggest that many related research questions could be explored. Do these findings apply to IT project managers given the nature of their work and needs for knowledge? Are some sources of networks better than others (i.e., local chapter of a project management group versus conferences or some other form of interaction)? Wasko and Faraj (2005) examined the factors that impact those who are willing to contribute to the network. What about the factors that impact whether or not an IT project manager is willing to use their social capital to obtain knowledge? Understanding how various interactions impact social capital would help organizations and IT project managers

better develop and utilize social capital to gain needed knowledge on IT projects. This raises some interesting research questions:

RESEARCH QUESTION 3: Are some forms of networks of practice better than others?

RESEARCH QUESTION 4: Do certain types of interaction increase the likelihood that an IT project manager will share his/her knowledge?

Potential Organizational Considerations

Given the potential importance of social capital theory in affecting an IT project managers' ability to manage projects successfully, there are many implications for organizations. Organizations should consider implementing the following recommendations to improve social capital.

First, both organizations and the profession of IT project managers need a shared language to better communicate with one another. The use of training, methodologies, and standards from organizations or professional organizations can provide a shared language among IT project managers where there is an "overlap in knowledge" (Nahapiet and Ghoshal, 1998, p. 254). This development of a shared language among IT project managers facilitates the exchange of knowledge through the cognitive dimension of social capital. Furthermore, those within the project team or the user group should also have a shared language to better communicate with the IT project manager.

Next, organizations need to realize that novice IT project managers or those new to an organization have smaller social networks and will need to build up social capital. Novices have a difficult time soliciting advice when problems arise because they do not know who to ask for help or have a limited number of people within their network to ask for advice. When entering an organization, the structural dimension of social capital is lacking. New employees lack network ties and are thus unable to access the resources that have the necessary knowledge for reuse (Nahapiet and Ghoshal, 1998). Over time, one's network of resources can grow and improve and the organization can encourage networking both within the organization and within a professional community. The reliance on social networks is a commonly used method of obtaining knowledge and is subject to the structural dimension of one's social capital (Nahapiet and Ghoshal, 1998); this reliance is consistent with other research on cross-project learning (Newell, 2004).

The primary drawback to this type of knowledge reuse is that a person's social network dictates the knowledge available to them. A person within the organization may have a solution to the project manager's problem, but if the project manager does not have a relationship with this person, the knowledge cannot be obtained. By formalizing knowledge, the need for the structural dimension of social capital is reduced. By capturing and storing knowledge in a formal knowledge management system, anyone in the organization has access to the data (Hansen, Nohria and Tierney, 1999). This lessens the importance of social networks because people can obtain and reuse knowledge that exists outside of one's social network. Related to the former point of having a shared language, new users to the organization may have difficulty using this formal knowledge because of their inexperience in the organization and lack of shared knowledge to communicate information. This lack of structural knowledge about the organization may also impact the use of social capital.

Another option for improving social capital is establishing social norms that promote reliance on others. The perceived norms of employees within an organization affect exchange of knowledge by impacting the strength of relationships among colleagues, thus reflecting how the relational dimension of social capital theory can encourage project managers to share what they know with one another. However, while organizational norms can be supporting factors for knowledge reuse by encouraging the use of social capital among employees, norms can also affect social capital negatively if taken to an extreme (Leonard-Barton, 1995), thus inhibiting the pursuit of social capital. For example, a social norm that encourages success among its employees could be a motivating factor to seek out knowledge from colleagues during a project; however, other project managers may interpret the same social norm as the need to be perfect, meaning that asking for help would be perceived as weak or unknowing (Citation Omitted 2008). Therefore, organizations need to be cognizant of these norms and promote them positively within the firm.

CONCLUSION

Within this manuscript, we proposed that researchers more closely consider social capital theory within the domain of IT project management. This theory has received much attention in political science, sociology, and management, and is becoming more prominent in recent information systems research as reflected in the International Research Workshop on

Information Technology Project Management (IRWITPM) by Chua, Lim, Soh, and Sia (2007). The people within an IT project manager's network and the network's collective knowledge may be important for the IT project manager as s/he searches out solutions to problems that arise on his/her project. Therefore, we briefly introduced the related social capital theory and described some specific practical implications for organizations based on this theory. We also proposed a research agenda with some implications to IT project management research as well as some research propositions that could be investigated based on this theory. Although this theoretical introduction is brief to fit the guidelines of a conference publication, we believe it will challenge readers to consciously consider this theory in their study of IT project management. Thus, we may help uncover another important dimension to understanding IT project success.

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The Influence of Knowledge Management on Business Value in IT Projects: A Theoretical Model

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ABSTRACT

This paper develops a theoretical model to explain the relationships between knowledge management and business value in IT-enabled business projects. It draws upon a wide range of literatures including project management, management information systems, software engineering, organization and management theory, organizational behaviour and strategy.

The overall model comprises two sub-models. The first shows how the alignment of three project-based knowledges directly influences business value. The second shows how four knowledge-based concepts, knowledge management, knowledge stock, enabling environment, and knowledge practices, combine to create the project-based knowledges. Together these two sub-models provide an overall model of the causal system through which knowledge management influences business value.

This research makes contributions to the research into IT Projects by (1) integrating fragmented literatures which connect knowledge management and project success; and (2) proposing for discussion a predictive model in which knowledge management influences business value. It has the potential when further developed to clarify what project managers can do to manage knowledge in a systematic way.

KEYWORDS

Project management, knowledge management, business value, IT project

INTRODUCTION

Motivation

The traditional practitioner view of IT project management has seen the project manager's goal as delivering a pre-defined IT system to the business client. Consequently, the management task has been to plan, monitor and control a set of work packages in order to deliver the pre-defined system. Successful performance has traditionally been viewed as delivery to cost, schedule and scope/quality (Johnson 1995). Most research has accepted this view of projects as seen through the lens of action (or, as Bredillet (2007) calls it, the "optimization" perspective). It has similarly viewed performance in terms of variance against cost, schedule and scope/quality rather than in terms of business value achieved.

Today, executives focused on maximizing shareholder returns view IT projects as investments that must be seen to deliver business value. The project management tasks involved in timely and cost-efficient achievement of projects are not sufficient to guarantee value. Value is essentially the outcome not solely of action but of well-directed action. It is a function of knowledge of how IT can be used and how use can deliver value.

Recent research has begun to re-think the traditional framing of projects in two ways (Winter et al 2006a, Sauer & Reich forthcoming 2009). First, researchers and practitioners have recognised a variety of supplementary lenses including economic, social, emotional, and knowledge-based. Each lens adds to our understanding of projects and, when empirically explored, should add to our ability to predict performance. Second, the goal of projects has been re-framed to focus primarily on the delivery of business value. In this paper, we exploit these shifts in order to address the problem of managing projects for value. We take the knowledge lens, and explore how knowledge management can influence the business value delivered by projects. By combining a knowledge perspective with the attainment of business value, we aim to increase our ability to predict as well as deliver value.

Description

The purpose of this paper is to develop a theoretical model of the relationships between knowledge management and business value in IT projects. We use the term "IT project" as shorthand for "IT-enabled business projects" – those projects which combine information technology and business processes to impact business value. The proposed model is conceptual in nature. It is developed by drawing upon a wide range of literatures where relevant concepts and theoretical relationships have been investigated. These include project management, management information systems, software engineering, organization and management theory, organizational behaviour and strategy. We use these literatures to identify and define key knowledge concepts, such as Knowledge Stock, Enabling Environment, Knowledge Management, and Knowledge Practices. We combine these concepts into a model of the causal system through which knowledge management can positively influence business value. In particular, we step beyond the literature to propose that projects develop three distinctive sets of knowledge which when aligned will influence the ultimate achievement of business value. We claim that the model has face validity and that it will be susceptible to empirical validation once formal propositions have been developed in the next stage of the research.

Contribution

This research makes contributions to the research into IT Projects by (1) integrating fragmented literatures which connect knowledge management and project success; and (2) proposing for discussion a predictive model in which knowledge management influences business value. When further developed, it has the potential to clarify what project managers can do to manage knowledge in a systematic way.

Outline of the Paper

Our strategy in developing this paper is to start by examining prior research to set the context for the theoretical model. We then present the structure of our proposed model and a detailed explanation that grounds each element in specific aspects of relevant literatures. We make explicit certain assumptions, limitations, discuss the potential for practice, and point the way for future research.

CONTEXT FOR THE THEORETICAL MODEL

This section discusses the need and prospects for a model which connects knowledge management with business value in IT projects. It draws on a wide range of research literatures to support the core thesis embodied in our model – that knowledge management influences the business value of projects – and to identify concepts that can serve as building blocks for the model.

Need for the Model

There are three reasons why we need a new model to expand our perspectives on the factors that influence project success. The first concerns the problematic nature of IT projects. Empirical evidence shows that IT project managers find their task to be increasing in difficulty. Dimensions such as project size, complexity, novelty of technology, rate of business change, and number of stakeholders are all perceived to have become harder to deal with (Sauer & Cuthbertson 2003). In cases of high uncertainty or novelty, knowledge sharing and innovation are of critical importance.

The second reason that we need this model is that the concept of business value is under-theorized in IT project management. Practices such as value management and value engineering have concentrated on creating processes for solving traditional problems of project delivery rather than formulating a business-centered concept of value. Thus, while the importance of business value is beginning to be recognized (Winter et al 2006b, Sauer & Reich forthcoming 2009), surprisingly little literature focuses on what we mean by the term or how project managers can achieve it.

The third reason the model is needed relates to the important role of knowledge management in existing practice (Soderlund 2005). Project managers have always incorporated aspects of the management of knowledge and learning into their practice, for example through the management of expertise (Reich 2007). They have not typically referred to such activities as knowledge management, neither have they developed and managed a knowledge plan or strategy. More generally, there is not an explicit model of the role of knowledge in projects and no clear understanding of what project managers can and should do to secure and apply relevant knowledge to advance project outcomes. Thus focus on knowledge and knowledge management is desirable in terms of understanding these concepts as independent variables.

The linkage between knowledge and business value seems particularly relevant to IT projects because the task of building or implementing IT-enabled business systems is a knowledge-intensive activity. Where construction projects, for example,

involve the management and deployment of large quantities of materials, IT projects work with knowledge as their core material. Because the product or process represents an innovation, project tasks require sharing, creation, usage, and integration of knowledge among members of the project team and stakeholder groups including knowledge of business value, organization and technology. Also, because the project team is a temporary organization, team members may have no shared work or social history so the explicit management of knowledge becomes critical to develop shared understandings.

For these reasons, we argue that conceptualizing IT projects using a knowledge lens addresses a critical dimension and should add important insights to our ability to manage projects successfully.

Research into Knowledge in Related Disciplines

Project management, including IT project management, is inherently a multi-disciplinary domain. It is not realistic to expect a single unified theory of project management in the way in which we might aspire to a unified theory of strategic management (Sauer & Reich 2007). For any project management theory of more than modest scope, it is necessary to draw upon results from multiple disciplines.

Knowledge management, by contrast, is a conceptualization that has application in many different domains. Consequently, researchers in a range of management disciplines have examined aspects of knowledge and learning and their impact on various outcomes, including core capabilities (Kotnour 1999), team learning (Akgun et al. 2005), team satisfaction (Janz & Prasarnphanich 2003), and project success (Karlsen & Gottschalk 2003, 2004). In this paper, we synthesize concepts of knowledge management from the MIS, software engineering, project management, organizational theory, and organizational behaviour literatures. Each of these literatures is very briefly discussed below.

The MIS and software engineering literatures recognise the importance of knowledge management (Corbin et al. 2007, DeSouza et al. 2006, Aurum et al. 2008) and point to its limited application in practice (Aurum et al. 2008). Published studies make five positive contributions to the development of our theoretical model: (1) they provide empirical evidence that knowledge and knowledge management significantly affect project performance and project management performance, that is respectively outcomes such as business value, and delivery to budget and schedule (Faraj & Sproull 2000, Gemino et al. 2008, Tiwana 2004); (2) they highlight the importance of modelling at the level of specific knowledges (Tiwana 2004); (3) they provide relevant constructs such as project knowledge resources (Gemino et al. 2008) and expertise coordination (Faraj & Sproull 2000, He et al. 2007); (4) they introduce the idea of team-based knowledge (He et al. 2007); and (5) they introduce the concept of project alignment as a knowledge process (Jenkin & Chan 2006).

The project management literature has recently acknowledged the appropriateness of business value as a key project target (Winiter et al 2006b). It has relaxed some of its assumptions about the importance of control in favour of ideas about experimentation, innovation, knowledge management and learning (e.g. Akgun et al. 2005, Grant 2006, Reich & Wee 2006, Reich 2007, Sense 2003, Sauer & Reich forthcoming 2009) with some researchers connecting knowledge and learning with project performance (Reich et al forthcoming 2008).

The organizational and management theory literature includes two relevant theories that are based in knowledge concepts and have been applied to projects: organizational control theory (Ouchi 1977, 1979, 1980, Kirsch 1996, 1997, Choudhury & Sabherwal, 2003, Liu et al 2003) and information processing theory (Galbraith 1973, 1977, Winch 2002). At a more detailed level, empirical studies in this literature show a strong correlation between project management and knowledge management practices (Brown & Duguid, 1991; McElroy, 2000) and between good knowledge management practices and project performance (Leseure & Brookes 2004).

Research in organizational behaviour offers relevant insights into the knowledge practices of teams through concepts such as the shared or team mental models (Lee 2007, Cannon-Bowers et al. 1993, Rico et al. 2008), and transactive memory systems and the collective mind (Zhang et al. 2007, Yoo & Kanawattanachai 2001, Austin 2003).

We also draw on literature on learning on the basis that although it is a different research tradition, knowledge and learning are closely related concepts in that learning can be considered as a process of change in knowledge and a process of change in knowing which involve respectively changes in cognition and changes in behaviour (Bohn, 1994; Vera & Crossan 2003).

In summary, there is encouragement in existing literature for our core thesis – that the business value achieved by IT projects is influenced by knowledge management. From this literature, we draw the following key ideas for our model:

- project managers can actively manage knowledge through practices such as expertise coordination;

- a stock of knowledge has to be assembled;

- the enabling environment will be influential;

- multiple knowledges are required;

- these knowledges need to be aligned;

- the actual practices that teams apply to access, create and process knowledge will produce knowledge instrumental to the achievement of business value.

We now propose a structure for our model using these principal elements. We then describe the model more fully, drawing on the literatures cited in this section.
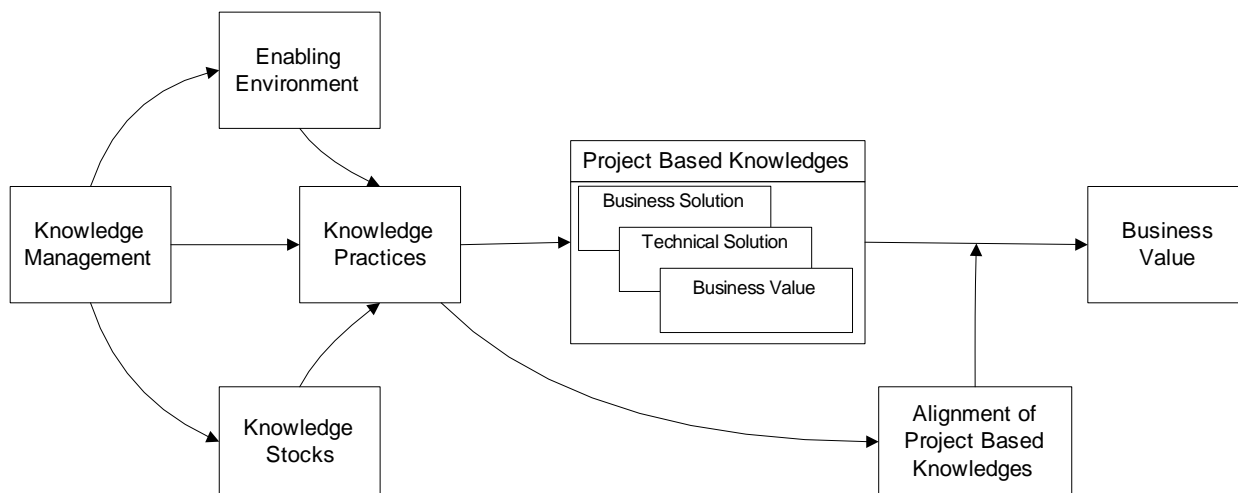
THE THEORETICAL MODEL

Structure of the Overall Model

The model (Figure 1) starts at Knowledge Management[6]. This term connotes the interventions that a project manager and her project management team make to improve the discovery and use of knowledge by the project team. It has as its end point the Business Value to be achieved by the application of the project's deliverables in its organizational setting. The model posits key intervening variables to explain how Knowledge Management influences the achievement of Business Value.

In speaking of a "project", we adopt a broad interpretation that includes organizational as well as technical change. We make no assumptions about limitations to the project manager's scope of responsibility. Rather, we conceptualize project management in terms of the project management team as comprising managers of both technical IT and line organizational units. The intention of this approach is to avoid our model being limited in its applicability by the contingent choices of businesses about how they divide project responsibilities.

Our model confines itself to proposing how knowledge and learning in an IT project can impact business value. We acknowledge that the traditional project management activities such as task and schedule management are still critical for completion of a project, but believe that knowledge management will add to a manager's ability to deliver business value. Issues of political support, emotional involvement or financial return are also valuable perspectives, but outside our current scope.

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[6] From this point we capitalize the concepts in our model. When we employ the same words in their more general usage then we use lower case.

Overall, the model proposes that knowledge management results in an enabling environment, knowledge stocks, and knowledge practices. The knowledge practices lead to a set of project-based knowledges, which have a level of alignment. The alignment of the Project-Based Knowledges moderates their effect on the achievement of Business Value such that the stronger the Alignment the greater the Value achieved.

The model as depicted in Figure 1 is a simplification in that its arrows are unidirectional. We acknowledge that in practice there will be feedback loops. For example, knowledge practices that generate new knowledge will add to knowledge stocks. Nevertheless, the central thesis is that the manipulation (by Knowledge Practices) of available knowledge (Knowledge Stocks) will influence the development and alignment of the three project based knowledges. Unidirectional arrows highlight this.

In the following sections, we discuss the model in two parts (or sub-models) to provide a more detailed account of the individual elements and logic. The first sub-model discusses the relationship of Alignment among three Project-Based Knowledges with Business Value. The second demonstrates how Knowledge Management influences the creation of the Project-Based Knowledges and their Alignment. For each element of the sub-models, we draw upon the different reference literatures as needed. Our focus is on the concepts, so for now we leave aside issues of measurement and researchability.

Sub-Model 1: Business Value as a Function of Knowledge and Alignment

Sub-model 1 (Figure 2) includes three elements: Business Value, the three Project-Based Knowledges, and Alignment. Two propositions underlie this model. The first is that several types of knowledge are important in order to deliver business value – Knowledge of the Business Value, Knowledge of the Organizational Solution and Knowledge of the Technical Solution. IT systems (the technical solution) deliver Business Value primarily through organizational and business process change (the organizational solution) (Brynjolfsson & Hitt 2000, Brynjolfsson et al 2002). The second proposition is that since each knowledge may be developed by different stakeholders within a project, Alignment among them will be critical to the achievement of Business Value. Each element of the model is discussed below.
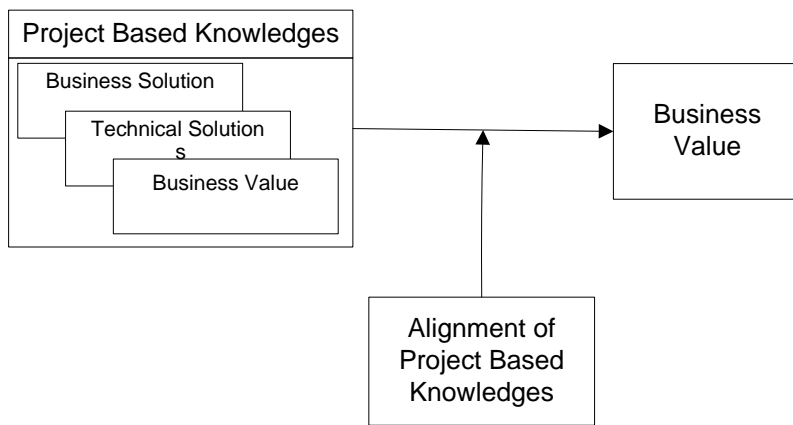
Figure 2: Sub-model 1 –Business Value as a Function of Knowledge and Alignment

Business Value

Currently, there is no consensus as to the definition of the business value of a project but there is growing recognition of its importance and its multi-faceted nature (Winter et al 2005a,b). Also, in most cases business value is not fully realizable by a project manager because the project is dependent upon others to harvest the benefits. In practice, however, project managers are increasingly focused on business value. So, what do we mean by business value and how do we reconcile these tensions?

The focus on business value is a relatively recent development as the world of projects has moved beyond the Optimization School (Bredillet 2008) in which business value was taken for granted as inherent in the project definition. Attention has now turned to what is actually delivered in terms of the product of the project activity, how it contributes to the larger task of the organization, and its financial return on investment.

Focus on the product of projects has given rise to the notion of Product Performance (Nidumolu 1996, Barki et al. 2001) as a description of what the project achieves by way of client satisfaction and/or business benefit. While Product Performance represents an improvement on Process Performance it does not encompass all the ingredients of value because it is possible for a client to be satisfied without value being attained and for benefits to be realized but either too few or at too high a cost or too late for value to accrue from the project.

More explicit measures of financial performance such as return on investment or cost-benefit analysis are typically limited in being unable to adequately recognize and measure intangible or non-financial dimensions. For example, the installation of an IT system that represents a competitive necessity may save a company from losing customers and going out of business. Its business value is high but the return on investment may not be measurable in objective and balanced terms (Hirschheim & Smithson 1988, Symons 1991, Willcocks & Lester 1999).

There are disciplines within the project world that explicitly focus on value – earned value, value management, and value engineering – yet none quite captures the notion of benefit to the client (Winter et al 2006b). Earned value reflects the value achieved by the project deliverer in terms of percentage completion of the full specification (Fleming & Koppelman 2005). Value engineering and value management concern the continual review of the project in terms of its desired functions (Kelly & Male 1993). Each potentially bears upon the issue of business value but none captures all aspects of what IT project managers mean when they say that their task is to contribute business value.

In the organizational and strategic management literature, the concept of shareholder value is widely employed (Rappaport 1986). Its advantage is that it captures the need for benefit to the enterprise. However, it is often a narrow financial goal (e.g. percentage increase in share price). It is not, by itself, broad enough to represent the multiplicity of goals that a project may be expected to achieve.

Our concept of Business Value fits between attainment of targets and shareholder value. We define it as "the achievement of a set of strategic objectives which may be long- or short-term, financial or non-financial". Consistent with the dynamic orientation of the model, these objectives may vary over time. They may vary across stakeholders. Indeed, the business value by which a project is justified and celebrated post hoc may never have been understood or clearly articulated by the business clients at the outset. For these reasons, Knowledge of Business Value is critical to its achievement and non-trivial as a condition for project success. We discuss this knowledge further in the next section.

Project-Based Knowledges

The model focuses on three areas of domain knowledge that are central to the delivery of business value: Knowledge of Business Value, Knowledge of the Organizational Solution, and Knowledge of the Technical Solution. We refer to the three as Project-Based Knowledges. We define each in turn, locating it within appropriate literature as justification for its inclusion in the model. We identify a set of shared characteristics that each knowledge should exhibit.

Knowledge of Business Value

Knowledge of the Business Value a project is to achieve is an extension and development of some less value-focused concepts. For example, the importance of a clear understanding and articulation of the principal objectives of IT projects is a long established success factor (Pinto & Slevin 1987) – the objectives may be but need not be value-based. Similarly, it has been argued that IT professionals should have business benefits in view when designing IT artefacts. The more recent benefits management literature has got closer to recognition of a concept of knowledge of business value. This work stresses the importance of a clear understanding of the desired value (Ward & Daniel 2005).

While the IT benefits management literature, like much earlier work on IT evaluation, has assumed that business value can be known from the outset, some writers on the dynamics of strategic IT have produced evidence of the emergent nature of business value (Ciborra 1991, Yetton et al. 1994). These researchers show that opportunities may emerge during a project through learning about the business application of the technology. In some cases they challenge the idea that it ever can be understood ahead of exploration, experimentation and improvisation – Ciborra's notion of bricolage. In effect, therefore, they

show that Knowledge of Business Value needs to be a dynamic concept such that it can grow and be modified throughout the project lifecycle.

We define *Knowledge of the Business Value as a "dynamic shared understanding of the business objectives that the project is expected to deliver and how the project will help achieve these business objectives"*. Thus we suggest that it is important to know what will constitute a business success and how the project will contribute to that success. The project must continually review whether what it is producing will lead to Business Value. This knowledge must be shared across a sufficiently wide constituency and it must be explicit and appropriately concrete.

Knowledge of the Organizational Solution

The IT project literature has increasingly recognized that benefits are only secured if a new system is accompanied by business process and organizational change (Markus 2004). Alignment models such as MIT90s embody the recognition that strategy, structure, process and people need to be aligned to core technology systems to achieve high performance (Scott Morton 1991). We use the term Knowledge of the Organizational Solution to reflect the need for understanding of what organizational change will be required. We use the idea of the Organizational Solution rather than the Business Solution both to explicitly include organizations such as non-profit and government organizations, and also to include solutions that run beyond the boundaries of a single business entity, for example by integrating a complex supply chain.

The literature on the dynamics of strategic IT (Ciborra 1991, Yetton et al 1994) also applies to the organizational solution. That is, knowledge of the organizational solution will emerge as a function of evolving understanding of the organizational issues both as the value becomes clearer but also as the organizational implications themselves become clearer.

We define Knowledge of the Organizational Solution as *"the dynamic shared understanding of the changes that need to be made in the organization and the ways in which these changes will be accomplished"* to exploit the IT system and attain the expected business value from the project (e.g. process change, training, hiring, and reorganizing).

Knowledge of the Technical Solution

Over the last fifteen years, industry has increasingly developed architect roles at the corporate and project levels. The task of the project technical architect is two-fold - to develop a satisfactory Technical Solution, and also to do so in a manner consistent with corporate architectural standards (Zachman 1999, Pearlson & Saunders 2006 p138). Not only must the project technical architect know what technology can do, how it works and what new technology is emerging, he/she must also understand the corporate architecture.

Again, technical knowledge is subject to dynamic change. It will develop and grow over time, particularly where a new technology is employed. It is also subject to a degree of volatility. New technologies can emerge and supersede old ones within the time frame of medium to large projects. Thus Knowledge of the Technical Solution may also be subject to fluctuation.

We define Knowledge of the Technical Solution as a *"dynamic, shared understanding of the architecture and infrastructure of the technical solution within the context of any wider architectural standards or infrastructure standards and constraints"*. This understanding comprises recognition of the ways in which the project solution architecture and infrastructure will be created and made to work.

Characteristics of Project-Based Knowledges

In order for the three Project-Based Knowledges to affect actual business value, they have to exhibit some common characteristics. In this model, each knowledge type is expected to be: negotiated and socially constructed, shared, externalized, actionable, dynamic and interrelated. Each of these characteristics is discussed below.

What counts as knowledge in the project context is typically negotiated. For example, the notion of Business Value may be an outcome negotiated among senior executives or their Board. Even technical knowledge is often a function of the process of negotiation through which specialists learn about and share their knowledge of a technology (Collins 1985, Strauss 1978). However, knowledge, for example that a given piece of software works in a certain way, will typically be treated by team members as if it were objective. We therefore treat knowledge as weakly socially constructed (Searle 1995).

Project-Based Knowledges need to be shared in the sense of understood by multiple members of the team, not contained in and restricted to a single individual. This is particularly important in highly uncertain environments. When specialists apply their own expertise, they need to have a shared understanding of the common objectives of their part of the project. This concept is often operationalized as shared mental models to explain how dispersed effort can pursue a common direction (Rico et al. 2008).

It follows that to be shared widely, particularly in the context of virtual project teams, the knowledges need to be externalized. In the context of IT projects where the knowledges are abstractions that stand for organizational and technological reality, to externalize means to render the knowledge explicit for example in a document, diagram, spreadsheet or discussion that is understandable by others. Staples and Webster (2008) show the particular importance of knowledge sharing for virtual team performance.

Projects inherently seek to create change within organizations and therefore knowledge needs to be actionable. For example, a statement of business value such as "this project will reduce unnecessary hospital deaths by reducing the variance in clinical diagnostic decisions" is more concrete and explicit than just "this project will improve hospital health outcomes".

We have already noted that knowledge is emergent and therefore dynamic. More generally, we can say that in most projects the three sets of knowledge will grow and develop continuously through the course of the project as a natural function of learning. Discontinuous changes may occur to affect each set of knowledge; for example, changes in the competitive environment may affect the potential business value; changes in the organization may affect the organizational solution; changes in technology may affect the technical solution.

The three knowledges are also interrelated, not discrete. For example, some business knowledge and technical knowledge will be needed to create Knowledge of the Organizational Solution – business knowledge informs as to the business value needed, technical knowledge informs as to how the technical solution might be developed. In effect, for knowledge of any one solution to be effectively applied it will need to be with awareness of the other two.

Alignment of Project-Based Knowledges

Sub-model 1 states that Business Value is influenced by the three knowledges and the level of alignment between them.

In the strategy literature, alignment commonly refers to the extent to which internal firm resources match the needs of the externally-focused competitive strategy (Leavitt & Whisler 1958, Scott Morton 1991). The Resource-Based View of the firm embodies the assumption that knowledge in the form of capabilities is a key internal resource (Collis & Montgomery 1995). In the IT literature it refers to the extent to which the IT function is organized to support the principal business lines (Henderson & Venkatraman 1992, Chan & Reich 2007).

Although a discussion of Alignment among knowledges is seemingly to introduce a new meaning for the term, there are existing concepts to guide us. It is implicit in our model that we see Alignment of knowledges as involving some degree of knowledge sharing across individuals. Thus concepts relating to team cognition may assist (He et al 2007) to signify overlap or coherence among individuals with potentially different expertises or knowledge bases. Empirical research has reported that shared mental models influence team performance positively (Levesque et al. 2001). Although the effects of shared mental models are not consistent across studies (Lee 2007), two characteristics that appear to influence performance are the similarity and accuracy of the mental models (Edwards et al. 2006, Lim & Klein 2006, Mathieu et al. 2000). For our theoretical model, similarity implies Alignment. Accuracy would imply that the knowledges are of a high quality were they representations of an objective reality. Rather, to the extent that the three Project-Based Knowledges are related, social constructions their quality may be better assessed in terms of their joint coherence. Related concepts include transactive memory (Akgun et al. 2005, Yoo & Kanawattanachai 2001) and integrative capability (Mitchell 2006). Research and experience indicates that free and frequent exchanges of knowledge across boundaries are key performance predictors.

In our context, Alignment can be defined as *"the level of congruence between the three Project-Based Knowledges"*. An image of knowledge alignment might be a set of three cogs, representing Knowledge of Business Value, Knowledge of the Organizational Solution, and Knowledge of the Technical Solution. If the knowledges are aligned, when one shifts, the others will also move. They are out of alignment when change in one knowledge fails to trigger an appropriate change in the other two. A simple example of the Alignment of knowledges might result from a change in organizational structure which separates two previously integrated functions. In terms of our model, if the implications of the structural change are recognized, we have a change in Knowledge of the Organizational Solution. If this results in recognition that we now need

two distinct sets of financial and management reports, then we have alignment between the Knowledge of the Technical Solution and the Knowledge of the Organizational Solution. Alignment therefore involves continuing feedback among the three Project-Based Knowledges. The process can be considered one of mutual adaptation.

In summary, this sub-model represents important conditions for knowledge in a project to contribute to business value. While we recognize that the business value achieved will be a function of the organization's ability to execute on its preferred solution, and that therefore our model represents necessary but not sufficient conditions, we expect that aligned knowledge of the solution will be correlated with the achievement of value.

Sub-Model 2: The Influence of Knowledge Management

Sub-model 2 (Figure 3) represents the knowledge management process - the process by which the three Project-Based Knowledges are generated and aligned. It proposes that knowledge is generated through a range of Knowledge Practices, using Knowledge Stock as input and operating within an Enabling Environment. Knowledge Management generates and maintains these three elements. We describe each component below.
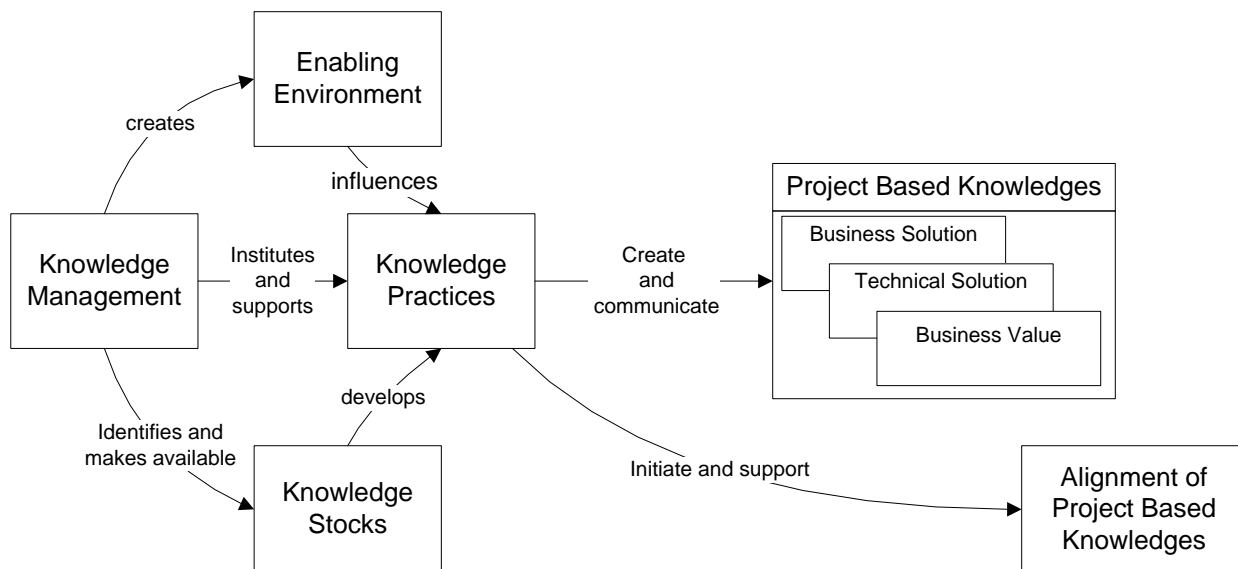
Figure 3: Sub-Model 2: Theoretical Model of the Influence of Knowledge Management

Knowledge Management

Past work has tended to incorporate all knowledge-related activities under the heading of Knowledge Management. In this paper, we draw out three distinct concepts: Knowledge Stock, Knowledge Practices and Enabling Environment. In this Sub-Model, therefore, we restrict the concept of Knowledge Management to the distinctive management practices involved in managing a project's Knowledge Practices, Knowledge Stock, and Enabling Environment. We define Knowledge Management as *the management activities required to source Knowledge Stock, create the Enabling Environment, and manage the Knowledge Practices* to result in an aligned set of project-based knowledges.

Creating the Enabling Environment includes identifying and establishing the knowledge channels (committees, networks etc) within and between the technical, business and organizational Knowledge Stock. It also involves creating the group memory process such as stage end meetings, and logs of decisions and lessons learned. It involves designing the technology infrastructure to support the channels. It also involves creating the right climate – for example, establishing incentives, shadow roles, learning plans and mentoring processes as well as role modelling appropriate behaviours.

Sourcing the Knowledge Stock (the knowledge acquisition process according to Jordan & Segelod 2006) includes generating knowledge requirements for each of the three Project-Based Knowledges, matching these against existing knowledge inventories, identifying the Knowledge Stock required, locating it using knowledge maps and knowledge networks, and obtaining it. Because research to date has not adopted a holistic knowledge management approach to projects, the notion of sourcing knowledge has not been fully defined.

Knowledge Management in this sub-model also comprises active management of the Knowledge Practices. This can be viewed as standard management with the difference that it is applied to knowledge. Basic elements include creating a knowledge plan for the project, identifying the processes needed to accomplish the knowledge plan, and monitoring achievement against the knowledge plan with modification of the plan as necessary

Knowledge Stock

The term Knowledge Stock represents the total cognitive capacity available to the project. This covers two facets: the store of knowledge that is possessed by members of the project, and the potential to increase that knowledge – a combination of existing knowledge and the capacity to learn. It can be defined as *"the sum of the actual knowledge of project team members together with their capacity to extend their knowledge and their access to other knowledge sources through their networks".*

The importance of the Knowledge Stock has been recognised by the literature on knowledge loss and failure to learn (Schindler & Eppler 2003, Gable et al. 1998, Eskerod & Blichfeldt 2005, Parker & Skitmore 2005).

The literature discusses several aspects of a Knowledge Stock. The team selection literature (Walz et al.1993) notes the embodied nature of important aspects of a Knowledge Stock. The knowledge of individuals involved in governance is also recognised (Henry et al. 2003). The store of knowledge in a project includes both the tacit experiential knowledge embodied in individuals and the explicit knowledge represented in documents, models, designs, and other repositories (Arthur et al. 2001). These are part of the project's Knowledge Stock if they are known about or understood by someone within the project. A book in the project library describing a new technology that no-one in the team knows about is not part of the project's knowledge stock. Knowledge Stock also includes knowledge inherent in project processes and design methods. For example, established gateway review processes may embody knowledge about how to ensure project quality is being maintained. Together, there may be a collective knowledge of the team that is more than the sum of the individual stocks (Adenfelt & Lagerström 2006).

Knowledge Stock also includes external expertise that is available to the project, such as that of vendors and consultants (Mitchell 2006, Owen et al 2004). It includes meta-knowledge such as knowledge inventories and knowledge maps within a project (Faraj & Sproull 2000). It includes latent knowledge, that is, knowledge that is implicit in the existing stocks ("capacity" in the terminology of Klimoski & Mohammed 1994).

The stock of knowledge includes three general classes of knowledge that mirror the three more specific project-based knowledges (see Reich 2007 for a discussion of types of knowledge). Thus, there is business knowledge necessary to develop Knowledge of Business Value, technical knowledge necessary to develop Knowledge of the Technical Solution, and organizational knowledge necessary to develop Knowledge of the Organizational Solution.

We also use the term Knowledge Stock to include the project's ability to increase its knowledge. This includes the project's learning capability. Including learning capability reflects some project managers' preference to hire team members more for their ability to learn than for their personal store of knowledge or expertise (Sauer & Reich forthcoming 2009). An important dimension of a project's ability to learn is its absorptive capacity. This captures the ability to absorb a diverse range of knowledges and make use of them (Cohen & Levinthal 1990, Szulanski 1996). The project's ability to increase its knowledge also includes the access that individuals have to sources of knowledge external to the project such as knowledge networks (Ancona and Caldwell 1992, Nagarajan & Mitchell 1998, Henderson 1994, Henderson & Cockburn 1994, Leonard-Barton, 1992). This represents the knowledge dimension of the project's social capital, or, more simply, it's not only what you know that counts, it's also who you know. Thus, there is scope for substitution of experts for networkers so long as there are good channels between the networkers and their alternative sources of knowledge (Szulanski 1996).

Enabling Environment

Numerous research studies have focused on the conditions that facilitate or hinder effective knowledge processing. These include the need for: appropriate resources including human and financial resources and IT infrastructure (Holm et al. 2006,

Carrillo et al. 2004, Lytras & Pouloudi 2003); standard processes and techniques including those for knowledge bases such as lessons learned databases, knowledge mapping including yellow page systems (Disterer 2002, Reich & Wee 2006), and HR processes including incentives for sharing knowledge, job rotation (Carrillo et al. 2004), and mentoring programs (Leseure and Brookes 2004); key knowledge roles such as project knowledge broker (Schindler and Eppler 2003); informal and semi-formal social groupings such as communities of practice and centers of excellence both inside and outside the project (Kodama 2005, Walker & Christenson 2005, Jewell and Walker 2005, Carrillo et al. 2004); and a culture of knowledge sharing and learning including the existence of an open and constructive atmosphere of intra-team trust, freedom, and safety (Disterer 2002, Janz & Prasnanphanich 2003).

Prior research has identified technological and social components of what we call the Enabling Environment. In particular, this refers to the technological and social aspects of a project that encourage or make it easier to create, process, and share knowledge. We therefore define the Enabling Environment as *those aspects of the infrastructure and climate of a project that facilitate Knowledge Practices*.

The technological component combines the physical resources such as IT infrastructure including the communications infrastructure, project websites, shared repositories and other similar elements of a technology-based knowledge management system (Earl 2001). This is particularly important for large and virtual or geographically dispersed projects (Espinosa et al. 2007).

The social component of the enabling infrastructure relates to the project organizational structures and processes and the project climate. The organizational structures and processes can be seen as defining the formal knowledge channels that support knowledge transfer and creation. Galbraith (1977) defines structures and processes for information (and knowledge) processing. These include arrangements such as committees, working groups, liaison groups, and conference calls that together help define who will be systematically involved in group-based Knowledge Practices and in what ways. In addition, there is a group memory process whose function is to ensure that learning that occurs during the project is not lost either as a function of time or turnover. It is both instrumental to ensuring continued clarity within the project team about project direction and to rapidly inducting new members into the project. It can also contribute to lessons learned processes both during and at the end of a project.

Climate is a social facet of the Enabling Environment. We use the term "climate" rather than "culture" to reflect the ephemeral nature of projects. *Climate* has been defined as the shared perceptions of employees concerning the practices, procedures, and kinds of behaviours that get rewarded and supported in a particular setting (Schneider, 1990: p384), or simply, the shared perceptions of "the ways things are around here" (Reichers & Schneider, 1990: p22). Therefore, climate involves employees' perceptions of what the organization is like, with a focus on the situation and its link to the perceptions, feelings and behaviour of employees (Ostroff et al. 2003). In our project context, a project manager can create a "climate for learning" or a "climate for collaboration" that may or may not be reflected in the permanent organizations that the team members belong to.

The Enabling Environment in Sub-Model 2 facilitates or inhibits the intensity and effectiveness with which Knowledge Practices employ the project's Knowledge Stock. Further, research suggests that its proposed impact on performance is well founded. In particular, the availability of channels that permit access to external sources of expertise is linked to higher performance (Ancona and Caldwell 1992, Nagarajan & Mitchell 1998, Henderson 1994, Henderson & Cockburn 1994, Leonard-Barton, 1992).

Knowledge Practices

Knowledge Practices are the activities that transform Knowledge Stock into an aligned set of Project-Based Knowledges. For example, a database design team translates its knowledge of a particular software product (a Knowledge Stock) into a specific design for a database (part of Knowledge of the Technical Solution). This part of the technical solution will become a knowledge input to be used by other colleagues, such as transaction designers.

We are unaware of any catalogue or taxonomy of Knowledge Practices for IT projects. Studies of the generation, integration and sharing of knowledge are numerous within the MIS research domain but do not build on each other. For example, Huang and Newell (2003) focus on team members' ability to manage social capital. Fernie et al. (2003) use the concept of social ties to explain levels of knowledge sharing and resultant innovation. Likewise Jackson and Klobas (2008) focus on knowledge sharing. Bresnen et al. (2003) are concerned with the capture and transfer of tacit information as a function of trust, social norms and shared values. Boh (2003) has created a model to predict whether personalization or codification is the best

strategy for knowledge sharing. Fong (2003) has developed a process model of knowledge creation, arguing that the first step must be role and disciplinary boundary spanning. Reich et al. (2008) refer to knowledge integration, coordination and transfer as influences on performance but they do not elaborate beyond reference to Faraj and Sproull's (2000) expertise coordination. This last is perhaps the best defined account of Knowledge Practices in the IT project context because it operationalizes expertise coordination for a survey. Even this, though, involves a conflation of Knowledge Practices – what the project team does – and Knowledge Management – what the project *management* team does.

The knowledge management literature offers high level models of Knowledge Practices using concepts such as socialization, internalization, combination and externalization (Nonaka & Takeuchi 1995). These concepts are applicable to projects in that at the start of a project socialization is necessary to enable knowledge sharing, externalization is necessary to make the knowledge manipulable by the team, and combination is necessary to create new knowledge from what is currently known.

We cannot talk about Knowledge Practices without talking about learning because they involve learning, both at the individual and organizational levels. This learning is particularly important for specialists to acquire knowledge of domains that are not their core expertise (Enberg et al. 2006, Eisenhardt & Tabrizi 1995). The management learning literature makes the distinction between exploitation of existing knowledge and exploration for new knowledge (March 1991). Exploitation involves the re-application of existing knowledge for a new purpose. Knowledge exploration by contrast is more creative and would involve activities such as innovate, invent, design, discover, experiment, prototype, and create (Tiwana and McLean 2005). Both exploitation and exploration involve different forms and levels of learning. As such they offer a relevant distinction among project Knowledge Practices but they do not offer a fine grained taxonomy.

For our current purposes, the definition of Knowledge Practices includes but is not restricted to certain basic practices recognised in the literature discussed above including the acquisition, creation, storage, diffusion and processing of knowledge with learning as a continuing reflexive process operating in parallel with specific Knowledge Practices. Beyond this basic set of practices, the model suggests one area in which we may discover distinctive Knowledge Practices – alignment practices. That is, if Alignment of Project-Based Knowledges is an important influence on Business Value, project teams should be expected to work to maintain Alignment among the three knowledges as they develop. In particular, to the extent that they are negotiated and socially constructed, we would expect explicit practices that develop coherence among them to be effective. However, more concrete descriptions of Knowledge Practices in the IT project context must await future research.

The Dependent Variables – Project-Based Knowledges and Alignment

Project-Based Knowledges and Alignment are the link between our two sub-models. In sub-model 1 they functioned as independent variables. In sub-model 2 they operate as dependent variables. Although alignment has been defined in other research both as a state and a process, in this work we envision it as requiring a dynamic process to achieve the state of alignment (described in sub-model 1) and describe this below.

It is quite possible for each of the three Project-Based Knowledges to develop independently and in the interests of efficiency it may be desirable that they do so. However, if little attention is paid to Alignment of the technical and organization solutions with the desired Business Value, that value is unlikely to be achieved. In order for mutual adaptation to occur, relevant aspects of each Project-Based Knowledge need to be explicitly represented, transferred across boundaries of knowledge categories, and integrated into another knowledge. Mutual adaptation not only addresses the orderly development of Project-Based Knowledge over time, it also permits responses to changes triggered by external dynamics (e.g. industry, technology, ideas) and internal dynamics (e.g. organizational structural change).

Prior research has shown that knowledge of project objectives (Pinto & Slevin 1987), and more generally goal clarity (Gibson & Earley 2007), is a critical influence on performance because it directs action in a coordinated way. Thus, a likely starting point of dynamic alignment is a Knowledge Practice which examines and clarifies the Business Value that the project might be expected to deliver. This generates some initial Knowledge of Business Value which becomes essential feedstock for Knowledge Practices which generate the initial Knowledge of Technical Solutions and Organizational Solutions. The expectation is that these knowledges will develop iteratively as the project progresses. As knowledge of the solutions becomes more detailed and more concrete, and as project-based learning occurs, each of the three knowledges will develop through Knowledge Practices that enable mutual adjustment. Further, these will themselves be supported by the Enabling Environment including conditions that support environment scanning, regular meetings, co-location, liaison roles, job swaps, and formal reviews among others.

SUMMARY AND ASSUMPTIONS OF THE THEORETICAL MODEL

The model we have proposed in this section depicts a systems view of how knowledge influences business value in IT projects. The underlying thesis is that knowledge has to be brought into a project and processed and that new knowledge may need to be developed. Business value is influenced through the quality of three Project-Based Knowledges developed during a project and the degree to which the three are aligned. Knowledge Management within a project directly influences the Knowledge Practices by which solutions are developed and the processes by which they are aligned with desired Business Value. It also influences them indirectly via the sourcing of Knowledge Stock and the creation and maintenance of the Enabling Environment. If a project manager can ensure that the Project-Based Knowledges are aligned, this will have a substantial influence on the actual achievement of Business Value notwithstanding any deficiencies in project implementation capability.

This model is mid-level inasmuch as it employs project and team level concepts without being able to fully translate them into atomic components of specific items of knowledge and specific knowledge practices. It therefore assumes that if we understand and execute Knowledge Management even without fully understanding the underlying structure and composition of knowledge, that nevertheless the achievement of Business Value will be positively influenced.

The model makes no assumption about the Project Manager's area of formal responsibility. However, it considers it desirable that the project manager is (1) brought in early enough to facilitate the development of Knowledge of Business Value; (2) willing and able to actively influence the creation of the Knowledge of the Organizational Solution even though she may not have formal jurisdiction over the Solution or implementation of the Solution; and (3) organizationally responsible for the Knowledge Practices designed to create the Knowledge of the Technical Solution.

The model does assume that projects start with a felt business need – a problem or opportunity that needs to be addressed – however difficult it may be to articulate. It does not purport to describe make-work projects for which there is no business value to be uncovered and therefore none to be achieved. It does assume that it will be most applicable and most predictive in projects where the uncertainties surrounding the project are great. In these circumstances, the impact of the management of knowledge and learning is likely to be at its highest.

DISCUSSION

In this section we discuss the limitations of our theoretical model, its contribution to practice, and directions for future research.

Limitations

The proposed model is focused on the influence that Knowledge Management exerts on the Business Value generated from IT Projects. It does not attempt to explain all factors which might impact Business Value. It also does not purport to model all the results of a knowledge approach – for example it does not include the individual and organizational learning that may result from Knowledge Practices. It also does not include any intermediate impacts on process effectiveness or emotional health of a project that may result from Knowledge Management. This model is focused on improving our ability to predict attainment of Business Value.

We argue that the influence of explicit Knowledge Management on Business Value is more likely to be apparent in strategic or transformational projects. This is not to say that it will not contribute to more tactical or operational-improvement focused projects, but in such cases the evidence of Business Value may be impossible to surface so it would not be possible to validate the model in this regard.

The mid-level nature of this model means that we have not identified cross-project outcomes, nor have we gone deeply into understanding the mechanisms of knowledge and learning. Similarly, we have a limited conceptualization of Knowledge Practices – we have neither a complete inventory of such practices nor have we offered a precise logical structure that differentiates terms such as knowledge transfer from knowledge diffusion, knowledge integration from knowledge application and others. Nor do we suggest which Knowledge Practices might be most salient. We are therefore only able to provide a conceptual overview of the Knowledge Practices that may require management, not a toolkit or a set of practices.

We have not articulated the connections with all the other relevant perspectives that may affect the achievement of Business Value. We note that the achievement of Business Value will be in part dependent on organizational implementation

capability, but have not clearly identified a connection between the knowledge perspective and the action perspective. Similarly, we have not linked the knowledge perspective to the economic perspective of a project. These limitations are consistent with our objective to examine one influence on Business Value, viz Knowledge Management, and not to attempt to model the full set of determinants of Business Value.

Application to Practice

Although this model is largely a product for researchers to evolve and test, we believe it has potential for developing more specific guidance for project managers. The term "knowledge management" often seems elusive to practitioners – it can signify everything that happens on a project or just a tiny fraction of it, such as a project website or the "lessons learned" session. In our model, knowledge management is a set of practices carried out by the project governance team – which may include roles such as the project sponsor and client manager as well as the project manager. Knowledge management includes three separate processes: creating an enabling environment, selecting and developing the knowledge stock, and managing the knowledge practices. With careful operationalization of the concepts, each of these processes can be subdivided into project tasks and managed accordingly. The aim of knowledge management is to generate three project-based knowledges that are of high quality individually and are aligned collectively.

If project managers, when faced with a project in which uncertainty or complexity are high, take the time to develop appropriate knowledge management practices, their projects will deliver higher levels of business value than if they acted as if task and schedule were the only appropriate areas of interest. This involves managing what often cannot be measured or seen, but will be reflected in the team members' shared understanding of their tasks and vision.

Directions for Future Research

As researchers, we see much promise in a knowledge-based view of the project. We believe that adopting Knowledge Management can improve the chances of success in innovative or complex projects and the empirical research supports this assumption. However, digging into this black box to uncover "how" and "when" to adopt Knowledge Management will require a concerted research effort.

The model is intended to provide a structure for testing the influence of Knowledge Management on the Business Value of IT projects. The fact that in the full model (Fig 1) Knowledge Management directly influences three elements of the model and indirectly the other two strongly suggests that it would be worthwhile to empirically test just the relationship between Knowledge Management and Business Value. However, testing either Sub-Model 1 or 2 should generate stronger findings and help to shed light on the relationships among the elements of the overall model. Either way, the development of formal propositions of the theory will be required. They have not been included in this paper because of complexities associated with the iterative nature of knowledge processes over the course of a project and the as yet incomplete description of constructs such as Knowledge Practices.

Testing will be challenging for empirical researchers for a number of reasons. Measuring many of the concepts will require innovation. For example, how exactly do we quantify the stock of a given knowledge? Is there an objective measure or will we need to rely on perceptions? It may be necessary to measure the application of Knowledge Management rather than try to quantify their outcome.

The challenges of quantitatively validating the model and the incompleteness of existing knowledge about some of our proposed constructs represent an opportunity for qualitative research. For example, because project managers have not explicitly identified their Knowledge Management practices, there is much scope for qualitative investigation. One useful direction would be to explore the actual practice of Knowledge Management within projects through case studies, participant observation or ethno-methodology. Another direction would be to employ action research to develop and test new knowledge-based project management practices because existing training courses and textbooks offer little guidance on this topic.

One further direction for research is to investigate the dynamic nature of the model. Here longitudinal research both qualitative and quantitative should be helpful. For example, is learning linear or punctuated? In particular, quantitative research should enable us to chart levels of growth in knowledge and thus velocity of learning. This would itself be a new concept for the model.

SUMMARY

Our intention with this research is to model how knowledge management can impact the attainment of business value in IT projects. Ultimately, we hope to operationalize each construct, test the model and better understand the causes of variance in project performance.

We have identified four elements of the knowledge-based perspective of IT Projects – Knowledge Management, Knowledge Stock, Enabling Environment, and Knowledge Practices. These elements interact to create three Project-Based Knowledges which influence the attainment of Business Value – Knowledge of Business Value, Knowledge of the Organizational Solution and Knowledge of the Technical Solution. The Alignment of these knowledges is critical to the achievement of Business Value. For innovative projects, these outputs (knowledges and their alignment) will need continual management, since they are both dynamic and emergent.

We hope that this preliminary work will lead to a productive researchers dialogue as we work together to uncover the secrets of IT project success and failure.

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The impact of culture on IT Project Management practices Research in Progress

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ABSTRACT

Rapid technological changes along with political, social and economical decisions have led the IT and Telecommunications industry to become a very dynamic and changing sector. Partnerships at the international level are everywhere and the stronger influence of IT represent high-risk potential. Statistics show that 70% of IT projects are out of time or budget or simply fail. With such perspectives, measures ought to be taken to avoid the further replication of this pattern. The risk of failure is perceived to be greater as projects rely on players with different cultural backgrounds increasing managerial complexity and supposedly requiring a unique set of skills. Efforts should be aimed to find out the management profile necessary to avoid pitfalls in the implementation of technology projects and provide practitioners with a culture-based project management practice. The research will allow the identification of project management patterns and preferences consistent with national culture.

Keywords

Cross-cultural management, project management, project success, information technology

INTRODUCTION

In the last two decades, more and more organizations have been and are engaging in projects related to IT at different stages of their infrastructure, the actual conditions are taking them to partner and interact with domestic and international organizations increasing technical and organizational complexity (Grover and Saeed, 2003; Turner, 2005). Unfortunately, past experiences showed, in general, that IT projects are high risk undertakings and the IT industry still struggles to improve their efficiency rate when it comes to successful projects (Hasan and Ali, 2007; Nelson, 2007). Under these circumstances, the convergence of telecommunications and information technology propose an unlimited but also threatening environment, as possibilities expand so do the chances of repeating the IT project failure phenomenon (Yetton, Martin, Sharma and Johnston, 2000).
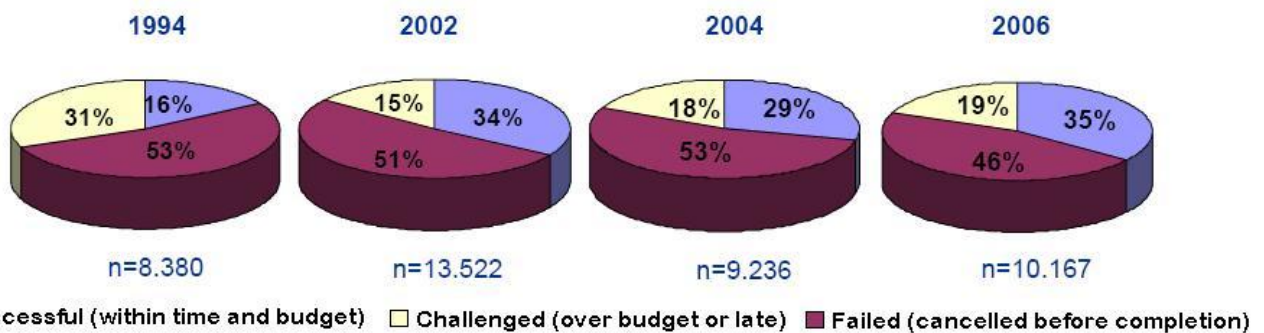
Source: Standish Group (www.standishgroup.com)

Figure 1. The Standish Group's Chaos Report on IT Project success

Practitioners in the field of project management have a great deal of techniques, tools, technologies and management practices to choose from. These resources are supposed to support the whole life cycle of a project, from idea generation, project initiation, planning, execution, control to closure and maintenance. The Project Management Institute has compiled the very best practices in management of projects in its publication the Project Management Book of Knowledge (PMBOK) and provides consistent world-accepted certification for practitioners. Control Objectives for Information and related

Technology (COBIT) 4.0 dedicates a whole control objective to the issue of project management. The Institute of Electrical and Electronic Engineers (IEEE) dedicates a set of standards to software engineering and provides a certification path for practitioners. Still the rate of failure in IT projects has not really improved over the last decade, and approximately 70% of the projects are out of time, budget or have been cancelled (see Figure 1) (Nelson, 2007; Tichy and Bascom, 2008).

RESEARCH QUESTIONS AND OBJECTIVES

The changes in the economic environment have fostered industries, including IT and Telecommunications, to go beyond national boundaries. This increased cross-cultural interaction emphasizes the importance of understanding culture's influence in business. Up to now, different authors and institutions have dealt with IT project management practices as if they were a one-fits-all recipe with very limited consideration of soft management aspects (Yetton et al., 2000; Gowan and Mathieu, 2005; Hasan and Ali, 2007; Iacovou et al., 2008), without taking into account basic cultural and contextual differences. There have been also some efforts on the side of public organizations to establish project management practices in specific countries, take, for example, the Projects in Controlled Environments 2 (PRINCE2) model endorsed by the British government, or its Swiss counterpart: HERMES, or even the German V-Model for software development.

The prevailing controversy on the ingredients and causes of project success, and on the definition of success itself, can be traced back to the universalistic approach applied, where it is often assumed that projects are the same irrespective of their contextual and cultural environment. The use of detailed cross-cultural data will enable us to account for the interaction between managerial and success variables and to address perspectives, often left unanalyzed by previous research.

This work intends primarily to develop an empirical instrument to identify ideal project management frameworks across national cultures in the telecommunications industry with the idea in mind that a comprehensive and integrated project management system can work as a facilitator for project success. We intend to answer the following research questions:

- If cultural conditions determine the development, use and modification of technology, could the same be also argued about project management practices?

- Do cross-cultural differences exist in project management frameworks?

- Is there a significant difference in the definition of project success among different cultures?
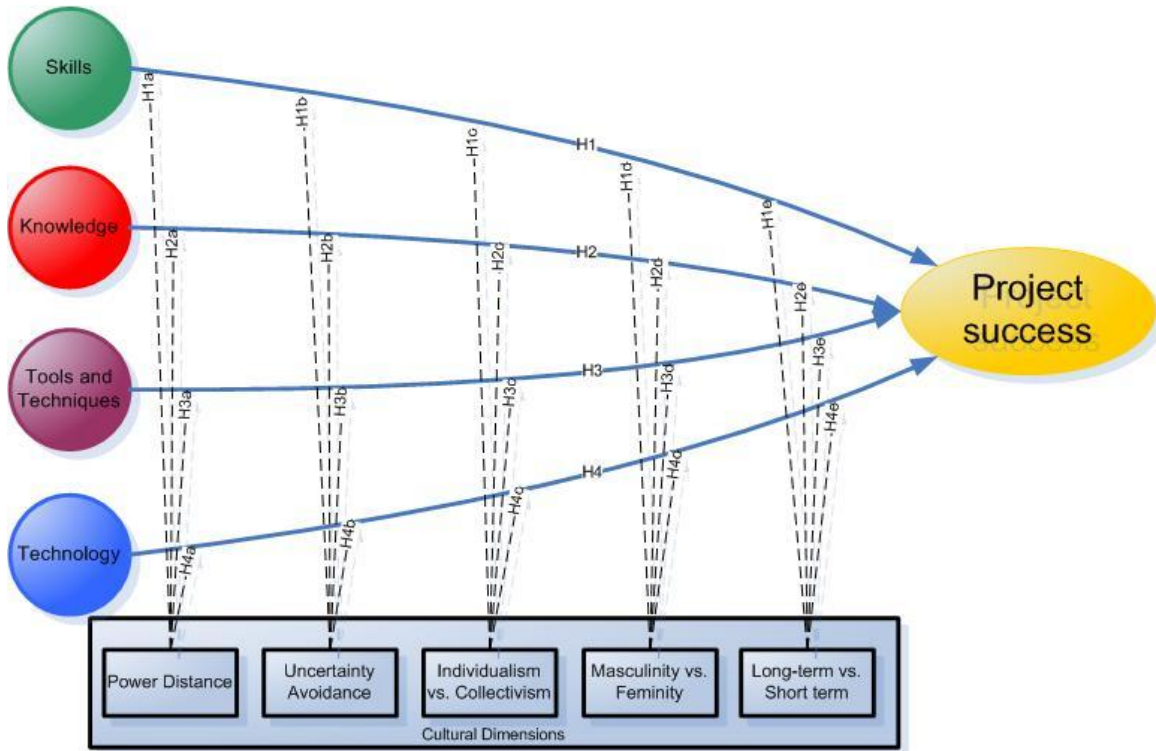
Figure 2. Research model

Our proposed model, shown in Figure 2, was partially derived from the theory of social construction of technology (SCOT) and the theory of reasoned action; it depicts the influence of the components of a project management framework on project success, where the cultural dimensions proposed by Hofstede and Hofstede (2005) act as moderating variables.

We argue that when project participants perceive a tool or a skill as being valuable for the success of their enterprise, they will probably act according to their beliefs and attitudes which are influenced by their national culture, leading them to use the artifact, thus affecting project outcomes.

One of the critical factors most mentioned in the literature are the skills that a project manager or participant should possess in order to produce positive outcomes; such skills refer to leadership, communication style, negotiation, problem solving, influence and motivation, among others. Thus, we pose the following hypothesis:

H1: The skills perceived as necessary in an IT project will have an influence in project success.

H1a-e: Culture moderates the skills that are positively perceived as necessary in an IT project.

The hard-core knowledge of project management refers to the familiarity with best practices, standards and guidelines. These can be easily accredited by certification bodies, for example, the PMI credential, the certification PRINCE2; HERMES; the International Standards Office 10006:2003, which provides guidelines for quality management in projects; just to name a few. Our hypotheses in this sense are:

H2: The knowledge perceived as necessary in an IT project will influence project success.

H2a-e: Culture moderates the knowledge that is positively perceived as necessary in an IT project.

Tools are the entities that provide an advantage in accomplishing a task or actually enable the completion of the task, and the techniques are the way the task is accomplished. Examples of this include project management tools like the Gantt chart, or the risk break down structure. Still the utilization of such artifacts depends in their acceptance among project participants.

H3: The tools and techniques perceived as beneficial in an IT project will influence project success.

H3a-e: Culture moderates the tools and techniques that are positively perceived as beneficial in an IT project.

By technology, it is meant the software, hardware and communication resources deployed during all phases of a project and whose aim is to facilitate its positive completion.

H4: The technology perceived as beneficial in an IT project will influence project success.

H4a-e: Culture moderates the technology that is positively perceived as beneficial in an IT project.

THEORETICAL FOUNDATIONS

Cobit 4.0 recognizes that one of the critical success factors in project management is the availability of experienced and skilled project managers and a robust life cycle methodology (IT Governance Institute, 2005).

The research literature has mainly focused on evaluating projects in terms of schedule, cost and sometimes functionality, and amazingly enough the findings lead us to attribute failures in any of these fields mainly to human interactions (Iacovou and Nakatsu, 2008). There are assumptions that the IT project participants might require a unique set of social and emotional skills in order to achieve success in a project. The question magnifies when it comes to managing culturally mixed teams. Hofstede and Hofstede (2005), and Trompenaars and Woolliams (2007) argue that culture is the underlying factor that leads humans facing similar situations to take different actions based on their values, beliefs and/or customs.

A Definition of Culture

The most accepted definition of culture was given by Tylor (1881) who described it as a complex whole which includes knowledge, values, belief, art, morals, law, custom and any other capabilities and habits acquired by man as a member of society.

Culture is also a multi-layered construct existing at different levels (see Figure 3): global, national, organizational, and group cultures encompassing also the individual (Craig and Douglas, 2006).

Figure 3. The construct of culture

Cultural Influence on Management

Demeester (1999) affirms that *"science and technology are context-blind components of real life problems, but they can only affirm themselves in a cultural context"*. The SCOT theory affirms that technology does not determine human action, but rather, that human action shapes technology (Pinch and Bijker, 1984). Furthermore, it argues that the reasons for acceptance or rejection of a technology rely on the social world.

In many IT-related studies, project success has been attributed to specific critical success factors (CSF). Nevertheless, CSFs differ from one manager to another depending on the context of his or her organization and according to geographical regions (Rai, Borah and Ramaprasad, 1996; Niazi, Wilson and Zowghi, 2006). Other studies have shown supportive evidence of the

impact of culture on managerial practices (Allen, Takeda and White, 2005; Kayes, Kayes and Yamazaki, 2005; Kanungo, 2006). These studies concluded that competencies must be consistent with the values of culture, emphasized flexibility to work in multicultural teams understanding cross-cultural values while contradicting the notion that a homogeneous world culture has developed and that a standard set of management practices can be universally used by multinational corporations. Despite globalization and trends towards convergence of management practices, there appear to be many differences still between behavioral patterns and adoption of practices.

The field of cross-cultural management proposes two currents of thought about engaging on "western ways" of doing business (Garg and Ma, 2005), one results on the adoption of Western values and suggests that the demands, opportunities, management and leadership styles of a technologically advancing society responds to industrialization rather than to indigenous cultural forces. On the other hand, the argument exists that culture is a force powerful enough to ensure that managerial values will remain different for businesses in different countries despite the impact of Western-style industrialization. Still, the phenomenon goes beyond Western vs. Eastern culture, differences can be found among countries in the European Union, across all Latin American countries, and even inside the Middle-East (Kanungo, 2006).

In the field of psychology, the theory of Reasoned Action (Fishbein and Ajzen, 1975) and its extension, the theory of Planned Behavior (Ajzen, 1985) have been widely used to study the relationship between beliefs, values, attitudes, norms, intentions and behavior. The meaning of these theories to our research is that project participants hold specific attitudes towards certain managerial styles, project management tools, technologies and acquisition of knowledge depending on their culture, constituted by values, norms, and beliefs, then they will act accordingly.

In this sense, a study conducted across different industries in the UK suggested that variations in attitudes and behaviors of project managers towards leadership, staff, policy and strategy, partnerships and resources, life cycle processes and key performance indicators could be used to measure levels of performance (Bryde, 2003). Usually the perceptions and attitudes towards management practices, styles and, tools are deeply rooted in beliefs, values and norms bound to the cultural environment in which the individual unfolds, therefore if managers believe that a certain skill or tool is useful or appropriate they will probably apply it to real life situations and will have an impact in project management performance.

Project Management Practice

Loo (2003) provides a multi-level causal model for best practices in project management (PM); he found four main components of a successful PM practice:

•   Project management skills

•   Organizational facilitators and inhibitors, e.g. available technology

•   Project management competencies

•   Project management outcomes

While Bryde (2003) adopts from the European Foundation of Quality Management Excellence Model a project management assessment model whose structure is based on "enabling" and "results" criteria. Remarkably, Loo's (2003) and Bryde's (2003) research allowed us to envision an arrangement of the aspects that constitute a project management practice providing the rationale for consolidating both models to form a project management framework comprising three main components (see Figure 2):

1. Project Back-End

2. Project Life Cycle Management

3. Project Outcomes

Project Back-End

The first component of our framework deals with features that are indirectly related to the project itself but provide the support for the life cycle management. They are referred to as skills, knowledge, tools and techniques, and technology.

In the IT industry, the growing dispersion of teams due to internationalization exacerbates the importance of soft management skills, as well as, the domain-relevant skills (Hoegl, Ernst and Proserpio, 2007). Nelson (2007) identified classic mistakes in project management and found that failure to deal with people was one the main causes for project failure, it follows that personal and emotional skills are a must in the profile of project participants.

Napier, Keil and Tan (2007) performed a qualitative analysis and found four project manager archetypes, the experiment was carried out among specialist from IT and Telecommunications sector. The four archetypes represent beliefs held by experienced project managers about the required combination of skills associated with ideal IT project managers. In this study, the importance of communication, general management, leadership, planning and control, and systems development was confirmed, as well as, client management, problem solving, personal integrity and team development. Napier et al. (2007) also found that process issues, such as planning or controlling, could be mitigated by a solid basis of knowledge; Nelson suggests that becoming well acquainted with the PMI's documents or following the work of the Software Engineering Institute could help achieving better results. The conclusion is that practitioners should possess and/or have access to proper project management knowledge and training. Aided by the availability and application of appropriate technology and tools they integrate a consistent project management environment in which the outcomes could be satisfactory.

Project Life Cycle Management

The best practices found in the literature (Yetton et al., 2000; Bryde, 2003; Loo, 2003; Napier et al., 2007) suggest, as depicted in Figure 4, paying attention to at least ten aspects of project management: scope, schedule, stakeholders, team, communication, procurement, resources, quality, risk and change. The empirical evidence shows that the utilization of a formal project methodology to manage a project's life cycle predicts whether the estimated completion time will be met or not, whereas project size and complexity do not have a direct influence (Gowan and Mathieu, 2005).
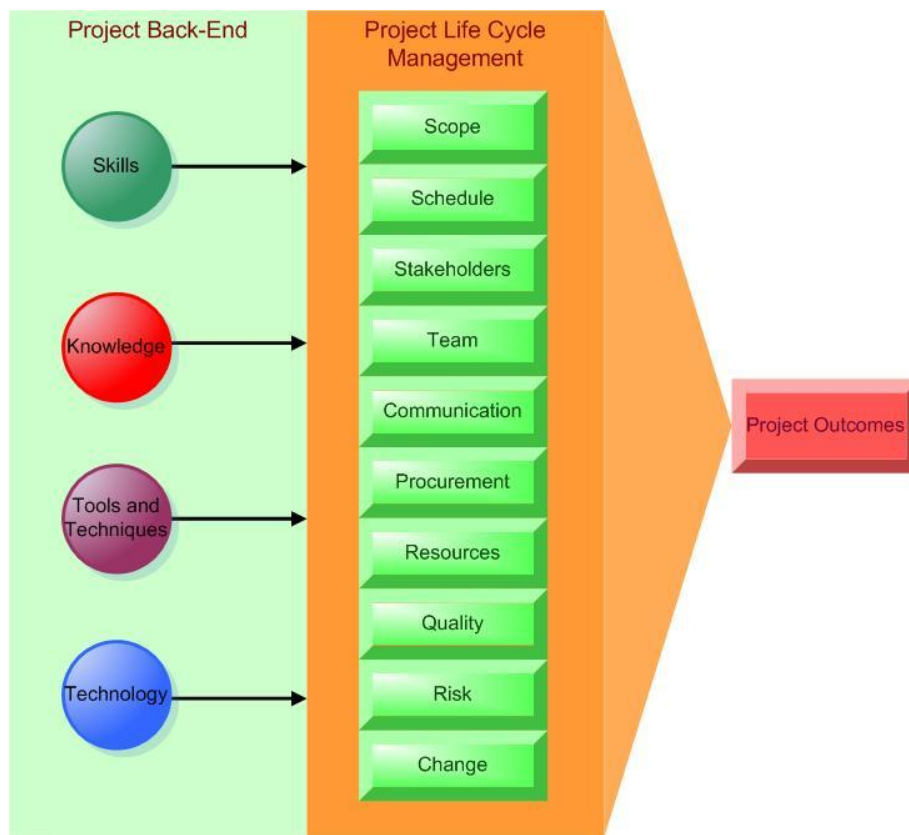
Figure 4. Project Management Framework

Project Outcomes

As stated before, the outcomes of a project have been often measured in terms of completion time and budget, sometimes functionality has played a role in the assessment. Still, even projects that were completed on time and within budget have often failed to bring the expected value. Procaccino, Verner and Lorenzet (2006) argue that the concept of successful IT project is vaguely defined and have suggested at least nine aspects of a successful project. Nevertheless, just as the necessary skills, tools and technology for a successful project might vary across cultures, so does the definition of success.

RESEARCH METHODOLOGY

One of the main difficulties of performing research in the high-tech sector is the reluctance of firms to disclose sensitive information. To overcome this obstacle, the researchers will constantly participate in activities sponsored by the Tele Management Forum (TM Forum; www.tmforum.org); the forum is the world-wide industry association providing strategic leadership, best practices and pragmatic standards in the telecommunications branch. The solutions provided are developed by bringing together the technical minds from vendors, service providers and systems integrators. The work of the TM Forum is well recognized by the International Telecommunications Union.

Under the guardianship of the TM Forum, a project will be initiated within the Catalyst Program focusing on the topic discussed previously. The Catalyst Program of the TM Forum provides stakeholders in the telecommunications industry with a collaborative platform to solve common, critical industry challenges through short term projects.

In order to achieve the proposed objectives, the project will be carried out in two phases combining qualitative and quantitative methods. The reason to apply a multi-method approach lays in the explorative nature of our work, by first establishing country models, and later on testing the validity of the models in a larger sample.

Stage One: Country Profiles

The first stage is aimed at identifying key constructs of each project back-end category by performing interviews with up to ten project managers in each participant country. They will be asked to relate their experiences in project management and describe the four aspects of the project back-end presented in Figure 4, then briefly explain project success.

Through the application of qualitative methods we will derive a set of skills, knowledge, tools and techniques, and technology relevant to each country as well as a definition of project success. After the first round of interviews, it is expected to have a profile of an ideal IT project management system for a minimum of 5 countries. Some of the methods to be used during this phase of analysis are the content analysis, laddering method, repertory-grid analysis and means-end chain. From the profiles described by practitioners, a country model will be derived, to explain the relationships between skills, knowledge, tools and technology and the success factors of a project in the specific country.

Stage Two: Data collection

At the second stage of the research, we will test the country profiles drawn from stage one in a larger sample of project managers and team members (min. 70 participants per country) by means of a questionnaire. The constructs found in stage one will be formulated to be applied in a multiple choice questionnaire, and derive some conclusion based on the hypothesis posed in the previous section. Additionally, provided the respondents' sample per country is large enough, advanced statistical analysis like structural equations and factor analysis will be used in order to identify relations between variables that were not considered during the hypothesis elaboration as we intend to analyze the extend of cultural influence on the profile of the project management framework and the necessary skills accordingly, as well as, its impacts in a project realization.

CURRENT STATUS OF THE PROJECT

As of March 2008, our institution, became an academic member of the TM Forum, followed by the membership of the researchers. Since then, a white paper has been produced and published and the necessary steps are being undertaken to make this research part of the Catalyst program. This will enable us to gain sponsorship and industry acceptance, as well as access to a global community of experts. The requirements were already fulfilled by our organization.

Simultaneously, we have conducted an extensive literature review and we are working on the preparation of the interview. As soon as, the TM Forum approves of the project, we will start collecting the qualitative data corresponding to the first stage of the research.

CONCLUSIONS AND FUTURE WORK

A central argument of this paper is the understanding of project management practices, outcomes and national culture as a moderating factor. The study intends to analyze the attitudes of practitioners in the field towards specific models of PM and the effects of it on project success. Specially, we are interested in depicting different profiles for the participant countries and offer a guide for those conducting and leading projects in those countries. A recommendation for further research is to analyze project management practices in as many countries and industries as possible to discover tendencies and possible form clusters with the countries and industries showing similar patterns.

WHAT AUTHORS PROPOSE TO PRESENT AT THE CONFERENCE

The authors intend to present the project management framework and research model generated from the literature review and possibly the results of the first round of interviews.

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Coordinating Multiple Interdependent Projects in Innovative Product Development Programs

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ABSTRACT

A software product program is usually knowledge intensive, having highly interdependent projects and a high level of product development uncertainty. Different types of knowledge and expertise are viewed as critical resources that the software development program must acquire and manage. Based upon contingency theory, this study examines the effects of inter-project coordination between multiple project teams within a software product development program. A new model is proposed to examine each type of uncertainty and the moderating effects of inter-project coordination including administrative and expertise coordination. Four hypotheses are developed for empirical testing. Data is under collection from project managers working in IT product development programs. The results will provide an in-depth understanding on how inter-project coordination can effectively reduce the negative impact from requirement and technological uncertainty. The expected results are discussed and future research pointed out.

Keywords

Program management, project management, uncertainty, administrative coordination, expertise coordination

INTRODUCTION

Large scale software development is usually completed in the forms of a collection of projects. This approach of grouping multiple projects together that share common goals is called program management (Pellegrinelli, 1997). A program is a framework for grouping existing projects or defining new projects and for focusing all the activities required to achieve a set of major benefits. This development process is challenging because of different project schedules, a high level of project interdependence and substantial communication difficulties across project boundaries (Brusoni et al., 2001, Gerwin and Moffat, 1997, Hoegl et al., 2004, Kazanjian et al., 2000). The innovativeness and complexity in nature of software product development demands a large amount of coordination and information exchange among project teams. Related projects in a program are managed in a coordinated way to achieve a common goal, or to extract benefits which would not be realized if they were managed independently (Pellegrinelli, 1997) . Although there are many types of programs, this study focuses on the product development programs that develop complex software systems or the products that are integrated by software. More specifically, this studyexamines the management issues of a software product development program.

A software product development program is usually managed by a program management team which consists of project managers and program managers (product managers). A software product development program creates benefits through better organization of projects and their activities. A software product development program is responsive to business' needs in an uncertain competitive environment. Changing market needs and competitive pressures push the organization to take action. A supportive development environment is created by the program for the projects both in exploratory nature and with identified objectives. A software product development program also takes a wider view to ensure that the projects' activities will achieve overall business benefits instead of satisfying several project clients or sponsors in the organization. Without program management, projects are competing for resources in the organization with other projects and functional units directly. Decisions are made based upon the narrow views of involved project supporters.

Researchers have viewed business and technology changes as critical software development risks (Boehm, 1991, Schmidt et al., 2001). The extent of the inter-project coordination should be contingent upon the needs of information exchange because of business and technology changes. Although a few studies have examined the coordination issues in multiple projects (Hoegl and Weinkauf, 2005, Hoegl et al., 2004), the interaction between the extent of inter-project coordination and uncertainty is still unknown.

In addition, past studies of large scale projects (Hoegl and Weinkauf, 2005, Hoegl et al., 2004) only examined the management of tangible and economic resource dependencies, which is defined as administrative coordination (Faraj and Sproull, 2000). Knowledge is a type of intangible but critical resource which is crucial for non-routine, intellectual team work. In addition to the inter-project administrative coordination, the product development program performance is dependent on having the "right" expertise, creating knowledge through inter-project expertise coordination, and solving the emergent problems (Faraj and Sproull, 2000).

This study focuses on the management tactics that can manage uncertainty through two types of inter-project coordination: administrative coordination and expertise coordination. The research question that this paper addresses is *"How can a software development program manage the software product development uncertainties through inter-project coordination?"*

This study contributes to the literature in two ways. First, it will provide an in-depth understanding of the moderating effect of inter-project coordination on uncertainty. Requirements uncertainty and technological uncertainty are considered. The coordination effectiveness on different levels of uncertainty is pinpointed. Second, this study examines expertise coordination between multiple project teams. The unbalanced distribution of experts and knowledge in different project teams create the need for bringing the expertise in when the tasks cannot be solved by the present knowledge in the team. Expertise coordination has more meaning and importance in this innovative product development process.

A literature review of uncertainty and coordination will be briefly presented and a theoretical framework proposed based upon Information Processing Theory (Galbraith, 1973). Following the theoretical framework, the hypotheses are developed in the Hypotheses Development section. Planned research methodology follows and future research is addressed at the end.

LITERATURE REVIEW

Software development uncertainty comes from the changes in the business and technological environment (Lee and Xia, 2005). The Information Systems Development Project's business context frequently changes during the development process. These business changes subsequently result in changes in user requirements of the software system under development. Business changes are usually signaled in the competitive market first. When business changes are recognized, they are translated into requirements by the program management team. Requirements uncertainty in software development processes has been widely studied because of the difficulty of eliciting requirements from users (Cossick et al., 1992, Nidumolu, 1995). Requirements uncertainty has three dimensions: requirement instability, requirement diversity and requirement unanalyzability (see Table 1 for the definition of each dimension) (Nidumolu, 1996). A high level of requirements uncertainty will need more coordination efforts and lead to less process control and product flexibility (Nidumolu, 1996).

Uncertainties	Dimensions	Definitions
Requirements uncertainty	Requirement Instability	the extent of change in user requirements from the early phase to the later stage of software product development.
	Requirement Diversity	the extent to which users differed amongst themselves in their requirements of a complex software product.
	Requirement Unanalyzability	the extent to which a conversion process can be reduced to mechanical steps or objective procedures.
Technology Uncertainty	Technological Unpredictability	the extent to which unexpected and novel events for the technology occur during the software development process.
	Technological Unanalyzability	the extent to which the task of converting requirements specifications to software could be undertaken using well-established procedures.
Adopted from (Nidumolu, 1996)		

Table 6: Definitions of uncertainty

Technological uncertainty is another source of threats to product development (Nidumolu, 1996). Technology is theoretical and practical knowledge, skills, and artifacts that can be used to develop products and services as well as their production and

delivery systems (Burgelman et al., 1996). Typically, a development team deals with two types of information technologies: software development tools and infrastructure technologies (Cooprider and Henderson, 1990). Technology continually is creates new imperatives for the conduct and structuring of product development activities because new knowledge is being applied at a faster rate, greater numbers of new products are being introduced over time, the time between innovations is decreasing, and technological fusion is occurring across and within industries (Song and Montoya-Weiss, 2001). Perceived technological uncertainty has negative impacts on the costs of new product development and will result in distinct managerial action (Ragatz et al., 2002, Song and Montoya-Weiss, 2001).

A software product program can be more effective in responding to requirement and technological uncertainty if the program team can manage the inter-project coordination well. The software product that a program develops is usually more complex than the product that a single project can handle. Administrative coordination is usually determined by the extent of the existing knowledge and expectations on the development process. However, cross-project administrative coordination cannot be sufficient because of the emerging requirements and technological uncertainties. The innovative nature of software development requires not only the presence of experts in the program but also the patterned interactions and solution-seeking processes for the new problems and task exceptions.

This expertise coordination process has three dimensions: knowing where expertise is located, recognizing where it is needed, and bringing it to bear (Faraj and Sproull, 2000). They are not rigid steps that must occur in a preset temporal progression. They represent general patterns of activity that a team needs to manage to be effective. Expertise is context specific and emerges from patterned interactions and practices (Faraj and Sproull, 2000). Therefore it is critical for the project teams in a program to know where expertise is and when expertise is needed. The program management team should be able to understand the project teams' need and bring the expertise to solve the problems quickly and responsively. The expertise coordination process will contribute to the problem solving for the project teams effectively and efficiently.

In a program, the experts in other projects team are treated as internal knowledge resources. Knowing expertise location requires knowing about a variety of potentially useful expertise sources. These sources can include specialized documents, corporate Q&A files, and most important for knowledge work, knowing who has what knowledge/skill. Only in the simplest situation does knowing expertise location refer to knowing where an answer to a problem is located. In nontrivial cases, it refers to knowing the most effective expertise to call on to develop a solution. Recognizing the need for expertise is critical for coordination. The delay of recognition of the need will leave the problems unsolved and cause schedule delay and even lengthen the time to market.

When the need for expertise is identified, the most important thing will be to bring the expertise to bear. In a single team setting, interpersonal interaction is easier to achieve and rich information can be exchanged with the experts to work on the tasks that have special needs. But in a multiple-project environment, bringing an expert to the most urgent tasks in other projects involves more than task coordination. Many times it has to be done by administrative procedures. Program managers and related project managers in the program team have to be involved in identifying the importance of need. Sometimes the experts are official assigned to solve the problems in a project team. Sometimes the experts just give some tips to the team members to have a trial and error start via an informal talk. When the information is equivocal, the interpretation will be difficult even with experts' helps. The program management team plays a critical role in understanding the essence of the problems and bringing the appropriate experts to the project teams.

Although the direct effects of uncertainty and coordination on program performance are clearly understood, how and when the inter-project coordination mechanisms reduce the negative impact of uncertainty is not answered yet. Based upon Information Processing Theory (IPT) (Galbraith, 1973), a contingency approach is adopted in this study to examine the coordination effects between multiple project teams on the individual project performances in a software product development program (see Figure 1).
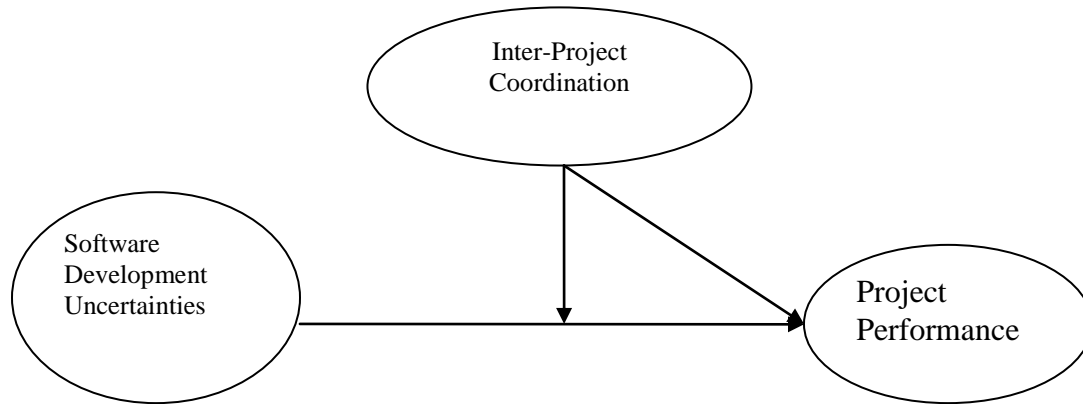
Figure 1. Theoretical Framework of Inter-project Coordination

Facing critical business and technology changes, this study argues that these changes can be handled by using coordination efforts at a multi-project level, particularly the inter-team administrative coordination and expertise coordination. The key point for this framework is that different types of uncertainty demand various focuses on the efforts and contents of the coordination. The interactions between uncertainty and different types of coordination will have a complicated impact on individual project performances in the program.

HYPOTHESES DEVELOPMENT

Requirements uncertainty reflects the changes in the business environment and the interests of different stakeholders. Requirements can be changed in terms of scope and/or the extent of diversified user interests. When the requirements uncertainty is high, the formal and informal meetings among multiple project managers and product managers are conducted extensively. Rich information will be exchanged and common understanding of the priority of the requests will be developed. With support from the program management team, problems and issues associated with the requirement changes within a single project will be solved in a timely manner and lead to the success of individual project performance.

When requirements uncertainty is low, product features will be developed based upon the original design. Individual project teams can stick to the original plan and develop the products on time and under budget. When requirements uncertainty is high, multiple project teams coordinate collectively in incorporating the requirement changes in the ongoing product development; the product will be responsive to a large range of requirement changes. The individual team's performance might be affected and evaluated accordingly. From this, the following hypothesis is developed.

H1: The magnitude of the relationship between requirements uncertainty and project performance changes as the level of administrative coordination changes.

When requirements uncertainty is high, the estimation of the impact of the possible change is critical for the product development program. Sometimes user requirement is not only instable but also ambiguous. Interpretations are needed and common understandings have to be developed. At this time, expertise can be developed because of distributed, heedful, and emergent processes in the program.

When requirements uncertainty is high and expertise coordination is conducted extensively, close interaction among project teams and project managers, shared common background on the product, and past experience can facilitate the interpretation process. Consequently a common understanding can be built for the product design. The product development program can find the solutions to respond to the changes through the inter-project expertise coordination. The solutions will be responsive to changes in the business and lead to a high level of product responsiveness. An individual project team can get a clear task assignment and is more likely to deliver a successful component. Based upon the previous arguments, the following hypothesis is proposed:

H2: The magnitude of the relationship between requirements uncertainty and project performance changes as the level of inter-project expertise coordination changes.

Technologies are understood as the bodies of knowledge, or understanding and practice, that underpin product design and manufacturing (Brusoni et al., 2001). When technology uncertainty is low, the current program structure and the interfaces between multiple project teams are sufficient to handle communication needs. When technology uncertainty is high, the current structure of a product development program and the assignment of tasks become inadequate. The current skill sets in the individual project teams are built based upon the past technology needs. When the nature of the tasks is changing, the software product program needs to restructure the procedures and practices of software product development. Formal meetings and informal communications can handle the large amount of information exchange. Therefore when technological uncertainty is high and administrative coordination is performed extensively, the software development program can develop a solution for the technological changes responsively and restructure the project assignments which can lead to individual project success. The above discussion can develop the following hypothesis:

H3: The magnitude of the relationship between technology uncertainty and project performance changes as the level of administrative coordination changes.

Brusoni et al. (2001) argue that technological changes are more than the component change and involve changes in product architecture. Knowledge integration and application will be critical for the product development success. When technology uncertainty is high and when the expertise coordination is high, the distributed expertise in the multiple project teams is pulled together. The interactions between experts and teams are enabled to develop the solutions for the new problems that arise in the product development process because of technological change. The solutions will clarify the technological requirements for each individual project. Individual project performance can be achieved with clear technological requirements and goals. The integration of different product components will also be responsive to the technological changes. Therefore it is proposed that

H4: The magnitude of the relationship between technology uncertainty and project performance changes as the level of inter-project coordination changes.

RESEARCH METHODOLOGY

A survey is used to collect data and test the hypotheses. A pilot study was administered in summer 2006. The survey questions were adjusted based upon the pilot study results. The formal data collection is on-going. The data collection unit is a "program". On average each program includes 3-5 individual IT projects. For each program, a project manager is identified and invited to fill in the questions about the inter-project coordination within the program. The sample size is expected to be more than 100. At this point, the number of returned questionnaires is about 70.

The researchers successfully obtained the support from a prestigious university. They are allowed to contact alumni from the Engineering School of this University. Because this university is well known for its strong Software Engineering program, it has a large number of alumni and work in diversified industries. If the alumni agree to participate in the surveys, they will be asked to provide further contacts for the researchers.

Constructs

All the constructs are adopted from the existing literature. However the questions are re-worded according to the software development program context. A group of experts examined the survey questions and did card sorting to assure the validity issues. All the items are measured on a five-point Likert scale, ranging from "to a large extent" (5) to "not at all" (1). The constructs are:

- *Inter-project Administrative Coordination*: The measure for inter-project administrative coordination has six items from Kraut and Streeter (1995). A sample item is "the extent of using formal policies and procedures for coordinating the projects in the program".
- *Inter-project Expertise Coordination*: The measure for inter-project expertise coordination is adapted from Faraj and Sproull (2000) with four items for knowing expertise location, three items for recognizing where expertise is needed and four items for bringing expertise to bear.
- *Requirements uncertainty*: The measure for requirements uncertainty is adapted from Nidomolu (1995). It has three dimensions. Requirement instability is described by the extent of change in user requirements over the course of

product development and had three items. Requirement diversity is described by the extent to which users differed amongst themselves in their requirements and has three items. Requirement analyzability refers to the extent to which a conversion process can be reduced to mechanical steps or objective procedures and has four items.

- *Technology uncertainty*: The measure for technology uncertainty is adapted from Nidomolu (1995). It has two dimensions. Technological unpredictability describes the extent to which unexpected and novel technology occur during the software development product process and has four items. Technological analyzability describes the extent to which the task of converting requirement specifications to software could be undertaken using well-established procedures. Technological analyzability has eight items.

- *Project performance*: Project performance must represent many aspects of the development process and has been recognized as an important construct by the past literature. The measure of project performance includes seven items (ability to meet project goals, expected amount of work completed, quality of work completed, adherence to schedule, adherence to budget, efficient task operations and high work morale) and requires the respondents to answer based on the most recently completed projects in the program (1 – Never, 5 – Always) (Nidumolu, 1995).

Hypotheses will be tested and verified by using partial least squares (PLS) analysis. This is a latent structural equation modeling technique that uses a component-based approach to estimation; it contains two steps. The first examines the measurement model and the second assesses the structural model. When using PLS, researchers must pay attention to three concerns: (1) the reliability and validity of measures; (2) the appropriate nature of the relationship between measures and constructs; and (3) path coefficient, model adequacy, and the final model from the available set of alternatives. PLS-Graph Version 3.01 will be used to test the hypotheses. The initial data analysis result will be reported at the workshop presentation.

This research will have several limitations. This study only examines a set of moderators. Many moderators that can affect the relationship between uncertainty and project performance will not be examined. The researchers adopt the positivist methodology. The sample size will limit the interpretation of the statistical analysis. The last limitation will be common method bias. Future research can test the validity of the conclusions by using multiple sources of data or a combination of quantitative and qualitative methods.

CONCLUSION

What differentiates this study from previous efforts is that this study focuses on the inter-project coordination issues in a software product development program. Although planning and project structuring are critical for the product development, exceptions and unexpected events have to be handled effectively and efficiently for the final product delivery. It is expected that the results of this research study will highlight the importance of inter-project administrative and expertise coordination in the innovative product development process. Project managers are well trained to execute a project and focus on the projects at hand. However, the increasing interdependence and complexity in software product development demand the project managers to pay attention to the context and be sensitive to the future changes and impacts on their own projects. The right extent of inter-project coordination will help the project managers to identify the impacts of changes on their own project performances and the integration of project deliveries for the final product. The ongoing exchange of information and communication will give more room for the emergent planning and problem-solving across the project boundaries.

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A Study of the Use and Effectiveness of Controls in Agile Information Systems Development Projects

Research-in-Progress (RIP) Paper

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ABSTRACT

This study uses control theory as a lens to examine the use of control in agile information systems development (ISD) projects, specifically within software project teams that use agile methodologies. Traditionally, requirements for ISD projects have been defined at the outset and it has been the role of the project manager to control the project and help the team to achieve their goals. However, the goals of agile ISD projects are flexible and can change frequently, with the consequence that it can be difficult for a project manager to determine the most appropriate and effective type of control to use at each stage of a project. The aim of this research is to: develop a research instrument that will identify the control modes used by project teams in agile ISD projects; conduct a survey to collect data; and develop a framework for assessing the effectiveness of each control mode.

Keywords

IS project management, IS project control, IS project teams, IS control issues, agile methodology, agile systems development

INTRODUCTION

Information systems development (ISD) is a complex activity of designing, building, testing, implementing and maintaining a software system (Kirsch and Cummings, 1996, Nidumolu and Subramani, 2003). In the early days of information systems development, applications were typically constructed in an ad-hoc fashion. As systems began to grow in complexity, difficulties in controlling ISD projects came to the fore, ultimately leading to calls to establish a discipline of "software engineering" (Naur and Randell, 1969). At that time, software developers looked to the established branches of engineering, such as manufacturing and construction, for guidance on systematic methods and processes. There ensued through the 1970's and 1980's what Avison & Fitzgerald (2003, p537) refer to as the "methodology era", during which time numerous formalised ISD methods were proposed. However, from the early 1980's onwards, there grew an increasing level of discontent surrounding the suitability of methods founded on assumptions which did not seem to hold in the domain of ISD (Boehm, 1988, McCracken and Jackson, 1982). The backlash against "heavyweight" formalised methods gained further momentum with the emerging realization that not alone were those methods largely ineffective, but they could actually be counter-productive because there was a tendency for ISD project managers to become absorbed in self-serving "rituals" to the extent that the pursuit of the method became a goal of its own right, displacing the primary objective of developing a good system with covert defensive motives (Fitzgerald, 1996, Robey and Markus, 1984). It became clear that there was an incongruence between, on the one hand, the rigid, cumbersome procedures prescribed by formalised methods and on the other, the flexible and dynamic nature both of the systems development process itself and the wider business environment. Thus emerged a new paradigm of ISD project management and control, now known as "agile" methods (eXtreme

Programming, Scrum, DSDM etc.), which has grown out of earlier movements such as incremental, iterative and rapid development.

Business environments and information technology are changing at an extremely fast pace with organisations continuously revising projects (Elonen and Artto, 2003, Lee and Xia, 2005). It is suggested that businesses should be flexible in order to operate in such a dynamic and changing environment as the market expects high-quality software to be delivered in a short period of time (Highsmith and Cockburn, 2001, Nieminen and Lehtonen, 2008). As a result, it is important to the performance of the organisation how their systems development teams are controlled (Nidumolu and Subramani, 2003). Highsmith and Cockburn (2001) believe that agile systems development can address this need for dynamic, innovative approaches within organisations as agility is about "creating and responding to change". Boehm (2002) concurs with this and is of the opinion that the traditional plan-driven approach to systems development does not work well when requirements change frequently. Developing and controlling systems development in this changing environment provides a major challenge for systems development managers as they must implement appropriate controls on their projects to cope with the these demands (Harris, Hevner and Collins, 2006, Simons, 1995). Previous studies such as Kirsch (1997) highlighted the lack of research about the modes of control used to manage ISD projects and even less focuses specifically on control modes used in agile ISD projects.

MOTIVATION FOR THE RESEARCH

Control in organisations has been a topic of interest to researchers for many years as it is generally recognised that control mechanisms are of critical importance in helping organisations to achieve their goals (Kirsch, 1996). Control can be viewed broadly as an attempt by an individual or a group of individuals to influence people to take actions and make decisions, which are consistent with the goals and objectives of the organisation (Das and Teng, 1998, Eisenhardt, 1985, Jaworski, 1988, Ouchi, 1979). The process of control can be defined as the process of monitoring behaviour, evaluating the outcomes that result from that behaviour, and providing feedback (Ouchi, 1977, Ouchi and Maguire, 1975). Researchers examining control in the context of ISD have studied the relationship between controller(s), who exercise the control, and the controllees, who deliver on the agreed tasks to meet the desired objectives (Henderson and Lee, 1992, Kirsch and Cummings, 1996, Kirsch, Sambamurthy, Ko and Purvis, 2002). This study adopts this view of control where the project manager acts as the controller and the project team as the controllees.

Prior research on control has focused on organisational control (Flamholtz, Das and Tsui, 1985, Ouchi, 1979, Ouchi and Maguire, 1975), management control (Otley, 1994), retail sales (Eisenhardt, 1985), marketing (Jaworski and MacInnis, 1989, Merchant, 1988), HR (Snell, 1992) and more recently ISD (Kirsch, 1996, Kirsch, 1997). Control research in an ISD context has examined, for example, control of internal systems development projects (Kirsch, 1996, Kirsch, 1997, Kirsch et al., 2002); the performance of project teams (Henderson and Lee, 1992); the factors influencing the choice of control modes on ISD projects (Kirsch, 1996, Kirsch, 1997); controlling a project from the client perspective (Kirsch et al., 2002) and controlling outsourced projects (Choudhury and Sabherwal 2003). However, existing research on ISD control has tended to be limited to projects that use a traditional, more plan-driven approach. In recent years there has been an increase in the number of organisations that have adopted agile practices or that use agile methodologies (Hovorka and Larsen, 2006, Nerur, Mahapatra and Mangalara, 2005) and only a few studies have examined control in the context of agile systems development projects (Harris et al., 2006). Such studies are clearly warranted as agile practices may fundamentally affect the way in which ISD projects are controlled. For example, on agile systems development projects

- the project manager's role as is greatly reduced, and is more akin to that of a facilitator or coordinator (Alleman, 2002, Boehm and Turner, 2005, Lindstrom and Jeffries, 2004, Nerur et al., 2005). Traditionally, the project manager would have been the primary project controller.

- the development team is empowered and is forced to self-organise, creating a "pluralist environment" (Coram and Bohner, 2005, Nerur et al., 2005) due to the diverse backgrounds, attitudes, goals, and cognitive dispositions of the team members (Highsmith, 2004, Chin, 2004, Cockburn and Highsmith, 2001), all of which may have implications on the choice and implementation of controls.

- the organisation or team structure is "organic and flexible", as opposed to traditional structures which are "mechanistic, bureaucratic and formalized" (Nerur et al., 2005).

- the project is completed through a series of iterations, each often as short as a few working days (Fowler and Highsmith, 2001, Fitzgerald, Hartnett and Conboy, 2006). This means that control may need to be more short-term,

may not be as rigid or binding, and may have to be implemented quickly 'on the fly', and is often based on incomplete or imperfect information.

- software is valued over documentation (Fowler and Highsmith, 2001). Agile methods attempt to minimise documentation, and although this may bring several advantages, such records would traditionally have served as a useful means of control.

- the customer plays a more continuous and embedded role, and thus is intrinsically involved in most decisions (Boehm and Turner, 2005, Coram and Bohner, 2005, Farell, Narang, Kapitan and Webber 2002, Griffin, 2001). This is in contrast to more traditional approaches where customers do not get involved in day-to-day operational development; rather their involvement is limited to intermittent events such as prototyping sessions and release meetings.

- developers are not confined to a specific specialised role as is usually the case with traditional approaches. Instead, the team are encouraged to self-organise, interchanging and blending roles on a continual basis (Nerur et al., 2005). Control over such non-static roles and responsibilities may be significantly more challenging.

Controls in ISD have been shown to evolve during the course of a software projects. However, minimal research has focused on how this evolution occurs in agile ISD. The most notable contributors to this are a study by Choudhury and Sabherwal (2003) which examines how controls change over time in outsourced ISD projects; a study by Kirsch (2004) which addresses the evolution of controls in large IS projects; and a study by Rustagi, King and Kirsch (2008) which looks at the extent to which a client uses formal control to exercise control over a vendor in outsourced ISD projects.

In addition, it is important not just to measure the extent to which control is applied to a project, but also to measure the effectiveness of these controls. Although control is often positively associated with performance (Henderson and Lee, 1992), this is not always the case. Excessive use or unnecessary tightness of controls may, in some instances, have a negative impact on performance (Merchant and Otley, 2007, Hartmann, 2000). A project manager must therefore identify an effective level of control, suitable to their project and its environment. As far as we are aware, no rigorous research has examined the effectiveness of controls in ISD, or within the context of agile systems development projects. This suggests that there is a need to examine control from this perspective.

RESEARCH OBJECTIVE AND QUESTIONS

The importance of control on ISD projects has been widely recognised and studied. Research on flexible or agile systems development is limited, but it is growing. As yet, little is known about how agile ISD projects are controlled. While previous studies have detailed control measures in traditional ISD projects there is a lack of valid, reliable measures for assessing the control modes used in agile systems development. This research-in-progress paper focuses on the control modes used in agile systems development projects with the aim of understanding how project managers control such projects. There are three objectives to this research:

Q1. What control modes are used in agile information systems development projects?

Q2. How and why do the control modes (both formal and informal) evolve during an agile information systems development project?

Q3. How effective are these control modes from the perspective of the project manager and the project team?

This research hopes to contribute to previous work on control in ISD projects by investigating the use of control modes in agile systems development projects and by developing/adapting and validating control measures for agile systems development projects. We also hope to provide a practical contribution by developing a framework that project managers and project teams can use to measure and assess the effectiveness of specific control modes at various stages throughout an agile project. It is envisaged that this framework may include facilitators/inhibitors of each control mode from the perspective of the project manager and the project team.

THEORETICAL FOUNDATIONS

Control theory is based in cybernetics, the science of control and communications. It has been applied to many areas such as motivation (Klein, 1989), self-management (Manz, 1986) and organisations (March and Simon, 1958, Tannenbaum, 1968).

The use of control theory in the context of organisations is of particular interest in the social sciences as an organisation is a social unit that is established with the explicit purpose of achieving specific goals (Blau and Scott, 1963, p1). Within an organisation it is the function of control to ensure that processes are followed and order is maintained in order to achieve these goals (Tannenbaum, 1962). In the past organisations have adopted one of two approaches to control: performance evaluation (referring to the cybernetic process of monitoring and rewarding performance), or to focus on people policies such as training and socialisation (Ouchi, 1979, Blau and Scott, 1963). More recently, control theory has been adopted to study control in smaller work units within an organisation, such as IS project teams (Henderson and Lee, 1992; Kirsch 1997). These smaller work units are the focus of this research, with the aim of gaining an insight on their approach to control.

The existing literature defines two broad categories of control: formal control and informal control (Eisenhardt, 1985, Jaworski, 1988, Ouchi, 1979). Formal control employs rules and procedures that require particular patterns of behaviour to be followed in order to achieve desired goals (Das and Teng, 1998, Nidumolu and Subramani, 2003). Behaviours or outcomes are measured and evaluated, and rewards are made in accordance with the tasks that have been achieved (Eisenhardt, 1985). This suggests that there are two types of formal control: behaviour-based control and outcome-based control. This stems from Ouchi's (1979) concept of control as detailed in Figure 1 below which suggests that the optimal choice of control mechanisms is determined by characteristics such as task programmability (i.e. knowledge of the transformation process) and outcome measurability. If organisations know the precise behaviours and processes that will transform inputs into outputs they can use behavioural control, whereas if an organisation's desired result can be measured, then outcome control should be used. If neither outcomes are measurable nor appropriate behaviours are known, then clan control is implemented.

Knowledge of the Transformation Process

		Perfect	*Imperfect*
Ability to Measure Outputs	*High*	Behaviour or Output Measurement	Output Measurement
	Low	Behaviour Measurement	Ritual and Ceremony "Clan" Control

Figure 1: Conditions determining the measurement of behaviour and output (Ouchi, 1979)

Behaviour control requires the identification of appropriate behaviour to complete a task (Nidumolu and Subramani, 2003). Behaviour control can be implemented on ISD projects by enforcing procedures and methods for tasks, for example, the use of a formal procedure to develop a project schedule or employing a formal systems development methodology (Kirsch, 1996). Outcome control can be implemented by specifying criteria that can be measured for example, quality metrics, meeting a schedule, or completing a project within budget (Nidumolu and Subramani, 2003).

Informal controls differ from formal controls in that they are social or people-based and they focus on the role that individuals or groups play in the exercise of control (Eisenhardt, 1985, Jaworski, 1988, Ouchi, 1980). They rely on common values and beliefs, or traditions among people or individuals (Ouchi, 1980). In Ouchi's (1979) framework one informal control was identified, namely; clan control (see Figure 1), where clan control is defined as a group of individuals who are dependent on one another and who work together to achieve a common goal (Ouchi, 1980). Careful selection of members of a clan should result in a group of individuals with a strong sense of identity with and commitment to the group (Kirsch, 1996). Within a clan each group member can effectively function as both the controller and the controllee (Choudhury and Sabherwal 2003). Ouchi (1980) suggests that only certain organisations exhibit the characteristics of a clan. These organisations typically operate in industries where teamwork is common, technology changes often and it is difficult to clearly measure and evaluate employee performance (Ouchi, 1980). As a result, clan control evaluation and reward are a function of the group as a whole (Kirsch, 1996).

Since the development of Ouchi's framework other researchers (Choudhury and Sabherwal 2003, Henderson and Lee, 1992, Kirsch, 1996) have suggested a second type of informal control called self-control in which individuals set their own goals; determine the actions by which those goals should be achieved; monitor their own work; and reward themselves accordingly. This is in contrast to clan control where individuals are socialised into a group (Jaworski, 1988). In some instances the goals and processes of individuals may not be formally documented (Kirsch, 1997), which means that organisations must ensure

that any decisions individuals make are consistent with the interests of the organisation (Harris et al., 2006). However, even if controllers do not directly exercise self-control over others, they may still encourage others to exercise self-control by appropriately structuring the work environment (Kirsch et al., 2002) by selecting the correct individuals and socialising them so that they understand and value the objectives of the organisation (Harris et al., 2006).

Each of these control modes consist of various characteristics which define them. A summary of the characteristics of each of these four modes of control is displayed in Table 1 below:

Mode of Control		Characteristic
Formal Control	Behaviour	Behaviours that transform inputs to outputs Controller monitors and evaluates controllees' behaviour Explicit link exists between extrinsic rewards and following behaviours
	Outcome	Desired task outcomes are known and measurable Controller evaluates whether outcomes were met Explicit link exists between rewards and producing outcomes
Informal Control	Clan	Task-related behaviours and outcomes are not pre-specified Goals are determined by clan and evolve during the task period Clan identifies and reinforces acceptable behaviours Rewards are based on acting in accordance with clan's values and attitudes Shared experiences, values, and beliefs among the clan members Members exhibit strong commitment to the clan
	Self	Controllee sets own task goals and procedures Controllee is intrinsically motivated Controllee engages in self-monitoring and self-evaluation Rewards are based partly on controllees' ability to self-manage

Table 1. Characteristics of Four Modes of Controls Adapted from (Kirsch, 1996)

The intention is to develop/adapt and validate constructs to measure each of these control modes as they are used within agile systems development projects and to develop a framework that will allow a project manager or a project team to assess the effectiveness of each of these control modes.

RESEARCH METHODOLOGY

To investigate the research questions detailed above a quantitative study is proposed. Currently, we are reviewing the literature to identify research instruments that may be suitable for this study. As the research instruments reviewed to date specify constructs that measure control in the context of traditional plan-driven ISD projects it is likely that these will need to be adapted to study control in the context of agile systems development projects. The proposed approach is not limited to identifying/adapting existing constructs, but may also identify new constructs that are more appropriate to agile systems development projects. Each construct will be measured using a Likert scale with a scale of at least one to five.

The research instruments reviewed to date identify: measures of behaviour, outcome, clan and self control in relation to the project leaders and client liasions (Kirsch et al., 2002); measures of behaviour, outcome, clan and self control on ISD projects (Henderson and Lee, 1992, Kirsch, 1996), measures of self-control (Kirsch and Cummings, 1996); and measures of behaviour and outcome control (Snell, 1992). Kirsch et al. (2002) state that the measurement of clan control proved difficult as few researchers had previously operationalised this construct.

The advantage of using an existing research instrument or constructs means that the instrument/constructs have already been validated and are reliable.

Proposed Data Collection

The intention is to conduct a survey of approximately 1000 ISD project teams that use agile methodologies. The reason for this target number of respondents is to ensure that a reasonable number of responses is obtained. It is anticipated that participating project teams will: vary across different industry sectors; be of different sizes; may be geographically distributed; have different timelines for projects; and use different agile methodologies.

It is envisaged that the survey will consist of three sections. The first section of the survey will capture demographic information relating to the organisation and the project. The second section will detail the constructs that will measure each of the control modes using a scale measure. It is proposed that both project managers and members of project teams will participate in the survey to determine the control modes used on their projects and the effectiveness of these control modes. Even though the customer is an important member of agile systems development projects it is not proposed at this point to include customers in the survey as we anticipate that there may be difficulty in gaining access to these individuals. However, it may be appropriate to include a third section on the survey, which project managers will respond to, that relates to the level of participation of customers on the project and whether the project manager believed they had an influence on the specific controls modes that were utilised. For example, how often did customers request status reports, how often was the customer on-site, was the customer internal or external to the organisation?

In order to determine the use of specific control modes over time it is proposed that respondents will be asked to indicate the length of each iteration on their current project; the number of iterations in the current project; and the specific iteration in which the respondent is currently working. As the intention is to gather data from approximately 1000 organisations it is hoped that the amount of data collected will indicate which control modes are employed on agile teams at various stages of a project (e.g. 20% complete 50% complete, 75% complete). This is in an attempt to ensure that the results are generalisable.

It is proposed that both an on-line version of the survey and a paper version will be prepared for distribution to participants. It is anticipated that the majority of respondents will use the on-line version as they are likely to be comfortable with the use of technology. The survey will be pilot tested with a number of project managers and project team members prior to its general distribution. This may involve the use of focus groups or interviews with specific individuals to obtain qualitative feedback. Any feedback that is received from the pilot testing will be reviewed and may result in a revision of the content of the survey. Several iterations of pilot testing may be required to refine the research instrument before the final version is ready.

CURRENT STATUS OF THE PROJECT

The project to date has reviewed the literature on control in many different domains for example: organisation control, general control theory, management control, marketing control, and control in ISD. Literature relating to agile methodologies has also been reviewed. At this point the motivation for the research is clear, the overall research objective has been identified and the research questions are defined. Currently, various research instruments that relate to each of the specific control modes are being identified and critiqued for their suitability and applicability to this study. It is hoped that at least some of the constructs already detailed in the ISD control literature can be adopted, but the expectation is that some new constructs will need to be developed that relate specifically to control in agile systems development projects. Once the research instrument is defined and pilot tested the data collection will proceed. A database of 1000 organisations is available to the researchers for this study. Each of these organisations currently uses agile methodologies and is willing to participate in research.

DESCRIPTION OF WHAT THE AUTHORS PROPOSE TO PRESENT AT THE CONFERENCE

At the workshop we propose to present the following:

- o   A review of the literature conducted, which will demonstrate the need for research in this domain

- o   The conceptual framework used in this research and the proposed theoretical and practical contributions of the research

- o   The research objective and research questions

- o   The proposed research methodology and data collection

- o   A draft research instrument, which will be available for review and discussion

- o   Issues and problems

o   Current status and next steps

We recognise that both formal controls (behaviour and outcome) will be relatively easy to measure due to their tangible nature. In contrast, the informal controls, particularly clan control, may prove more difficult to identify and capture. This has been acknowledged in prior research on control (Kirsch, 1996). It may be even more difficult in agile ISD projects, as opposed to traditional, plan-driven methods due to the softer, social and more intangible nature of interactions and artifacts. A discussion of these issues, the implications for the research and the extent to which our current research instrument copes with these challenges would be very valuable at the workshop.

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How to Orchestrate IT Project Portfolios More Successfully – Application of a Theory-Driven Proactive Operational Risk Management Approach

Research-in-progress

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ABSTRACT

Monitoring and managing thousands of IT projects simultaneously is extremely challenging for large consultancies or IT service providers wherefore a functioning and effective risk management approach is of pivotal importance. In this paper we illustrate the preliminary results of an ongoing longitudinal action research project. Invited by the CIO, the authors were embedded in a reorganization project of one of Europe's largest IT service provider's risk management office, responsible for several thousand IT projects. In this action research approach, the authors were able to contribute to the improvement of the existent risk management approach from a theoretical perspective as scientific consultants. First results indicate that the new proactive risk management led to a 25% reduction of critical project indexes in 2007. This research-in-progress paper will outline the applied action research approach and the current status of the ongoing project.

Keywords

project risk management, action research

RESEARCH OBJECTIVES AND QUESTIONS

One of the most challenging tasks IT project managers are confronted with is solving the problem of how to uncover, measure, and subsequently manage hidden, emerging, or latent risks in large IT software development projects. Finding a solution for this problem is even more difficult if one has to rely on reporting lines and project documentations. Unidentified or ignored risks have caused software development projects to fail or end in a disaster (Nash 2000). In extent literature, famous catastrophic project outcomes are reported such as the Taurus software development project for the London Stock Exchange (Bergman et al. 2002a; Bergman et al. 2002b), the software development project for the baggage-handling system at the Denver airport (Montealegre and Keil 2000), or the London ambulance computer-aided dispatch project (Beynon-Davis 1995). Although the aforementioned projects are not directly comparable with each other, a common denominator of all projects is that emerging risks within the projects have not been identified and communicated early enough wherefore appropriate countermeasures came too late or never happened at all to prevent the failing course of actions. Given the provided examples and many others more it is no surprise that a proactive risk management throughout the entire IT software development process is regarded as mandatory to increase the chance of delivering a successful product.

In this research-in-progress we analyze and consult one of Europe's largest IT service providers in its attempt to improve its risk management approach. The chief information officer (CIO) of this enterprise invited us to join the risk management reorganization team in order to contribute theory-driven solutions to the new risk management system. The intention is to establish a continuous proactive risk management process that supports the complete life-cycle of deals, projects and services and replaces several so far used, less coherent and structured approaches. A special emphasis is laid on the definition and traceability of countermeasures for preventing negative risk impacts. The authors have chosen an action research approach as their epistemological base due to their "embeddedness" and active role in the development project. Furthermore, the approach allows actively altering the researched object and testing the results of each action in a lab experiment like approach. *This project provides the authors the unique opportunity to a) develop theory-driven concepts to improve the communication and traceability of potential project risks, to b) implement the improved, new proactive risk management in IT software development projects, and c) measure the impact of the proactive risk management system on project success.*

The remainder of this paper is structured as follows: after providing some background information on IT project risk management aspects the most influential information systems concepts and theories are discussed that guided the authors during the development of the refined risk management approach. Then, the applied action research approach is illustrated as well as the technique of the conceptualization of the proactive risk management and the subsequent testing to allow for methodological transparency. In the concluding discussion of the findings the current results will be illustrated and the next steps in the ongoing research project will be outlined.

THEORETICAL FOUNDATIONS

Risk management aims at increasing a project's chance of success by explicitly addressing the uncertainties, potential hazards and other imponderabilities related to the project in the future (Hughes and Cotterell 2002). Boehm describes software project risk management by separating it into two main stages, risk assessment and risk control (Boehm 1991). The first stage, risk assessment, is a project-wide systematic approach to identify, analyze and prioritize project risk factors. The second stage, risk control, comprises risk management planning, risk resolution and monitoring (Boehm 1991). The crux of the matter lies in the identification of those risk factors that need to be controlled (Schmidt et al. 2001). Therefore the value of any risk management is dependent upon an effective and efficient method to assist project managers in identifying all significant risk factors (Schmidt et al. 2001).

The challenge of risk management is to minimize the personal bias in the reporting process and providing transparency of risks in projects. For instance, the commitment of a project manager to his or her project is essential for its success but it can jeopardize the outcome when the project manager adheres to its initial plan despite the fact that circumstances have changed and better alternatives have evolved. Here, an escalation of commitment takes place. It is marked by the continual commitment of additional resources into a failing course of action although negative information on the project development is available (Keil 1995; Staw 1976). In addition, the phenomenon of the "mum" and "deaf" effect represent a critical aspect on communication within the project as well as towards the management level. The mum effect occurs when one or more stakeholders who have information indicating a project is failing decide to remain silent and let the project continue. A study by Keil and Robey revealed that even when monitoring took place, the auditors censored themselves intentionally or unintentionally (Keil and Robey 2001). The deaf effect describes a situation in which a person in charge of preventing projects from a failing course of actions refuses to pay attention to the problem or risk (Keil and Robey 1999; Keil and Robey 2001).

Deaf and mum effect impedes any serious risk management approach that aims to increase a project's chance of success by explicitly addressing critical factors. It also ensures that de-escalation strategies are made available, aiming to reduce the commitment to previous decisions, and to enact an alternative action or plan (Montealegre and Keil 2000). A survey by Keil and Robey showed that factors such as regular evaluation of the projects, risk awareness, as well as separation of responsibilities for approving and evaluating projects encourage the transition from escalation to de-escalation (Keil and Robey 1999). Furthermore, top management was found to be the most common trigger for de-escalation, followed by internal as well as external auditors. Hence, risk management needs the mindset of a whistle blower to counter the mum and deaf effects and address the problem in order to find a solution as basis for initiating the de-escalation process (Dozier and Miceli 1985; Drummond 1996; Keil and Robey 1999). The intangible characteristic of IS projects and their dynamic development can lead to shift of technological and/or environmental requirements during the project life span. This adds an additional special challenge to the operative risk management (Abdel-Hamid et al. 1999; Zmud 1980). On this account, it is difficult for auditors to identify problem situations that may affect the success of the business venture (Smith and Keil 2003) so he or she might more likely withhold information due to uncertainty (as kind of mum effect) (Keil and Robey 2001). In fact, the lack of correct status information on a project is one of the major reasons for escalation in medium- to large-scale IS projects (Keil et al. 2000).

CASE DESCRIPTION AND RESEARCH METHODOLOGY

Case Description

The research takes place at one of Europe's largest IT service providers. The CIO of the enterprise has ordered a new, more sophisticated and proactive risk management approach in order to manage the project portfolio comprising a half dozen thousands projects more successfully. The service provider has implemented already a commercial risk management focusing on the financial accounting and controlling risks that are included in every business venture. A tool called RiskMan has been adopted, assisting the risk management process as it supports the registration, evaluation, analysis and communication of commercial risks. Quality gate checklists have been established for the quality gates 1 to 4 supporting the risk identification

and communication which provides an increased transparency of critical factors in the initial deal phase of new projects. In addition, a risk exposure and measurement tool (REM) provides an overview on the operational and commercial risks in a deal. Based on the existing tools, the CIO decided to establish a strategic project with the goal to provide and implement a unified, optimized, standardized, and integrated proactive operational risk management system throughout the company that starts in the deal phase of an new project and continues during the whole project life-cycle project and even beyond that if an ongoing service is established. The project started in February 2007 and is still ongoing. The project team was staffed with twelve members, recruiting ten representatives from different departments of the company and two scientific consultants. A clear scope of the project was derived from the goal set by the CIO to increase the transparency in deals, projects and services. This was achieved by expanding the quality check list on to quality gates 5 to 8, covering the project phase and 9 to 10 for the services phase. In addition, a new reporting system and monitoring mode was designed to ensure an up-to-date status on the development of the projects. The functionalities of the risk management tool were enhanced providing an ongoing risk identification and analysis in the project phase as well as a categorization of the deals and projects.

Research Methodology

To capture the performance and improvement of the development project, it was mandatory for the scientific consultants to apply a research method enabling them to actively participate in the changing process. In addition, the method had to possess the ability to adapt to the dynamic environment of IS projects (Coughlan and Coghlan 2002).

Methodological element	McKay & Marshall (2001)	Scope of application
Initiating	1. Identify: problem and research theme 2. Reconnaissance: problem context and research literature 3. Plan and design: problem solving and research questions	1. A kick-off meeting took place, a scope statement was issued and the research question was defined. Requirements by the IT service provider and AR were identified. 2. Significant company data and literature providing a theoretical base were collected. The compliance with the requirements of the IT service provider and AR were verified. 3. A milestone plan was issued, provided a timeline and structure for the problem solving and research process. The project team was selected as "project steering group", representing a "sparring partner" for the scientific consultants.
Iterating	4. Action steps 5. Implement 6. Monitor: problem solving and research 7. Evaluate in terms of problem alleviation and research questions 8. Amend plan based on 7	4./5. Actions were implemented according to the milestone plan. 6. Practitioners and scientific consultants tracked executed measures/actions and analyzed the data collected. 7. Findings were related to a theoretical base, linking theory with the practical experience. 8. Through the iterative process findings were incorporated in the risk management systems and field-tested in the pilot projects.
Closing	9. Exit, if: problem alleviated and research question resolved	9. The project was finalized as a stable economical problem solution was verified, linking the practical know-how to a theoretical base.

Table 7: Overview on the Action Research Approach

In order to meet these requirements the participatory action research (AR) approach was selected. AR addresses a significant management and/or research problem situation with the objective of finding a solution along with an understanding of how actions can change or improve the studied environment (Coghlan and Brannick 2001). In doing so, AR combines the theoretical approach to a research question with the practical element, as the researcher takes action and applies theories within the research project (Coughlan and Coghlan 2002; McKay and Marshall 2001). The key inspiration for the AR approach applied in this study refers to the framework provided by McKay and Marshall (2001), based on Checkland's

(1991) seven-step framework. In Table 7, the AR steps by McKay and Marshall (2001) are set into relation with the scope applied in this research.

	AR recommendation	AR application
Roles	Clarification of roles and responsibilities of researchers and practitioners is mandatory as well as the way in which their collaboration ought to develop over time (Baskerville and Wood-Harper 1996).	A scope statement has been issued in the beginning of the project clarifying the roles and authorities of all involved stakeholders.
Documentation	The data collection method and documentation style is a key discipline that distinguishes research form consultancy by audio-taping observations, using meeting minutes, or storing written recollections of practitioners (Baskerville and Wood-Harper 1996). A structured diary is recommended to keep track of all observations, events, ideas, and actions as they evolve over time (Jepsen et al. 1989). Such documentation is an essential part of any AR approach and serves as a quality indicator for the data collected (Iversen et al. 2004). Multiple data sources should be utilized and their origin and context should be documented to minimize potential bias and to allow for data triangulations (Yin 2003)	The following data collection techniques are applied within the project: (1) Weekly status reports were issued, (2) an open issue list was kept, a pilot project "watchlist" was set up, (3) a weekly conference call with the project team was established and (4) a monthly project team meeting took place and meeting minutes were made. The listed records form the basic elements of documentation. In addition, in-depth interviews were conducted and are documented in a diary along with other notes from conference calls and meetings.
Control	Control is an important factor as it aids the impartiality of the researcher. (Avison et al.) name three fields one should be aware of and report on: (1) control over initiation, (2) determination of authority and (3) degree of formalization (2001, 38).	The initiating IT service was setting up a team to realize the goal. Afterwards, the organizational responsibilities within the team were determined and a kick-off meeting took place clarifying the duties and responsibilities by the team members within the project. The details were documented in the scope statement which equals a framework agreement for the AR discussed in this paper.
Usefulness	Usefulness is acknowledged when the solution of the problem situation is of practical use (Checkland 1981). It creates a baseline upon which the findings can be evaluated and transferred (Baskerville and Wood-Harper 1996).	In the analyzed project, usefulness is measured by the reported project status (green, amber, red) on the factors of time, budget, and quality. The aimed at goal is to decrease the red statuses through the implementation of the proactive risk management system. If this is achieved, the system is regarded as being useful.
Theory	Theory addresses the question how the chosen framework supports the study and how findings can be set in relation to it (Iversen et al. 2004). A special characteristic of AR is that findings are often related to a specific situation and surrounding. The impartiality of the research can be supported by relating findings to scientifically recognized frameworks and theories. Baskerville and Wood-Harper highlight this key factor which distinguishes AR from consulting (1996).	The applied AR approach in this research is based on the extended framework of McKay and Marshall which also provides the theoretical basis on which the findings can be evaluated (2001).
Transfer	Transfer addresses the question of which conditions are required to transfer the findings to or adapt them into another context, since the context-dependency of AR sets a limitation on generalizing the findings (Baskerville and Wood-Harper 1996). Iversen et al. highlight five characteristics which may assist in defining a general scope of study: (1) the area of application, (2) conditions (e.g. time, resources), (3) an understandable approach, (4) necessary skill/capabilities and (5) a general approach to increase transferability (Iversen et al. 2004).	The applied AR approach considered the listed characteristics and uses the well-established framework of McKay and Marshall in combination with a solid theoretical base in order to increase the transferability of the findings towards at least, a mid-range theory contribution.

Table 8: Applied Action Research Generalization Process

The challenge in AR lies in the dual purpose of being part of an intervention and doing research at the same time (McKay and Marshall 2001). The researchers have to be sufficiently involved in the action to improve the problematic situation but, when necessary, have to stand back from the action and reflect on it in order to contribute new knowledge and insights to the project (Coughlan and Coghlan 2002). Action research focuses on a specific problem situation, which causes difficulties when attempts are made to generalize findings. Baskerville and Wood-Harper identified four detrimental factors to AR: (1) lack of impartiality of the researcher, (2) lack of discipline, (3) the process is mistaken for consulting, (4) context-dependency leading to difficulty of generalizing findings (1996). To prevent such pitfalls, Iversen et al. have formulated a criteria guide comprising roles, documentation, control, usefulness, theory, and transfer to proactively control and reduce the critical factors in their project (2004). In the following, these criteria will be introduced and examples will be given on how they were incorporated in the applied AR approach (Table 8).

Once the basic requirements were secured, the researchers have been granted access to the organization and were embedded into the development project for the proactive operational risk management system. From an AR research perspective, the assigned 10 project team members were our "project steering group" (Coughlan and Coghlan 2002). This ensured that the key members of the studied environment were committed to the AR and prepared to work with the researchers to achieve the communicated objectives. The AR approach supported the joint learning and close alignment between researcher and practitioners throughout the iterative research process from an inside perspective.

CURRENT STATUS OF THE PROJECT

An essential element of the operational proactive risk management system consists of quality gates (Q-gates), which are checklists, specially designed and tailored to ensure the right behavior for every form and phase of business case from standard to customized solutions. The Q-gate checklists represent the innovative and most critical element of the proactive operational risk management approach, the early-warning system. It is designed to provide continuous quality assurance and improvement. Q-gates are a preventive measure taken to avoid the escalation of commitment by applying the counter check principle, which states that two pairs of eyes are better than one. It reduces the likelihood of escalation and counters the mum and deaf effect as decisions cannot be made by a single person. This increases the probability that an accurate and detailed status is reported providing a transparency over all deals, projects, and services. Yet, the mum and deaf effect experienced by members of the project and the CIO of the company remain a critical factor in the execution of Q-gates. Hence, well trained and skilled project and risk managers with a standing in an organization are of vital importance for the success of Q-gates as whistle blowers.

Figure 1 gives an overview of the Q-gate process and lists the triggers for the execution of each Q-gate. It illustrates the Q-gate process, as it is subdivided into the deal phase (Q-gates 1-4), the project phase (Q-gates 5-8) and the service phase (Q-gates 9-10). The Q-gates 1-4 in the deal phase are already established throughout the company and only needed to be updated by the project team to ensure that the hand over from the deal phase to the project phase will be taken into account when designing the new Q-gates 5-10. The greatest challenge was drafting the first version of the Q-gates 5-8 for the project phase and the Q-gates 9-10 for the service phase. The project management institute standard was identified as the best foundation for the design of the Q-gate checklists 5-10.

The entire early-warning system requires a control level to schedule, execute, evaluate and track the results and measures stated when passing a Q-gate. A central risk office was established to manage the duties and responsibilities introduced with the new operative risk management, e.g. coaching the pilot projects. The feedback from the pilot projects verified that the early-warning system was positively acknowledged by the project managers, who viewed it as a supportive and helpful risk management instrument. They also confirmed that the counter check principle promoted by the early-warning system assists them in their decision-making. The project managers questioned the use of Q-gate checklists in small projects, which work with standard solution packages or simple change requests and do not require special risk analysis.

The decision of the project team to implement the early-warning system as the key element of the proactive risk management was confirmed through the feedback, given by the project managers of the pilot projects. For the team, the crucial point for the successful implementation of the proactive risk management approach was the reaction of the project managers to the counter check principle. The project manager's positive reaction encouraged the team to continue their efforts under the key-note of simplifying the workflow and increasing the productivity of the project managers. On that note the Q-gate checklists were reviewed and approved by the project team and the CIO.

In the first implementation stage the monthly reporting was established in the pilot projects. The risk office coached the project managers as they had difficulties in adjusting to the new key performance indicator (KPI) definitions. The team

members received a positive feedback by the project managers on the new reporting system and its design and functionality. With this positive response the team approved the further implementation of the reporting system. The risk office will support the next implementation phases, ensuring that all large-scale projects will establish project offices. These assist the project managers in issuing the necessary reports, maintaining the open issue list, tracking measures and executing Q-gates. The project office supervisor has the same occupational skills as the project manager and fulfills the role of a counter check. He/she acts as a sparring partner to the project manager with the objective of reducing the risk of escalating commitment and to counter the mum and deaf effect. Essential for a successful rollout of the new reporting and monitoring mode was the approval and support by the CIO and the promotion of an open minded corporate culture. The intention was and still is to encourage project managers to adapt and promote the negatively connoted whistle blower attitude throughout the company. The experiences and documentations of the pilot projects underline the need for a radical change in the corporate culture. Therefore, the team developed additional measures to ensure a successful implementation of the new risk management system. These measures included the unification of standards (e.g., categorization,) and a rollout of policies listing the main goals for project/service management. In January 2008, the next implementation stage of the reporting system and monitoring function was coordinated and aligned with the rollout of the "early-warning" system.
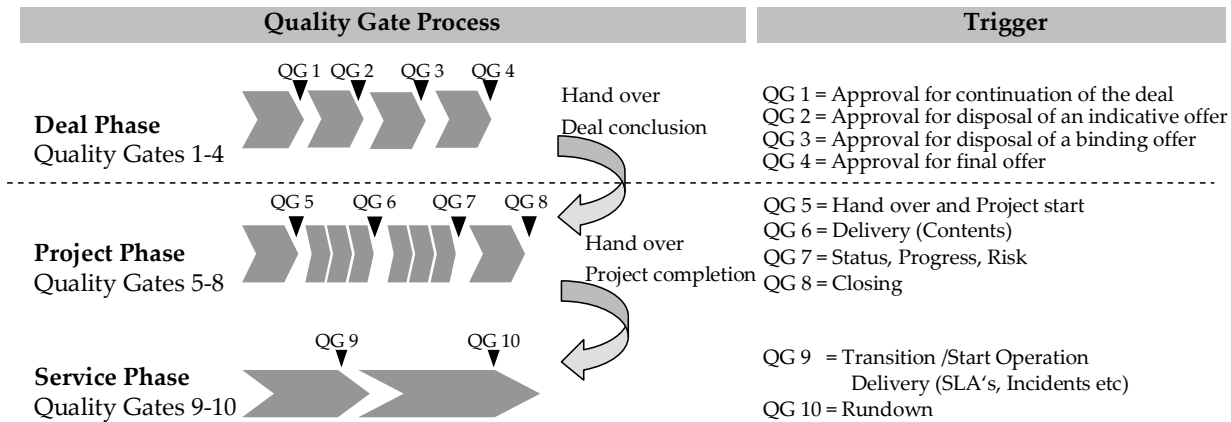

Figure 1: Quality Gate Process

CONCLUSION AND FURTHER RESEARCH AND POSSIBLE PRESENTATION CONTENT

The data collection and evaluation provided already a better understanding of the problem situation and encouraged the participants to find solutions by forming a collaborative and synergistic "scientists meets practitioners" alliance. With the help of the behavioral science concepts from IS literature (whistle blowing, as well as mum and deaf effects) as theoretical base, the AR researchers were able to start an iterative problem solving process within the project team leading to an adaptation of KPIs and quality gates with the goal to avoid deaf effects and mum effects and to encourage whistle blowing. In doing so, the new proactive operational project risk management system promotes an open communication style. Although it is still too early to significantly measure the success of the improved risk measurement approach, first results from 2007 compared with the statistics from 2006 revealed a 25% decrease of projects with a critical status (i.e., over time or over budget or both). However, between November and December 2007 the percentage of projects in a critical "red" status increased by 5 to 10% in comparison to the rest of 2007 which is actually a good signal since it indicates that the new proactive operational risk management approach reveals more pending risks than the previous approach.

Although the project is not completed yet and the research is still in progress, the new categorization of the projects along categories such as size and criticality already made a prioritization of the projects within the project portfolio possible. Our next steps will be to measure the effects of the complete roll-out of all instruments across all projects in the portfolio of the IT service provider in a positivistic research approach. The goal is to provide significant evidence for the effectiveness of the refined risk management approach due to concept applied which are motivated and deduced from IS literature.

At the workshop, the latest research results and data will be provided to discuss the research approach. The authors hope to have the ability to discuss possible ways to improve the work to make it a substantial theoretical contribution.

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Research on Global Information Technology Teams and Project Success:
Research in Progress

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ABSTRACT

The objective of this project is to determine how the composition of cross-cultural information technology (IT) development teams contributes to project success. Increasingly, IT projects are conducted across cultural boundaries, and this research will address the issues relevant to project success in this context. A cross-cultural IT team is defined as a project team responsible for an IT project. Part of the team is responsible for one phase of the project, and another part of the team is responsible for another phase of the project. For example, the requirements definition of the project may be handled by the U.S., and the implementation may be handled by Indian developers.

The composition of cross-cultural teams will be defined by the cultural difference factors identified by Hofstede (2001). These factors include: Power Distance Index (PDI): society's endorsement of inequality, hierarchy; Individualism Index (IDV): individuals look after themselves, not the overall good; Masculinity (MAS): assertive, competitive orientation; and Uncertainty Avoidance (UAI): feeling of discomfort in an unstructured situation.\

Keywords

Information systems projects, cross-cultural teams

OBJECTIVES AND DEVELOPMENT OF A MODEL OF CROSS-CULTURAL TEAMS

The objective of the research is to determine how the composition of cross-cultural IT development teams contributes to project success. A cross-cultural IT team is defined as a project team responsible for an IT project. In many projects, part of the team is responsible for one phase of the project, and another part of the team is responsible for another phase of the project. For example, the requirements definition of the project is typically handled by the U.S., and the implementation handled by Indian developers (Rottman and Lacity, 2006).

The composition of cross-functional teams will be defined by the cultural difference factors identified by Hofstede (1980).

These factors include:

- Power Distance Index (PDI): society's endorsement of inequality, hierarchy
- Individualism Index (IDV): individuals look after themselves, not the overall good
- Masculinity (MAS): assertive, competitive orientation
- Uncertainty Avoidance (UAI): feeling of discomfort in an unstructured situation

The cross-cultural teams will consist of various combinations of countries, such as: US + Norway, US + India, India + Pakistan, and Sweden + New Zealand. Each cultural team will be classified and depicted as an "effective team" vs. an "ineffective team," using the cultural ratings. These cultural ratings will be used to categorize the types of teams, because effective teams have certain characteristics, including shared commitment, a specific team purpose that the team delivers, mutual accountability, collective work products, and shared leadership roles. Teams are engaged in active-problem solving, active participation in work, and collective assessment of work products (Miles and Watkins, 2007; Katzenbach and Smith, 2005). These characteristics are consistent with Low PDI, Mid-Range IDV, Low MAS, and Mid-Range UAI. The linkage between team characteristics and Hofstede's dimensions will be validated with input from expert reviewers.

We will classify country combinations using the model of the effective team. For example: the combination of US + India would result in an ineffective team rating because team characteristics would not be consistent with the team effectiveness characteristics above.

Team-effectiveness rating	Cross-cultural indices	Average (Ave) for 2 countries
Mid	PDI	58.5
High	IDV	69.5
Mid	MAS	59.0
Low	UAI	43.0
Ineffective team		

Table: US + India

In another example, a combination of US + Brazil would create an effective team; as such the US + Brazil team would be a rational choice.

Team-effectiveness rating	Cross-cultural indices	Ave for 2 countries
Low	PDI	54.5
Mid	IDV	64.5
Low	MAS	55.5
Mid	UAI	61
Effective team		

Table: US + Brazil

The model for understanding the impact of cross-cultural teams on project success will look like this:

	Model recommends forming a cross-cultural team	Model recommends no team should be formed
Actual choice: Cross-cultural team (Requirements: one nation; implementation: another nation)	U.S. + Brazil Requirements: U.S. Implementation: Brazil **Rational choice**: Effective cross-cultural team	U.S. + India Requirements: U.S. Implementation: India **Irrational choice**: Ineffective cross-cultural team
Actual choice: No cross-cultural team (Requirements and implementation)	**Irrational** (no cross-cultural team)	**Rational**: 100% project completed in the U.S. (example)

Model for Cross-Cultural Teams

REVIEW OF THE LITERATURE

Performance of Cross-cultural Teams

A number of studies indicate that distributed teams report more task and interpersonal conflict, but effective communications and shared identity can mitigate this conflict (Hinds and Mortensen, 2005). In diverse teams, it is important to facilitate activities which enable team members to identify with group values (Fiol and O'Connor, 2005). There is a large body of research indicating that cultural differences in teams matter. In a study characterizing the dimensions of collectivism and uncertainty avoidance among Mexicans and Americans, Jarvenpaa and Leidner (1998) found that Mexicans had a high collectivist culture which caused them to develop extensive personal and professional networks. Additionally, Mexicans were high in uncertainty avoidance and preferred clear rules, structure, and standard operating procedures to obtain greater certainty. But, high trust and effective communications among team members can mitigate these differences (Connaughton and Shuffler, 2007; Jarvenpaa and Leidner, 1999). High-trust teams were proactive, relied upon frequent communication, and valued predictable, substantive feedback (Jarvenppa, Knoll, and Leidner, 1998). Even when high-trust teams had higher cultural diversity, extensive communications and feedback reinforced trust (Jarvenpaa, Knoll, and Leidner, 1998).

Other studies reinforce the importance of effective communications among members of cross-cultural teams, in spite of language differences. In a study of cross-cultural teams in the United States and Norway, Saker and Sahay (2002) noted that both the Norwegian and American members felt at a disadvantage because of only knowing one language well. Other cultural differences, such as information systems development strategies, caused the teams to separate some of their work tasks and to allocate specialized responsibilities to the different locations. While cultural differences can impact decisions, use of similar technologies, standardization, and effective communication can reduce the impact of these cultural differences (Tse, Lee, Vertinsky, and Wehrung, 1998) even among cultures as different as those in China, Hong Kong, and Canada.

Project Success

Studies dealing with risk factors which complicate project success describe issues of organizational factors, skill set, management support, software design, user involvement, technology planning, project management, and project escalation. Project success, as measured by the ability to complete projects on-time, on-budget, and with the quality needed to address user requirements, requires minimizing these risk factors.

Some risk factors are associated with organizational factors, including the extent of changes being proposed, sufficiency of resources, and magnitude of potential loss (Barki, Rivard, and Talbot, 1993). Project managers may have to address issues

over which they have no control, such as changing scope/objectives and conflicts between user departments (Keil, Cule, Lyytinen, Schmidt, 1998).   Lack of development expertise, lack of application-specific knowledge, and lack of user experience all contribute to project risk (Barki, Rivard, and Talbot, 1993; Ewusi-Mensah, 1997).

Lack of senior management commitment (Keil, Cule, Lyytinen, Schmidt, 1998) and lack of agreement on a set of project goals/objectives (Ewusi-Mensah, 1997) are factors leading to time/cost overruns.   Misunderstanding requirements and continuously changing requirements contribute to project risk.   Lack of an effective methodology and poor estimation can lead to cost and time overruns (Keil, Cule, Lyytinen, Schmidt, 1998).   Software risk factors include developing the wrong functions, developing the wrong user interface, shortfalls in externally furnished components, and shortfalls in externally performed tasks (Boehm, 1991).

Lack of user commitment, ineffective communications with users, and conflicts among user departments are all sources of risk (Keil, Cule, Lyytinen, Schmidt, 1998).   Lack of adequate technical expertise and lack of an adequate technology infrastructure to support project requirements contribute to escalating time and cost overruns and are associated with project abandonment (Ewusi-Mensah, 1997).   Technological newness (need for new hardware, software), application size (project scope, number of users, team diversity), application complexity (technical complexity, links to existing legacy systems) and failure of technology to meet specifications are all project "hazards" (Barki, Rivard, and Talbot, 1993).

In information technology projects, there is a tendency to discount problems and their severity may remain unknown for a long period of time.   When projects run into difficulty, there is a tendency to escalate projects because of societal norms (e.g. needing to save face) and to keep pouring resources into a failing project.   This creates greater risk of failure (Keil and Montealegre, Spring 2000).

In the cross-cultural context, the risk factors associated with information systems projects may pose even greater challenges. Minimizing these risk factors by employing effective project management and control strategies may not be sufficient to overcome challenges which arise because of context and communications differences.   This study will attempt to examine these differences and to identify strategies to address them as well.

PROCEDURES FOR THE STUDY

Research Question: Will effective cross-cultural teams contribute to project success, as compared with ineffective cross-cultural teams?

Selection of Sample Projects: We have identified a number of cross-cultural IT projects which can be used in the proposed study.   These projects will be comparable in terms of type and scope.   Additional projects will be added to provide a representative sample of IT projects in each quadrant of the model.

Effective team	Ineffective team
US + Brazil	U.S. + India
Nestle Purina (Insurance Project)	Monsanto (SAP Project)

Control Group: We will compare the cross-cultural project environments with the conduct of projects without a cross-cultural team.   The projects in the control group will be comparable in type and scope to the cross-cultural projects.

Identification of Effective Teams vs. Effective Teams: The Model for Cross-Cultural Teams will be used to depict effective vs. ineffective cross-cultural teams.   For example, according to the model, a team consisting of the U.S. + India would be an ineffective team, and a team consisting of the U.S. + Brazil would be an effective team.

Grounded Theory Approach: The research will use the grounded theory approach to information systems research.   In the grounded theory approach, data is gathered from interviews and case studies, and the data are analyzed and used to build theory (Glaser and Strauss, 2008, Strauss and Corbin, 2007).   The reason the grounded theory approach makes sense in this study is that it will enable us to identify the social, political, organizational, and economic factors associated with information

systems project management in a cross-cultural context. The interview results will depict a number of variables which can be used to build theory. As such, the theory will have practical and intellectual value for further research dealing with cross-cultural teams.

Development of a Structured Interview Form. A structured interview form will use the project retrospective methodology proposed by Nelson (2005) in his research on project characteristics. Nelson's project retrospective methodology includes a structured interview form with questions dealing with:

1. Project management, leadership, and organization.
2. Project justification, including business and system benefits.
3. Project timeline, including planned vs. actual completion dates and project timelines.
4. Lessons learned, including symptoms of project failure (lack of strategic alignment, lack of stakeholder involvement, poor planning, and poor execution).
5. Project risk assessment, including skill sets of IT and user personnel, requirements analysis, and organizational factors.

Measures of Project Success. Project success will be measured by the extent to which projects are completed on-time, on-budget, and meet user requirements. In addition, we will use interviews to find out how different people from these different cultural groups feel they contributed to project success. These individuals will be asked to describe their role in the project and to explain their contribution outside of completing a specific task or group of tasks.

TIMELINE AND RESULTS

The results of the case studies will be used to build a framework depicting the social, political, organizational, and economic factors relevant to project success in each of the quadrants associated with the Model for Cross-Cultural Teams. This research has excellent chances to gain external project funded support, because global IT workforce issues are of great interest to the research community.

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Understanding Sources of Conflict in
Near- and Offshore IT Outsourcing Projects

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ABSTRACT

The research objective is the development of a theoretical model depicting sources of conflict in near- and offshore outsourcing projects. As previous research in the IT outsourcing conflict domain is scarce, we draw on the literature stream on global virtual teams as a conceptual basis. We transfer an existing model of conflict in global virtual teams to the IT outsourcing domain and enhance our understanding of conflict in global IT outsourcing projects by additional near- and offshore outsourcing specific characteristics. A key finding is that conflict in global IT outsourcing projects is caused by antecedents that go beyond technology mediation. Furthermore, subtle differences exist between near- and offshoring projects concerning the relevance and effect of individual antecedents.

Keywords

IS Project Management, Outsourcing of IS, Nearshore, Offshore, Global Virtual Teams, Conflict, Conflict Antecedents

INTRODUCTION, MOTIVATION & RESEARCH OBJECTIVES

The increasing amount of global information systems and services outsourcing is an apparent trend that is expected to continue in the foreseeable future (King and Torkzadeh 2008). This is not surprising, considering the expected benefits and cost advantages that client firms can achieve due to significant differences in labor costs between Western countries and offshore locations in Middle and Eastern Europe or Asia (Apte and Mason 1995; Rottman and Lacity 2004; Schaaf 2004).

However, these cost advantages do not materialize easily since "inter-country outsourcing" is accompanied by unique challenges that can offset the expected benefits (King et al. 2008). In particular, global IT outsourcing projects are highly receptive to specific forms of conflicts (Holmström Olsson, O Conchhúir, Agerfalk and Fitzgerald 2008). The management of these conflicts is demanding, e.g., due to the multi-faceted distance between client and vendor such as geographic distance and time zone differences which make direct communication difficult to apply to conflict handling and resolution strategies (Hinds and Bailey 2003; Kankanhalli, Tan and Wei 2007).

We still have a limited understanding of potential conflict in global IT outsourcing projects. This perception is in line with calls for additional theory-building research in the area of conflict and conflict management in organizations in general (De Dreu, Evers, Beersma, Kluwer and Nauta 2001). Thus, more research is needed in order to increase our knowledge on conflict in global IT outsourcing projects leading to the following research questions (RQ):

RQ1: "What are potential sources of conflict in near- and offshore IT outsourcing projects?"

RQ2: "What is the influence of conflict on the performance of near- and offshore IT outsourcing projects?"

As there is a lack of literature in the IT outsourcing conflict domain, we draw on research findings from a contiguous research stream, i.e. global virtual team (GVT) research. Global virtual teams working across cultural, geographical, and time boundaries (Kankanhalli et al. 2007) have been found to be more affected by conflict than traditional teams and are therefore subject to respective research activities (Hinds et al. 2003; Kankanhalli et al. 2007; Martins, Gilson and Maynard 2004). As global IT outsourcing project teams can be understood as a specific form of GVT (Vlaar, Fenema van and Tiwari 2008), the findings from this research area will be used as a theoretical basis for the conceptualization process. The resulting research model will be operationalized as Structured Equation Model (SEM) and tested applying the Partial Least Squares (PLS) approach.

Our work aims at contributing to the research and practice of near- and offshore outsourcing projects by (1) enlarging our understanding of the respective project teams, (2) depicting the relationship between conflict antecedents, moderating factors, conflict and project performance in global IS outsourcing projects, and (3) disposing project managers for the conflict sensibility of global IS outsourcing project and their specific sources.

The remainder of this paper is structured as follows: in the next section we will provide the study's theoretical foundation. Subsequently, we will introduce the research methodology, followed by the current status of the research project (model development). The paper ends with an outlook on the workshop presentation.

THEORETICAL FOUNDATION

Conflict and Conflict Management in the IS Outsourcing Domain

In the domain literature a consensus has been reached that business relationships are inherently conflict laden and that the various forms of conflict have implications on the overall business collaboration in the future (Anderson and Narus 1990; Bradford, Stringfellow and Weitz 2004; Dwyer, Schurr and Oh 1987; Mohr and Spekman 1994; Uzzi 1997). With regards to global IT outsourcing arrangements, it is striking that only sporadic recognition has been given to conflict and its management in previous research. For example, cultural differences have been shown to account for conflict in offshore software development projects when not properly managed (Winkler, Dibbern and Heinzl 2008). Another study examining a two-stage IT offshore relationship identifies conflict management to be a central process constituting this type of a client-vendor-relationship (Holmström Olsson et al. 2008).

This is in line with research results on information technology outsourcing (ITO) emphasizing the importance of conflict management as a significant success factor for relationship quality (Blumenberg, Beimborn and König 2008; Goles and Chin 2005; Lee 1999; McFarlan and Nolan 1995; Sun, Lin and Sun 2002). With regards to outsourcing contracts, researchers stress the necessity of formalized conflict resolution routines (Gellings 2007; Goo, Kishore, Nam, Rao and Song 2007). Furthermore, empirical studies on business process outsourcing (BPO) have revealed the importance of conflict management as an effective mitigation factor to performance risk (Wuellenweber, Jahner and Krcmar 2008).

In summary, the few existing publications covering conflict and conflict management clearly indicate the importance of this research area. Thus, we investigate this topic by reviewing findings from research on GVT to complement and extend the existing information systems literature on conflict in IT outsourcing projects.

Characteristics of Global Virtual Teams

As the increasing globalization is accompanied by the disappearance of global work boundaries, virtual teams are growing in number and importance (Hinds et al. 2003; Kankanhalli et al. 2007). However, despite its comprehensive use, a consistent definition has not yet emerged (Dubé and Paré 2004). Basically, virtual teams can be understood as teams "whose members use technology to varying degrees in working across locational, temporal, and relational boundaries to accomplish an interdependent task" (Martins et al. 2004).

Global virtual teams refer to an increased geographical and cultural distance, implying that team members of GVT work in different countries and hence are culturally diverse (Powell, Piccoli and Ives 2004). For this research we adopt the view of Dubè et al. who call for a more differentiated view on virtual team configurations and therefore provide an extensive set of key characteristics allowing for a categorization of virtual teams according to the perceived degree of complexity (Dubé et al. 2004). Table 1 provides an overview on these characteristics.

Current research activities on GVT focus but are not limited to team inputs, socio-emotional processes, task processes, and outcomes (Powell et al. 2004). Based on research results indicating that GVT experience a higher level of conflict than traditional teams and that these conflicts have a negative impact on team performance (Hinds et al. 2003; Hinds and Mortensen 2005; Kankanhalli et al. 2007; Montoya-Weiss, Massey and Song 2001), conflict as well as conflict prevention and management have been receiving increasing research attention.

Conflict and Conflict Management in Global Virtual Teams

Several studies have set out to identify conflict antecedents that are specific to GVT as well as the related preventive measures (Hinds et al. 2003; Hinds et al. 2005; Kankanhalli et al. 2007). Others have evaluated various moderating effects either aiming at reducing the amount of conflict or aiming at mitigating the negative impact of conflict on GVT performance (Hinds et al. 2005; Kankanhalli et al. 2007; Montoya-Weiss et al. 2001). Nearly all researchers have pinpointed the important role of communication: in contrast to traditional teams, GVT need to rely on technology mediated communication as face-to-face meetings are scarce due to the geographic dispersion (Martins et al. 2004; Powell et al. 2004). Especially spontaneous communication has been shown to be important for facilitating conflict identification and handling (Hinds et al. 2005). Moreover, the way virtual teams manage conflict has been identified as a crucial success factor (Montoya-Weiss et al. 2001).

Even though global IT outsourcing project teams represent a specific form of GVT (Vlaar et al. 2008), the results from GVT research have not yet been transferred to and evaluated in the context of the global IS outsourcing domain. We will address this gap with our research and thus enhance our understanding of conflict in near- and offshore outsourcing projects.

Key characteristic	Definition	Degree of teamwork complexity…
Geographic dispersion	Geographic distance including time zone differences	increases with increasing geographic dispersion
Task or project duration	Duration of project team: temporary versus permanent teams	decreases with increasing task or project duration
Prior shared work experience	Common experience in the sense of existing work routines	increases with increasing prior shared work experience
Membership stability	Permanent members versus fluid members ("joining in response to task requirements, availability, emergencies, or opportunities")	increases with decreasing membership stability
Task interdependence	No definition given	increases with increasing task interdependence
Cultural diversity	Cultural differences in the sense of national culture, organizational (= cross-organizational) culture and professional (=cross-functional) culture	increases with increasing heterogeneous team culture
Team Size	Number of team members	increases with increasing team size
Members' assignments	Assignment of project team members on a full-time or on a part-time basis	increases with increasing part-time assignments

Table 1: Key Characteristics for the Categorization of Virtual Teams (Dubé et al. 2004)

RESEARCH METHODOLOGY

As target population for our study we will focus on project managers responsible for near- and offshore outsourcing projects in the financial services industry using Germany as the clients' home country. We decide for India as primary offshore location, whereas nearshore locations will include several countries from Central and Eastern Europe.

For data collection, we will submit a questionnaire-based survey with questions that are derived from our research model. The research will be conducted in a positivistic, quantitative fashion. However, we are aware that research in nearshore outsourcing projects is still under researched wherefore a qualitative exploratory study would also be imaginable. Since we build our research on literature from adjacent research areas which has tight relations to the object of our analysis, it can be argued that the planned quantitative study is an appropriate step to reveal new insights from global IS outsourcing projects.

With regards to data analysis, the research model in the paper will be operationalized as Structural Equation Model (SEM) and tested using the Partial Least Squares (PLS) approach. We prefer PLS to covariance-based techniques since firstly, the research model has not been tested before and secondly, since we use a survey to collect the data the data sample might not be normally distributed (Cohen, Cohen, West and Aiken 2003). Thus, PLS is an appropriate technique as the least squares algorithm is relatively immune to instances where the sample data is not normally distributed.

CURRENT STATUS OF THE PROJECT

Our goal is to develop a model of conflict in global IT outsourcing projects based on the findings of GVT research. Therefore we apply a two-step approach: first, we evaluate the nature of near- and offshore outsourcing project teams based on the understanding of global IT outsourcing project teams as a specific form of GVT. In a second step, we deductively develop a conceptual model of conflict in global IT outsourcing projects leading to several tentative propositions.

A Challenging Virtual Team Configuration: Global IT Outsourcing Project Teams

In this section we elaborate on specific configuration of near- and offshore outsourcing project teams. For this purpose, we apply a classification scheme from virtual team research to guide the identification of those attributes of near- and offshore IT outsourcing project teams that fit with existing research in IS. We therefore draw on the above presented set of key characteristics and interpret each key characteristic from the perspective of near- and offshore outsourcing projects. Since we base our analysis on the understanding of global IT outsourcing project teams being a specific instance of GVT we are convinced that the application of the classification scheme from virtual team research to the IT outsourcing research is legitimate. At this point, we attach importance to the distinction between near- and offshore outsourcing projects as the domain literature increasingly points to the differences between the two (King et al. 2008).

In the IT outsourcing domain, there have been several studies focusing on *geographic dispersion* between client and vendor (Carmel and Agarwal 2002; Espinosa, DeLone and Lee 2006; Rao 2004). In contrast to offshore locations which are by definition anywhere outside the client's home country and therefore mainly associated with a significant spatial distance, nearshore locations are mainly associated with geographical proximity to the client's home country (Carmel and Abbott 2007; Dibbern, Winkler and Heinzl 2008). Thus, in the context of global IT outsourcing projects geographic dispersion is likely to increase the complexity for offshore outsourcing project teams to a greater extent than for nearshore outsourcing project teams.

This cause-effect-relationship also holds true for *national culture diversity* being a largely discussed phenomenon in the IT outsourcing research (Carmel et al. 2007; Heeks, Krishna, Nicholson and Sundeep 2001; Krishna, Sahay and Walsham 2004; Nicholson and Sahay 2001; Rao 2004). Frequently, cultural differences in the offshore context are perceived to be more significant than in the nearshore context (Carmel et al. 2007; Rao 2004). However, *organizational culture diversity* can be expected for both nearshore and offshore arrangements, based on the fact that global IT outsourcing projects per definition involve multiple organizations, i.e. the client and the vendor organizations.

Based on this argumentation, we also presume a lack of *prior shared work experience* for both nearshore and offshore outsourcing project teams; moreover, the team building process may be exacerbated through the in many cases disparate goals of the parties (Holmström Olsson et al. 2008), resulting in an increased degree of complexity for both project teams likewise.

With regards to *professional culture diversity* arising in cross-functional teams we have not found any indications in the domain literature. However, concerning the *team size*, preliminary findings from a longitudinal case study in the banking industry indicate the risk of an unplanned increasing team size due to unforeseen efforts and insufficient competence level of the service provider (Gregory and Prifling 2008). Taking into account that nearshore locations often lack appropriate professional experience as they are just evolving to become a well-developed market for IS outsourcing services (Rao 2004), we presume the risk of an oversized project team to be higher in near- than in offshore outsourcing projects resulting in a potential increase in the degree of complexity especially for nearshore outsourcing projects.

Referring to the stability of the team setup we have not found any suggestion regarding in- or decreased *membership stability* in project teams being involved in nearshore arrangements. However, for offshore outsourcing projects there are in fact indications for decreasing member stability. India, for example, has established itself as an offshore outsourcing market featuring professional know-how in the outsourcing business since many years. Nevertheless, due to an increased competition for qualified resources the countries' firms are now facing high turnover rates (Lacity, Iyer and Rudramuniyaiah 2008) which may also negatively impact the resource continuity in offshore outsourcing projects with this country and thus increase complexity for project teams.

We expect same increasing effect in the degree of complexity from *task interdependence* due to the complexity of technology as well as the level of detail in the contracts (Holmström Olsson et al. 2008). Furthermore, task interdependence has been found to effect global IT outsourcing projects on various levels (Slepniov and Waehrens 2007).

Finally, we assume a decreasing effect on the degree of complexity from the characteristic *task or project duration* as IT outsourcing relationships are usually intended to be long-term relationships (Goles et al. 2005).

To our knowledge, the IT outsourcing literature does not contain any statements regarding *members' assignments* in global IT outsourcing projects. Nevertheless we include this characteristic into the subsequent model development as it obviously constitutes an important characteristic of virtual teams and we have no reason to believe that this is not valid for a special form of virtual teams, i.e. global IT outsourcing project teams.

In summary, the results of the analysis essentially suggest that nearshore and offshore outsourcing project teams represent not only a specific, but a notably complex configuration of a GVT configuration. A probable lack of prior shared work experience, high task interdependence, and different organizational cultures increase the degree of complexity for both near- and offshore outsourcing projects, only mitigated through task or project duration. Comparing the attributes of near - and offshore outsourcing project teams, we find geographic dispersion and national culture differences being more favorable in a nearshore outsourcing arrangement. However, there might be a bigger risk of oversized teams. Offshore outsourcing projects on the other hand seem to be especially prone to a lack of membership stability.

Conflict Antecedents in Global IT Outsourcing Projects

In order to deductively develop a model of conflict in near- and offshore outsourcing projects, we use Hinds et al.'s dynamic model of conflict and performance on distributed teams as a starting point. Evaluating conflict in distributed teams the researchers focus on distance and technology mediation as the two primary conflict antecedents (Hinds et al. 2003). We intend to broaden this view based on our above analysis indicating that a couple of other factors may also contribute significantly to the emergence of conflict in near- and offshore outsourcing project teams. Thus, we transfer the existing model of conflict in distributed teams to the IT outsourcing domain and enhance our understanding of conflict in global IT outsourcing projects by additional near- and offshore outsourcing specific characteristics from our analysis above. Figure 1 depicts the resulting model.

Addressing our first research question (RQ1), we interpret the key characteristics with an increasing effect on the degree of complexity as conflict antecedents being specific to near- and offshore outsourcing projects. Generally speaking our analysis indicates that geographic dispersion, lack of prior shared work experience, lack of membership stability, task interdependence and cultural diversity cause conflict of all types in near- and offshore outsourcing projects. This understanding is captured in the following propositions (see also Figure 1).

Proposition 1a: *Geographic dispersion causes conflict in near- and offshore outsourcing project teams.*

Proposition 1b: *Lack of prior shared work experience causes conflict in near- and offshore outsourcing project teams.*

Proposition 1c: *Lack of membership stability causes conflict in near- and offshore outsourcing project teams.*

Proposition 1d: *Task interdependence causes conflict in near- and offshore outsourcing project teams.*

Proposition 1e: *Cultural diversity (national, organizational, and professional) causes conflict in near- and offshore outsourcing project teams.*
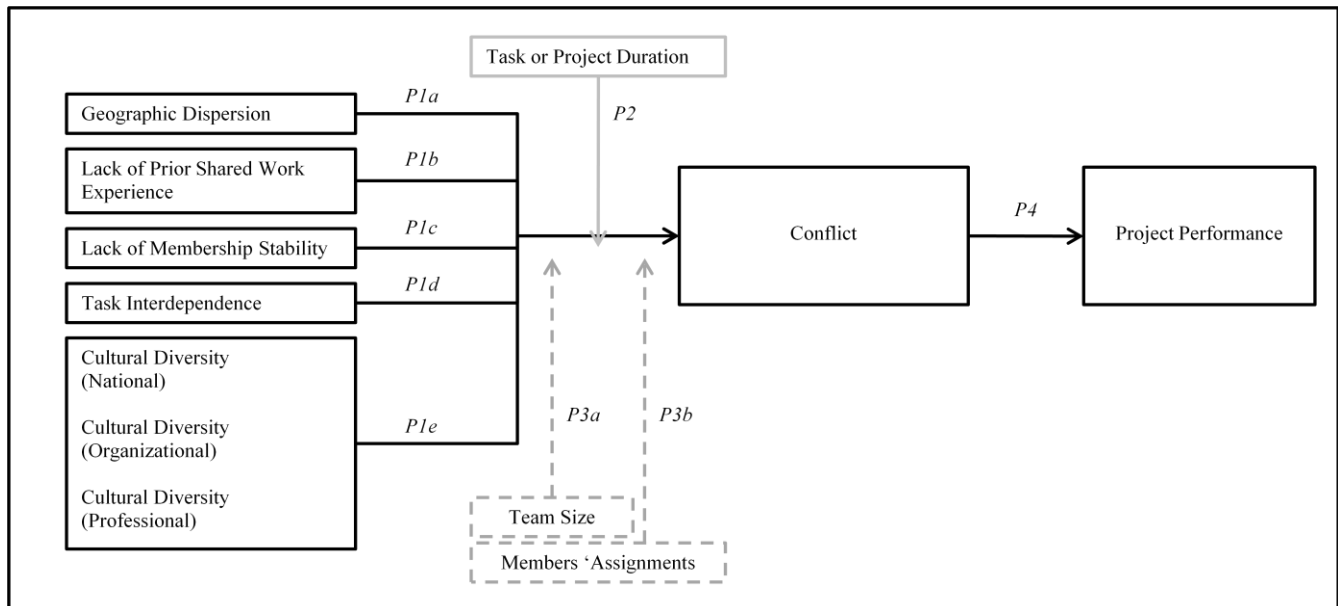
Figure 1: Conflict in Global IT Outsourcing Projects

The remaining characteristics 'task or project duration', 'team size', and 'members assignments' are incorporated into the model in form of moderation effects between conflict antecedents and project conflict. Based on our analysis above we thereby expect task or project duration to mitigate the emergence of conflict. Hence, we presume that the characteristic 'task or project duration' moderates the effect of the identified conflict antecedents on the different types of conflicts such that the effect of the conflict antecedents is stronger, when 'task or project duration' is short than when it is long, as is reflected in our next proposition (see also Figure 1).

Proposition 2: *The shorter the task or project duration the stronger the project team perceives negative the of the conflict antecedents on project conflict.*

A likewise moderating effect we expect also from the characteristics 'team size' and 'members assignment': both, an increasing team size as well as an increasing number of members working on a part-time basis in the project, increase the negative effect of the identified conflict antecedents on conflict, as is captured in our final propositions (see also Figure 1).

Proposition 3a: *The bigger the team size the stronger the project team perceives the effect of the conflict antecedents on project conflict.*

Proposition 3b: *The more team members have a part-time assignment the stronger the project team perceives the effect of the conflict antecedents on project conflict.*

With regards to the influence of conflict on project performance, we expect a negative effect based on the above presented findings from GVT research. Therefore we introduce the following proposition in order to address our second research question (RQ2).

Proposition 4: *Conflict will negatively influence the performance of near- and offshore outsourcing project .*

Limitations

There are several limitations to be taken into account. First, it should be recognized that the model depicted above has been deductively derived from the existing literature. No empirical data was at our disposal to challenge and complement the concept. Thus, the findings may miss dimensions that are influencing the model in practice but are not captured in the scientific literature yet. Second, it should be kept in mind that we have based our analysis on a scarce literature basis with regards to both conflict in global IS outsourcing projects as well as the nearshore phenomenon.

Conclusion

This paper is the first attempt to develop a comprehensive model to understand the origins and impact of conflict when managing global IT outsourcing projects. To our knowledge this topic has only been discussed marginally in previous literature. By applying findings from GVT research, we are able to offer a deeper understanding of near- and offshore outsourcing project teams being a specific and highly complex form of GVT. Furthermore, we provide insights into project-specific conditions that may cause conflict in global IT outsourcing projects. By doing so, we hope to lay the grounds for the development of a comprehensive framework on conflict in global IT outsourcing projects.

The paper makes two main theoretical contributions: firstly, it illustrates the specific configuration of global IS outsourcing project teams against the background of GVT. Secondly it deductively develops a model depicting the cause-effect-relationship between near- and offshore-specific conflict antecedents, moderating factors, conflict, and project performance.

In addition, the paper offers a set of practical contributions. First of all, based on the understanding that near- and offshore outsourcing projects are particular receptive to conflict as to their specific configuration, project managers in global IT outsourcing projects are well advised to enhance their project management skill set with appropriate conflict handling strategies. Moreover, knowing the potential sources of conflict in near- and offshoring projects facilitates the identification of the project-specific conflict risks and enables the project manager to take an initial preventive action by creating the respective awareness within the project team.

OUTLOOK ON WORKSHOP PRESENTATION

In the course of the workshop we would like to present our view on near- and offshore outsourcing project teams as a highly complex form of GVT as well as the current status of the research model. Particularly, we seek for feedback and support in

order to validate and further explore today's model. Furthermore, we consider the workshop participation to be a highly interesting opportunity in order to discuss the model and its propositions with regards to the relative importance of the individual conflict antecedents as well as their interplay between each other and with the moderating variables.

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