Boundary Spanning and the Differentiated Effects of IS Project Deviations

Completed Research Paper

Kurt Schmitz
University of Texas at Arlington
kurt.schmitz@mavs.uta.edu

Abstract

In environments where risk planning does not eliminate disruptions, advancing risk management requires an improved understating of the relationships among different types of deviations. This empirical study of IT professionals in a single organization differentiates requirements fluctuations, staff fluctuations and technology fluctuations to reveal distinct performance effects from challenges emerging from different domains of the IS Project work system. Data in this setting also reveal important moderating influences from the locus of initiation (either internal or external to the core project team). These findings integrate boundary spanning theory with the IS project risk management literature to provide explaining insight to the role of communication and knowledge transfer for IS projects faced with emergent disruptions.

Introduction

Investigators seeking to expose the causes of Information Systems (IS) project failure have attempted to identify success factors (Kappelman et al. 2006; Sabherwal and Robey 1995; Zmud 1980) and risk factors (Barki et al. 1993; Tesch et al. 2007; Wallace et al. 2004). Having identified risk management as a recurring success factor (Barki et al. 2001; Benaroch 2002), the literature recommends a litany of best practices (Austin and Devin 2009; Boehm 2002; MacCormack et al. 2001; Pich et al. 2002; Soderholm 2008) that too often fail to produce desires results (de Bakker et al. 2010; Keil et al. 1994; Kutsch and Hall 2005; Pender 2001).

Risk management planning will at some point suffer from diminishing returns as infinite imagination and resources are needed to foresee and mitigate all possible challenges (Wearne 2006). Indeed, unexpected events and challenges are inevitable for all but the most trivial IS projects (Pavlak 2004). Deviations are emergent risks that demand action not envisioned when initiating and planning a project (Hallgren and Soderholm 2010; Watson-Manheim et al. 2012). Improving IS project performance in dynamic environments requires understanding and improvement of within-project responses by individual participants to emergent issues. This motivates a focus on the relationships among different types of emergent challenges. While many schemes have been proposed to classify the source domains for risk (Lyytinen et al. 1998; Spencer and Hine 2005), the IS and Project Management (PM) literature has not yet explored the compounding impacts and relationships among different sources of disruption.

The categorization model based on the Work Systems Model (Alter and Sherer 2004) broadly subsumes other risk and factor classifications. The work system framework organizes IS project risks based on the nine elements of a work system. Four elements are internal to the work system project team (work practices, participants, information and technologies) and five are external (customers, products and services, environment, strategies, and infrastructure). This classification recognizes the distinct role of each work system element. Fluctuations emerging from each work system domain may have a different relationship to IS project performance and involve unique responses that are not addressed by blanket success factor prescriptions.

The Work Systems Framework views an organization as a group of work systems that are sometimes nested (Alter 2006). Systems theory highlights the interaction between a units and their environment (Boulding 1956). Systems theory posits that the behavior of individual units is explained by its internal
system relationships induced by different environmental stimuli. The stratification of levels presented by systems theory highlights the importance of the locus of risk emergence: whether issues emerge internal or external to the core project work system. The hierarchy of system levels suggests boundary spanning and communication channels within or across levels may moderate the impact of each type of disruption.

This study seeks to address two research questions:

1. What performance effects are associated with deviations emerging from different elements of the project work system?
2. Does the locus of risk emergence moderate the performance impact of deviation events?

This paper provides a theoretical review of emergent risk and boundary spanning in section two. This is followed by the development of a research framework with associated hypotheses in section three. Section four presents a survey based research design. Section five details the analysis of results and presents findings. The final sections present a discussion of implications and limitations followed by a conclusion.

Theoretical Background

Emergent Risk

IS project risk management and planning begins with efforts to identify risks that are detrimental to project performance. This starting point of “initial risk” involves potential problems or disruptions that a project may face but have not yet been realized (Hallgren and Maaninen 2005).

Once a project activity is underway, some risks become manifest in the form of actual events. These so called “emergent issues” can present a project with a discontinuity that causes a project crisis (Gareis 2006). Such disruptions interrupt normal operations creating confusion, disorder or displacement (Madni and Jackson 2009). These emergent events are the phenomenon of interest for this study.

One response to the inevitable issue of scope and requirements change is to apply iterative and incremental practices (Boehm 1986; Larman and Basili 2003) such as those emphasized by Agile methodologies (Beck 1999; Takeuchi and Nonaka 1986). Project disruptions can, however, emerge from internal and/or external domains including technology, team resources, the host organization and the user/customer environment (Barki et al. 2001; Benaroch et al. 2006).

Beyond classifying the source of disruptions, other scholars have pursued understanding the nature of risk. Daft and Lengel (1986) offer a two dimensional Uncertainty / Equivocality framework where uncertainty is the absence or incompleteness of information and equivocality relates to the ambiguity of information that does exist. Similar conceptualization (De Meyer et al. 2002; Pich et al. 2002) prescribe strategies for dealing with unknown-unknowns based on the events emerging from ambiguity or complexity. These schemes highlight the role of knowledge and understanding. A key insight is that managing risk depends upon the availability and transfer of information (Regev et al. 2006).

Boundary Spanning

This landscape of emergent disruptions originating from a broad range of domains is compounded by boundaries that hide or obscure understanding and delay or undermine the response of project participants. The theoretical constructs of Loosely Coupled Systems (Weick 1976) and Boundary Spanning guide the mechanisms of information and knowledge transfer central to the tendencies of IS project teams faced with unexpected challenges. Through a process of interaction and self-identification, individuals bond with their group, forming a sense of membership, satisfaction and group cohesiveness (Hackman 1987). Groups develop communication shortcuts and transactive memory that increase team efficiency (Wittenbaum et al. 1998). These shortcuts of local jargon, gestures and idiosyncrasies are covert in nature and may confuse outsider and delay knowledge integration across boundaries and thereby increase isolation (Carroll et al. 2008). Organizational boundaries, either hierarchically between a team and management or functionally between distinct teams and service organizations with different goals and objectives, decouple subunits to undermine the ties needed for effective communication (Orton and Weick 1990). In addition, contextual and process boundaries provide guidance to team members on where to
focus their attention (Watson-Manheim et al. 2012), creating blind spots that can hide unexpected challenges originating from the periphery.

Boundaries have a direct implication for managing emergent issues as awareness to breakdown, challenge, change and innovative solutions can become localized. Key information and knowledge from outside the team must navigate the boundary to become visible to the project members. Information and disturbances emerging from outside the boundaries represent data that is misaligned and inconsistent with participant memory models (Orton and Weick 1990). Not only must the message arrive, but the teams must also recognize the importance of information that may not conform to group jargon or arrive at a time and place where team processes are able to absorb it.

**Research Framework**

Risks and deviations are important because of their relationship to the four most important criteria for assessing project performance: time (schedule), cost (resources), scope (functionality) and quality (Agarwal and Rathod 2006; Jugdev and Muller 2005; Wateridge 1998). These measures relate to standards of performance that may be objectively observed and reported by participants without the need to infer subjective opinions of satisfaction or wait for the emergence of strategic organization benefit. The first three items are commonly used to measure project success (Lee and Xia 2010; Shenhar et al. 2001). Participants making tradeoffs for troubled projects also understand that compromises can reduce quality even as baseline function, cost and time goals are met. Quality is therefore an appropriate supplement for an aggregate reflective construct of project performance used in some studies (Chandrasekaran and Mishra 2012).

The term fluctuation or flux is used here to broadly represent the ideas of project deviations, unexpected challenges and emergent issues that have a disruptive influence on project outcomes. Fluctuations can emerge from many IS risk domains including the technology, team resources, the host organization and the user/customer environment (Barki et al. 2001; Benaroch et al. 2006). This study seeks to demonstrate the distinct impact dynamics of fluctuations emerging from three areas easily understood by IS project participants: requirements fluctuation associated with customer and products & services project domains, staff fluctuation associated with the participant's domain and technology fluctuation associated with the infrastructure and technology domains. These constructs defined in the following paragraphs provide the focal independent variables in this study.

**Requirements Fluctuation**

Requirements fluctuations have been identified by many scholars as a major factor that can impact project performance (Boehm 1991; Keil et al. 1998; Schmidt et al. 2001). Fluctuations of this type involve frequently changing requirements as well as requirements that are incorrect, unclear, inadequate, ambiguous, or unusable (Liu et al. 2010; Wallace et al. 2004). Practitioners recognize the disruptive potential of changing requirements and prescribe a variety of strategies to manage and mitigate these events.

Aggressive user engagement with formally approved requirements documents and rigorous change management processes are common among highly structured projects (Abran and Borque 2004; Forsberg et al. 2000). Agile projects employ incremental development and iterative release approaches that encourage requirements changes to improve IS system quality (Fowler and Beck 1999). Regardless of the methodological practices employed, requirements fluctuations must be recognized by participants in a timely manner and accommodated. This requires individuals to apply new effort to understand and adjust tasks and activities that are underway. New mental models are needed across members. Effective response involves altered designs, different decisions and new tasks. The direct effect on project process performance measured in time, cost and functional quality is expected to be negative. Therefore:

H1a: Requirements Fluctuation (RF) has a negative relationship with IS Project Performance (PERF).

**Staff Fluctuation**

Staffing volatility includes insufficient staffing, people who are not available when they are needed, and turnover of key participants (Keil et al. 1998; Schmidt et al. 2001). In addition to attrition this risk area
includes insufficient knowledge, cooperation and motivation (Liu et al. 2010). Poor performance and inconsistent availability of core team members can be a source of significant disruption for an IS project that is faced with having to reestablish or stabilize mental models, coordination schemes and team self-efficacy (van der Vegt et al. 2010; Wageman et al. 2012). The direct effect on project process performance is expected to be negative. Therefore:

H1b: Staff Fluctuation (SF) has a negative relationship with IS Project Performance (PERF)

**Technology Fluctuation**

Technology fluctuations have been identified by many scholars as a major factor that can impact project performance (Liu et al. 2010; Lyytinen et al. 1998). This risk factor is variously characterized as technology newness (Barki et al. 1993; McFarlan 1981) or novelty and complexity (Gemino et al. 2008; Zmud 1980). Short term tactical problems with technology are central to the specific system being implemented and include software bugs, infrastructure service lapses, data issues, connectivity challenges and compatibility problems the project must resolve before completing an implementation. Solutions depend upon acquiring new information, revisiting previous decisions, and applying increased effort to creating new solutions. Increasing the effort required to achieve an objective has a direct negative impact on process performance. Tatikonda and Rosenthal (2000) showed that technology novelty and complexity are negatively associated with new product development project success, suggesting the same can be expected for IS implementation projects. Therefore:

H1c: Technology Fluctuation (TF) has a negative relationship with IS Project Performance (PERF)

**Locus of Flux**

Teams treat within work system deviations as operational, and expect to address them (Hallgren and Wilson 2007). However, challenges often originate outside work unit boundaries (Chong and Siino 2006) and are beyond the core team’s domain of routine and focus of attention. These challenges cross the boundary that separate the core-team from the extended team, parallel project teams, service departments, vendors and the larger organization. Situational awareness that is critical for decision making and performance, particularly in complex environments (Foltz et al. 2008) degrades where boundaries delay perceiving and comprehending information (Sonnenwald et al. 2000). External interruptions are imposed on the decision making and task performing processes of participants and represent a factor with different moderating influence on fluctuations from different sources.

The idea that challenges, uncertainty and change are different when they are internal versus external has been documented by scholars in the related areas of IS investment (Wu and Ong 2008) and construction projects (Sun and Meng 2009). The expectation of a similar relationship for IS implementation a project leads to:

H2: External Locus of Flux (ExLOF) has a negative relationship with IS Project Performance (PERF)

The interaction of fluctuations may also be nuanced, with different types of interruptions having different compounding effects when considering the dynamics of boundary spanning. For example, technology related interruptions have a negative influence on knowledge transfer, whereas change in team structure can positively influence knowledge acquisition (Zellmer-Bruhn 2003).

When considering requirements fluctuations, prospective system users participating directly in a project team bring an evolving understanding of a system through repeated interaction episodes (Highsmith and Cockburn 2001). Close and regular contact with the project allows the team to recognize and respond with change plans in a relatively orderly manner. Externally imposed scope changes, such as adding entirely new user communities at additional geographic locations, represent unexpected events that demand action not envisioned when planning new projects (Wearne 2006). It is therefore expected that requirements fluctuations with an external origin may have significantly larger negative effects. Therefore:

H3a: External Locus of Flux (ExLOF) has a moderating effect on Requirements Flux (RF) that amplifies the negative relationship to IS Project Performance (PERF)
The locus of change for team membership may have very different impacts on team performance. A member who is absent due to illness or vacation (an event occurring within the local context of a team) is expected to have a negative impact on team performance. However, management action to replace a poorly performing member is likely to have a beneficial effect. The externally initiated management intervention allows new skills to be introduced to a team and facilitates boundary spanning for members that bring new relationships and contacts into a team. Membership change can be beneficial for group learning and performance as it increases a group’s knowledge stock (Kane et al. 2005) and can stimulate the creative process in groups and enhances group creativity (Choi and Thompson 2005). Therefore:

H3b: External Locus of Flux (ExLOF) has a moderating effect on Staff Flux (SF) that attenuates the negative relationship to IS Project Performance (PERF)

The locus of risk for technology change is relevant to project teams focused on a task with an agenda. The focus of attention, data gathering, discussion, problem solving and creative exploration are centered on the primary task. When issues arise within the focal activities of the team, these disruptions can be interpreted and understood in the context of the active memory models. When technology challenges arise from beyond the arena of focused attention, the team is faced with multiple challenges that start with recognizing the issue. With attention focused elsewhere, there may be a delay in appreciating the implications of disruptive information. Once the unexpected challenge is recognized, the team must shift a portion of its energies to building a new memory model that assimilates deviations in to the solution. Therefore:

H3c: External Locus of Flux (ExLOF) has a moderating effect on Technology Flux (TF) that amplifies the negative relationship to IS Project Performance (PERF)

The full research model of this study is presented in Figure 1.

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**Research Design**

This study employed a web survey to collect empirical data for testing the hypothesis. Instruments used in this study were adapted to fit the context of this study from validated scales used in previous research where available. Project performance utilizes a scale employed by Chandrasekaran and Mishra (2012). Requirements flux utilizes a scale from Wallace, Keil and Rai (2004). Staff flux builds an aggregate scale employing measures introduced by Carbonell and Rodriguez (2006) supplemented by items from Gopal and Gosain (2010). An existing survey scale introduced by Imamoglu and Gozlu (2008) has been adapted for Locus of Flux. Technology Flux has been widely conceptualized as an organization level phenomenon involving emerging and evolving technologies across an industry. Theses scales are not suitable for this study that examines technology flux at the tactical project level. As a result a new scale has been developed based on an assessment of 16 semi-structured interviews with members of four IS project teams. These assessments were also used to supplement requirements flux and staff flux scales. Several items were reverse coded to maintain motivation and cognitive engagement. In addition to the research
variables shown in Table 1, demographics and controls were included to capture the covariance associated with relevant factors not directly substantive to the proposed theory.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Load</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IS Project Performance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PERF1 This project completed in estimated time relative to its goals.</td>
<td>4.134</td>
<td>1.624</td>
<td>0.816</td>
<td>&lt; 0.000</td>
</tr>
<tr>
<td>PERF2 This project completed within estimated cost relative to its goals.</td>
<td>4.187</td>
<td>1.427</td>
<td>0.664</td>
<td>&lt; 0.000</td>
</tr>
<tr>
<td>PERF3 This project completed all functionality relative to its goals.</td>
<td>4.612</td>
<td>1.287</td>
<td>0.787</td>
<td>&lt; 0.000</td>
</tr>
<tr>
<td>PERF4 This project completed all promised quality.</td>
<td>4.739</td>
<td>1.082</td>
<td>0.762</td>
<td>&lt; 0.000</td>
</tr>
<tr>
<td><strong>Requirements Flux</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RF1 System requirements were not adequately identified. (WKR)</td>
<td>3.014</td>
<td>1.369</td>
<td>0.778</td>
<td>&lt; 0.000</td>
</tr>
<tr>
<td>RF2 Requirements never changed during the project. (new) (rev.coded)</td>
<td>4.260</td>
<td>1.280</td>
<td>0.672</td>
<td>&lt; 0.000</td>
</tr>
<tr>
<td>RF3 System requirements frequently needed correction. (WKR)</td>
<td>3.274</td>
<td>1.283</td>
<td>0.855</td>
<td>&lt; 0.000</td>
</tr>
<tr>
<td>RF4 Overall, requirements changes were highly significant. (new)</td>
<td>3.233</td>
<td>1.505</td>
<td>0.903</td>
<td>&lt; 0.000</td>
</tr>
<tr>
<td><strong>Staff Flux</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SF1 All project team members worked full time on this project, with no other work assignments. (C&amp;R)(rev. coded)</td>
<td>5.096</td>
<td>1.056</td>
<td></td>
<td>Removed (p-value = 0.464)</td>
</tr>
<tr>
<td>SF2 Member participation level continually changed due to non-project activities. (new)</td>
<td>4.384</td>
<td>1.401</td>
<td>0.465</td>
<td>0.006</td>
</tr>
<tr>
<td>SF3 Turnover of key project team members was common. (G&amp;G)</td>
<td>3.822</td>
<td>1.388</td>
<td>0.926</td>
<td>&lt; 0.000</td>
</tr>
<tr>
<td>SF4 Overall, member changes were highly significant. (new)</td>
<td>3.123</td>
<td>1.481</td>
<td>0.848</td>
<td>&lt; 0.000</td>
</tr>
<tr>
<td><strong>Technology Flux</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TF1 Technology problems occurred frequently during this project.</td>
<td>3.753</td>
<td>1.579</td>
<td>0.912</td>
<td>&lt; 0.000</td>
</tr>
<tr>
<td>TF2 Designs changed frequently to accommodate technology problems.</td>
<td>3.370</td>
<td>1.359</td>
<td>0.819</td>
<td>&lt; 0.000</td>
</tr>
<tr>
<td>TF3 Functional capabilities were removed or deferred due to technology problems.</td>
<td>3.219</td>
<td>1.446</td>
<td>0.774</td>
<td>&lt; 0.000</td>
</tr>
<tr>
<td>TF4 Overall, technology problems were highly significant</td>
<td>3.370</td>
<td>1.594</td>
<td>0.870</td>
<td>&lt; 0.000</td>
</tr>
<tr>
<td><strong>External Locus of Flux</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOF1 To what extent was the cause of issues and challenges something controlled by the core project team? (rev. coded)</td>
<td>4.041</td>
<td>1.504</td>
<td>0.839</td>
<td>&lt; 0.000</td>
</tr>
<tr>
<td>LOF2 To what extent was the cause of issues and challenges something to do with actions or responsibilities within the core project team? (rev. coded)</td>
<td>4.301</td>
<td>1.401</td>
<td>0.759</td>
<td>&lt; 0.000</td>
</tr>
<tr>
<td>LOF3 To what extent was the cause of issue and challenges something to do with the people or circumstances outside the core project team?</td>
<td>4.137</td>
<td>1.575</td>
<td>0.767</td>
<td>&lt; 0.000</td>
</tr>
</tbody>
</table>

Table 1: Measurement model statistics
Email requests were delivered to 304 professionals within a single global IS organization operating in the life-sciences industry. A single organization study allows soliciting input from a very high percentage of the population of full time IS staff while simultaneously controlling for variation in organization culture related to project management methods, organizational hierarchy, geography, regulatory environment and numerous other potential covariates. While this scope limits the generalizability of results, it provides an efficient setting for an initial exploration of the constructs in question.

A total of 73 responses were qualified for inclusion in this analysis for a response rate of 24%. Table 2 details demographic findings that suggest an IS staff with extensive experience.

<table>
<thead>
<tr>
<th>Age</th>
<th>%</th>
<th>Years of experience</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 24</td>
<td>0%</td>
<td>&lt;1</td>
<td>5%</td>
</tr>
<tr>
<td>25-34</td>
<td>4%</td>
<td>1-2</td>
<td>5%</td>
</tr>
<tr>
<td>35-44</td>
<td>30%</td>
<td>3-4</td>
<td>11%</td>
</tr>
<tr>
<td>45-54</td>
<td>44%</td>
<td>5-10</td>
<td>30%</td>
</tr>
<tr>
<td>55+</td>
<td>22%</td>
<td>10+</td>
<td>45%</td>
</tr>
</tbody>
</table>

**Table 2: Demographics**

**Results**

The measures and research model were analyzed using the SmartPLS (Ringel et al. 2005) implementation of PLS-SEM. Conclusions for hypotheses are assessed at α=0.05 level of significance common for the behavior sciences. A bootstrap resampling technique that is robust where data is not normally distributed is used to calculate the standard error and determine probability levels for hypothesis testing.

PLS-SEM allows simultaneous testing of the measurement and path model. One measure (SF1) was removed due to low indicator reliability. All other measures demonstrate construct validity using criteria and thresholds recommended for IS research (Gefen and Straub 2005). Item loading are above the acceptable threshold of 0.4 and statistically significant at the α=0.05 level. Internal consistency and reliability is supported by Composite Reliability (CR) scores above 0.7. Convergent validity is supported by average variance extracted (AVE) scores above 0.5. Discriminant validity is supported by a Square-Root of AVE for each latent variable larger than the highest correlation with other latent variables. Table 1 details item level statistics and Table 3 provides statistics for latent factor constructs.

<table>
<thead>
<tr>
<th>Perf</th>
<th>RF</th>
<th>SF</th>
<th>TF</th>
<th>ExLOF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perf</td>
<td>[0.76]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RF</td>
<td>-0.54</td>
<td>[0.81]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SF</td>
<td>-0.42</td>
<td>0.67</td>
<td>[0.77]</td>
<td></td>
</tr>
<tr>
<td>TF</td>
<td>-0.46</td>
<td>0.30</td>
<td>0.28</td>
<td>[0.85]</td>
</tr>
<tr>
<td>ExLOF</td>
<td>-0.08</td>
<td>0.01</td>
<td>-0.01</td>
<td>0.12</td>
</tr>
<tr>
<td>AVE</td>
<td>0.58</td>
<td>0.65</td>
<td>0.60</td>
<td>0.71</td>
</tr>
<tr>
<td>Comp. Reliability</td>
<td>0.94</td>
<td>0.96</td>
<td>0.90</td>
<td>0.96</td>
</tr>
<tr>
<td>Communal</td>
<td>0.90</td>
<td>0.89</td>
<td>0.77</td>
<td>0.95</td>
</tr>
</tbody>
</table>

**Table 3: Latent factor statistics**

For the structural model, a bootstrapping technique has been used to calculate significance levels for each path coefficient. Demographic variables of age and experience do not have a significant relationship with performance and are omitted from the final structural model. Control variables for geographic distribution of project team member, geographic spread of users, and technology new to the organization are not significant and are omitted from the final structural model. Control variables for team size (β=-

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1 SmartPLS 2.0.M3 settings for estimation are as follows: Mean replacement of missing data, Centroid weighting, Original data metric, Individual sign changes, and 100 bootstrap repetitions.
0.138, p-value=0.005, $f^2=0.05$) and project duration ($\beta=-0.196$, p-value=0.012, $f^2=0.10$) have a statistically significant relationship with performance and are included in the final structural model. Overall, the model explains 61% of the variance in project performance, suggesting good explanatory power.

Results for substantive constructs of the research model are summarized in Table 4. While all three forms of fluctuations have negative associations with performance, only Requirements Flux and Technology Flux are statistically significant, supporting H1a and H1c. The data does not support a direct association between Staff Flux and performance, leading to rejection of H1b. Similarly the data does not support a direct association between Locus of Risk and Performance, leading to rejection of H2.

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>path coefficient</th>
<th>p-value</th>
<th>Std Error</th>
<th>$f^2$</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1a: RF (-) → PERF</td>
<td>-0.39</td>
<td>&lt; 0.000</td>
<td>0.10</td>
<td>0.39</td>
<td>Accept</td>
</tr>
<tr>
<td>H1b: SF (-) → PERF</td>
<td>-0.06</td>
<td>0.251</td>
<td>0.08</td>
<td>0.01</td>
<td>Reject</td>
</tr>
<tr>
<td>H1c: TF (-) → PERF</td>
<td>-0.26</td>
<td>0.002</td>
<td>0.09</td>
<td>0.17</td>
<td>Accept</td>
</tr>
<tr>
<td>H2: ExLOF (-) → PERF</td>
<td>-0.09</td>
<td>0.127</td>
<td>0.08</td>
<td>0.02</td>
<td>Reject</td>
</tr>
<tr>
<td>H3a: RF * ExLOF (-) → PERF</td>
<td>0.09</td>
<td>0.101</td>
<td>0.08</td>
<td>0.02</td>
<td>Reject</td>
</tr>
<tr>
<td>H3b: SF * ExLOF (+) → PERF</td>
<td>0.28</td>
<td>0.004</td>
<td>0.10</td>
<td>0.20</td>
<td>Accept</td>
</tr>
<tr>
<td>H3c: TF * ExLOF (-) → PERF</td>
<td>-0.24</td>
<td>0.008</td>
<td>0.10</td>
<td>0.15</td>
<td>Accept</td>
</tr>
</tbody>
</table>

Table 4: Results of Hypothesis Testing

While it lacks a direct association with performance, Locus of Flux has a variety of insightful moderating influences. The data does not support Locus of Flux as a moderator of Requirements Flux (H3a is not supported in this setting), suggesting that the methods and practices employed in this organization to deal with requirements fluctuations are equally ineffective for requirements flux originating from users representative assigned to the core team as well as scope changes originating externally.

In this setting the data supports a moderation effect of External Locus of Flux on staff fluctuations, revealing a positive association with performance that supports H3b. The implication is that management interventions to change team membership have an overall beneficial relationship to project performance. The dynamic of introducing new knowledge, skills and abilities, as well as removing less effective team members can be beneficial.

Technology fluctuation is negatively associated with project performance, supporting H1c. This data also supports the moderation effect whereby External Locus of Flux amplifies the negative association with performance, supporting H3c. Technology Fluctuations on the whole have a negative association with performance. This relationship is amplified when technology challenges originate outside the project team, such as in external infrastructure departments or external providers of component technologies.

Discussion

Each of the work system framework domains examined in this study as sources for deviation events demonstrate unique combinations of influence on projects when assessed with their locus of flux. Requirements and scope fluctuation has a uniformly negative association with project process performance that is not moderated by locus of flux for this dataset. Staff fluctuations lack a direct effect, but the interaction with external locus of flux as depicted in Figure 2 is a significant crossover effect suggesting that staff changes instigated by management have a demonstrable positive association with performance. Technology fluctuations similarly exhibit an interaction with locus of flux. In this setting internal technology fluctuations appear to be handled in the normal course of a project with a negligible relationship with performance, but technology fluctuations originating outside the project team have a significantly negative association with performance.
The primary contribution of this study is to begin the process of disentangling emergent risk for IS project research into distinctly measurable domains. By building upon established ideas of boundary spanning this study sets the stage for a new attack on IS project risk. In addition, this study draws boundary spanning theory explicitly into the risk management discussion. By operationalizing constructs that demonstrate the distinction between internal and external sources of change, the otherwise equivocal impact of certain changes (such as staff flux) is revealed.

This study has several implications for practitioners, starting with the insight that boundary spanning behaviors represent levers of important control for project teams. Externally initiated technology challenges can be particularly disruptive, creating significant performance stress in settings where project teams are isolated. Management initiated staff changes have significant corrective potential. Practitioners should be particularly vigilant to maintain ties across team boundaries when choosing Agile methods that have a demonstrated tendency to become isolated (Karlstrom and Runeson 2006; Pikkarainen et al. 2012).

The study also has implications for researchers. First, it articulates a framework for understanding the dynamics of deviations/interruptions and their impact on project performance. Second, it uses the conceptual underpinnings of boundary spanning and loose-coupling to provide an approach to managing projects risks. This is particularly useful as traditional risk management strategies have not been very successful in mitigating risks in IS projects. Third, this exploratory work provides opportunities for researchers to examine how disruptions in projects may differentially affect traditional and agile project management practices.

A design decision for this study limited data collection to a single organization using a single project methodology. While this choice is appropriate for an early examination of previously unexplored contingent effects involving project deviations and provides added control for unexplained covariates, it does limit generalizability of results. An opportunity for future research is to expand this investigation to the general IS project population spanning a range of organizations and multiple project methodologies.

Another design decision limited the investigation to three work system domains as sources of project deviations (requirements, staff and technology). A more complete understanding will come from studies that examine additional elements of the work system framework.

**Conclusion**

In environments where risk planning does not eliminate disruptions, advancing risk management requires an improved understanding of the relationships among different types of deviations. This empirical study of IS professionals in a single organization reveals distinct performance effects from challenges emerging from different domains of the IS Project work system. Data in this setting also reveal important moderating influences from the locus of flux. These findings emphasize the role of boundary spanning behaviors for IS projects faced with emergent disruptions.
References


Differentiated effects of Project Deviations


Differentiated effects of Project Deviations


