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Critical Project Risk Factors for Virtual Software Projects - Research in Progress

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ABSTRACT

Software development project failure continues to be an industry problem, as failure rates remain high and cost businesses billions of dollars. Virtual software development projects are essential today primarily due to increased dependence on outsourcing and offshoring. Prior research has identified challenging characteristics of virtual teams and organizations. Prior research has also been conducted on traditional software project risk and its' role in reducing project failures. However, little or no research exists on virtual project risk. The goal of this research is to develop a list of critical risk factors specific to virtual software projects. The list can then be used by industry practitioners to improve risk management and consequently reduce the incidence of project risk and project failure rates for virtual software projects. A survey questionnaire is the main research tool and participants will consist of industry practitioners; project leaders/managers and systems analysts.

Keywords

IS Project Management, IS Project Teams, IS Project Risk Management

RESEARCH OBJECTIVES AND QUESTIONS

The main objective of this research study is to identify a set of *critical* risk factors for virtual software development projects that is both comprehensive and concise. Many risk factors exist in general; however, *critical* risk factors are the focus of this research because they have the greatest impact on the successful completion of projects. Virtual software project teams, also known as distributed teams, are a relatively new arena; they refer to projects where team members are not co-located and communication is typically electronic instead of face-to-face. This research is important because of the continued high rate of software project failures, as well as the growing interest in outsourcing and offshoring. In addition to the monetary losses, there are important losses associated with project failure that cannot be measured and occur in the form of lost business opportunities, discouraged resources and even loss of positive public image. Project failure rates and the phenomenon of virtual software projects are discussed in detail below in the section entitled Research Importance.

Prior research on virtual projects does not focus specifically on risk in virtual project teams but is useful in identifying important characteristics of virtual teams and virtual organizations. Many of these characteristics can result in challenges and are therefore treated as risks such as communication, trust, culture and conflict (Grabowski et al. 1999; Hinds et al. 2003; Jarvenpaa et al. 1999). Several empirical and theoretical research studies on virtual teams were identified during the literature review phase of this research.

Prior research has been conducted on *traditional* software development project risk (Barki et al. 1993; Boehm 1991; Keil et al. 1998; Wallace 1999); however, little research has focused exclusively on identifying risks for virtual software projects. Four seminal research studies on software project risk were identified during the literature review phase of this research. Each of these four studies made use of the survey method and had as their goal, creation of a risk factor list with the hope of improving project success. However, these research studies were conducted ten to twenty years ago and were primarily focused on traditional software development projects. In the span of twenty years major changes have occurred in the way work is performed. Telecommunications improvements have made computer-mediated communication commonplace. Consequently, there have been shifts in the risks that occur as well as the introduction of new risks, all of which necessitates an update in risk research.

The model of project risk developed for this study appears in Figure 1. It illustrates there are similarities (Type 3 risks) and differences (Types 1 and 2 risks) in risk for virtual and traditional software projects. However, the focus of this research is the "Type 2" risks that are specific to virtual software projects. The resulting list of critical risk factors will serve as a guideline to IT project managers/leaders needing to create an effective risk management plan while working in a virtual team environment. Risk management in this area will likely include modified strategies for resolving risks on virtual teams. The ultimate goal of this research is to reduce or eliminate project risk on virtual software projects.

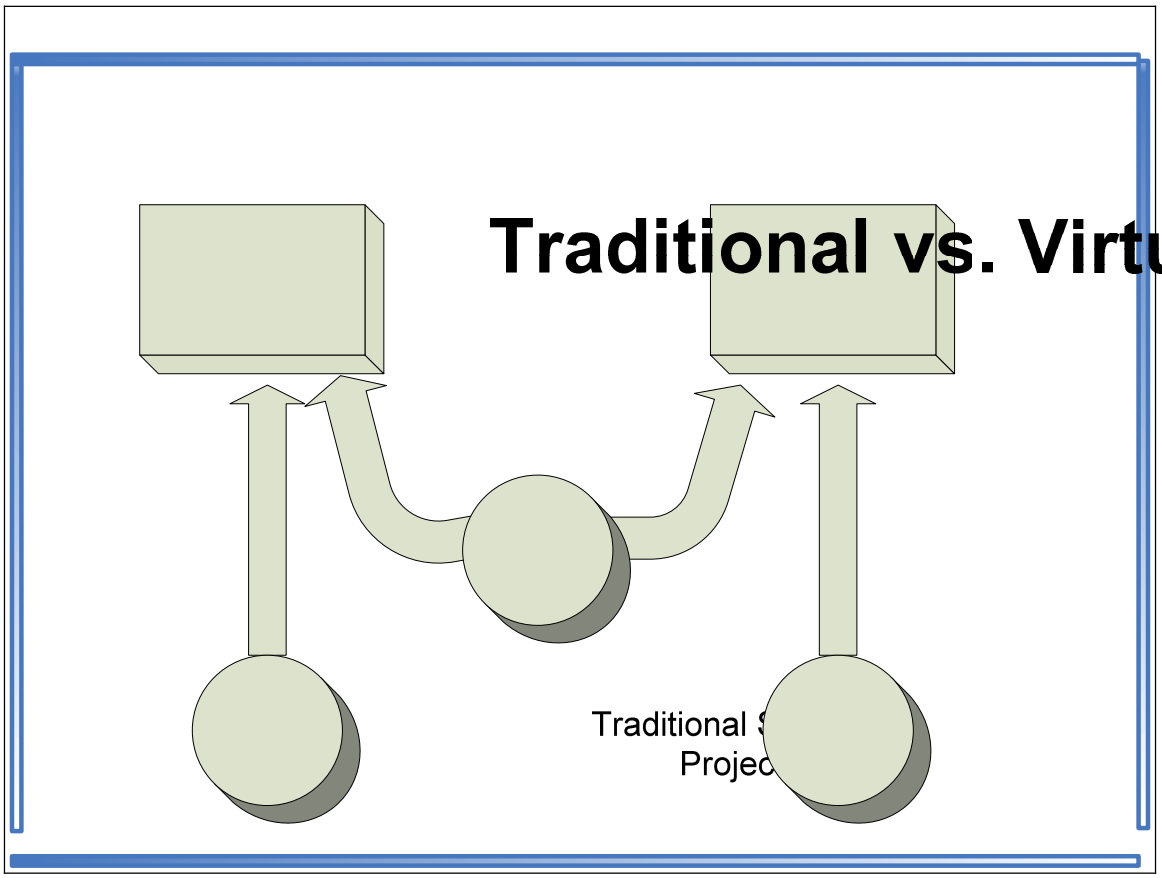

Figure 1: Project Risk Model

RESEARCH IMPORTANCE

There are several reasons why this is an important time to conduct this research. First, software project failure rates continue to be high even after years of activity. The CHAOS reports are well-known industry measures of the incidence of software project failures. They have been produced by the Standish Group through their surveys of industry practitioners in the United States and Europe since 1994. According to the 2004 CHAOS report, companies in the United States and Europe spent $255 billion on software projects while the cost of failed projects was $55 billion.(SoftwareMag.com 2004) These are staggering numbers.

Additionally, the CHAOS reports show little improvement in software project success over an eight year period from 1996 through 2004. In 1996, 27% of projects succeeded (Standish Group International 1999). In 2000, 28% of projects succeeded (Standish Group International 2001) and by the third quarter of 2004, 29% of projects had succeeded (Standish Group International 2004). Although the project success rates improved, the change was minor at only two percent. Massive monetary and non-monetary losses reinforce the need to investigate causes of project failure, especially causes having the greatest impact, i.e. critical project risks. This need is not just for projects in general, but particularly for the rapidly growing case of virtual software projects.

Type 3 Risks

Additional reasons for this research center on the way project work is being performed today. Working in a virtual environment has become important as project team members are often located in different cities, states, or countries. The increased dependence on virtual software project teams is being fueled by several driving forces, such as: offshoring, outsourcing, reduced business travel due to security concerns, and improvements in collaborative tools (Igbaria et al. 1999; Jones et al. 2005; Mayer 1998). A task force study on globalization and offshoring indicated information technology (IT) has essentially become "a global field, business, and industry"(Aspray et al. 2006). More research is needed in this area to increase the knowledge of the workings of virtual teams.

Type 1 Risks

An attractive potential bonus of virtual teams stems from the "dream team" effect, increasing the potential project resource pool by opening it up to all available company resources regardless of site or location. These type of teams have the potential of creating benefits to corporations in cost savings and improved products and services (Kirkman et al. 2005; Malhotra et al.

2005; Mayer 1998). Mayer (1998) supports this "super team" theory by saying: "companies are finding that using virtual work teams are not only more the norm but actually are most cost effective and definitely more productive".(Mayer 1998) For these many reasons, there is a need to study how the unique aspects of virtual projects relate to their success.

THEORETICAL FOUNDATIONS AND PRIOR LITERATURE

The theoretical foundation for this research lies in two areas; 1) characteristics of virtual project teams and 2) research identifying risk factors on traditional project teams. Very little research exists on virtual software project risk. However, prior research on virtual teams has focused on important characteristics which have often presented challenges. Since challenges and risks are quite similar this information will be used as theoretical support for this research study.

The most commonly researched virtual team characteristics are communication and trust; however, other characteristics are garnering more attention. Jarvenpaa (1999) conducted case study research on communication and trust in virtual global teams. The research was conducted using three hundred fifty business school master's students from twenty-eight universities to participate in a global virtual collaboration study over six weeks. The result of their research was confirmation that trust can exist in virtual teams, especially those teams relying predominantly on computer-mediated communication. The research also found many factors that have an impact on both trust and communication on virtual teams such as effective handling of conflict and skillful selection of virtual team members. One of the more interesting findings stressed the importance of the quality and predictability of communication, as opposed to the quantity of communication. Additionally, the research found virtual environments to be "bespeckled with uncertainty" (Jarvenpaa et al. 1999).

Pare and Dube (1999) conducted research to identify challenges facing virtual project teams. They investigated strategies for coping with those challenges as well. Their research consisted of conducting in-depth interviews with 20 experienced virtual team leaders and members in 14 organizations in Quebec from November 1998 to March 1999. The transcribed data was analyzed using coding techniques to identify several challenges. In their preliminary results, three challenges were identified; 1) commitment and alignment of the team, 2) team cohesion through communication and 3) coordination, control and management of a distributed team.

Other researchers used theoretical analysis to investigate virtual teams. Grabowski et al. (1999) and Hinds et al. (2003) both performed theoretical analysis on virtual teams and organizations. The result was the identification of several important virtual team characteristics that are often seen as challenges. These characteristics were in areas such as communication, culture, trust and conflict (Grabowski et al. 1999; Hinds et al. 2003).

There exists a theory from prior literature and research that identification of risk factors in a project reduces the likelihood of high negative impact. Boehm initiated the idea of the importance of focusing on the critical risks, instead of the entire pool of identified risks (Boehm 1991). Perhaps the idea here was that a small percentage of the critical risks appeared to cause the majority of the problems and have the most impact. On the other hand, the non-critical risks may have caused a bump in the project but were recoverable and rarely fatal. The general theory that project risk can lead to project failure was the driving force behind much of the research. Each of the researchers in the four seminal studies believed a risk list would help improve the rate of project failures. Prior literature also theorized about the value of risk identification on projects. Risk factor lists can serve as guides in the risk identification process which is a first step in project risk management. Boehm (1991) reviewed software project disasters and determined attention to risk could be the key to success. When referring to specific project disasters he indicated; "their problems would have been avoided or strongly reduced if there had been an explicit early concern with identifying and resolving their high-risk elements" (Boehm 1991). Other literature indicates identifying and analyzing "threats to success", can allow for appropriate actions to be taken to "reduce the chance of failure" (Wallace et al. 2004b).

The four seminal research studies on traditional software project risk focus on proper risk identification as a key to reduced project failures and are each summarized below. The earliest research was performed by Boehm who conducted a survey of experienced IT project managers who worked with him in the defense industry at TRW in the early 1990's. His research resulted in a list of "Top ten software risk items" (Boehm 1991). The goal of his research was to provide project leaders with a "checklist" to help identify and consequently resolve risk items. It is evident this research focused on production of a risk list as a means of improving risk occurrence.

Barki et al. in their research sent a questionnaire to the largest 100 companies across a variety of industries in Quebec. The result was a list of traditional software project risks grouped in five categories which they labeled risk dimensions: 1) technological newness, 2) application size, 3) lack of expertise, 4) application complexity and 5) organizational environment.(Barki et al. 1993) The purpose of their survey was to improve management of traditional software development projects by measuring their risk. It is evident this research focused on production of a risk list to measure risk which would consequently improve management of the project and presumably reduce the chance of failure.

The research conducted by Keil et al. did not use a survey, they conducted a Delphi study of forty-one experienced software project managers located in different parts of the world to identify a universal set of risk factors (Keil et al. 1998). Three separate panels were formed, one each in Finland, Hong Kong and the U.S. The participants identified and ranked risk factors in order of importance. This list is important because the same eleven risk factors in the same rank order were identified in all three panels. The researchers to concluded the list was "somewhat" universal (Keil et al. 1998). The purpose of this study was to identify a framework for classifying software project risks and to then identify appropriate strategies to manage each risk. Those strategies should result in more effective risk management.

Wallace, in her research surveyed software project managers to identify risks. She used a mass distribution of a survey to the Project Management Institute Information Systems Special Interest Group (ISSIG). The result was a list of risk factors grouped in six risk categories: 1) team, 2) organizational environment, 3) requirements, 4) planning and control, 5) user, and 6) project complexity (Wallace 1999). The purpose of her study was to create an instrument for the measurement of software project risk. This study, like the study by Keil et al. focused on identifying and correctly categorizing the risks in an effort to create a customized and more effective solution. .

The brief review of prior literature above shows these four studies on project risk were predominantly concerned with traditional, rather than virtual, software projects.

RESEARCH METHODOLOGY

During this research study a set of comprehensive risk factors was assembled and these factors were categorized into groups which had been identified in prior risk literature. Several hypotheses related to these categories/groups of risk factors have been proposed. The basis for these hypotheses was found in prior literature and logical reasoning.

Hypothesis 1: Risk factors related to inadequate communication will be rated "high impact" by a majority of participants among all risk factors identified on virtual software projects. The basis for this reasoning is the likelihood of virtual projects and outsourced projects to incur similar challenges since they both often involve multiple sites of the same or different organizations. Wallace, et al. (2004) in their study of software projects found outsourced projects had a significantly higher level risk in the category of team risk, as well as planning and control risk. (Wallace et al. 2004b) This result led Wallace to theorize the cause might be due to greater challenges in team communication and coordination, especially when at least two organizations were involved.

Hypothesis 2: Risk factors related to team member conflict will be rated "high impact" by a majority of participants among all risk factors identified as critical on virtual software projects. The reasoning behind this stems from team members not being co-located. Literature by Beise (2004) suggests globalization of project teams has changed the demographic and cultural diversity of teams.(Beise 2004) While Majchrzak, Malhotra, Stamps & Lipnack (2004) proposes another source of differences on virtual teams, such as different styles of working, different approaches to solving problems and differences in language based on the resources' discipline, i.e. an accountant versus a programmer.(Majchrzak et al. 2004) All of these differences are more likely to occur when teams are physically distributed across the country or world. Therefore, it is reasonable to expect difficulties coordinating a diverse group of team members at a variety of locations.

Hypothesis 3: Risk factors related to inadequate project management will be rated "high impact" by a majority of participants among all risk factors identified on virtual software projects. The reasoning behind this hypothesis centers on the important role project management plays on projects in general. Melymuka (2001) indicates IT global projects are "loaded with new opportunities for failure" that even veteran project managers may find difficult to coordinate.(Melymuka 2001) Virtual projects which involve sites in multiple countries fall into the IT global project category. Wallace and Keil (2004) in their research refer to the importance of two key project management aspects. They concluded project execution risk, including project planning and control, was likely more important than any other type of risk in influencing project outcome. (Wallace & Keil 2004a) In general, the percentage of these risk factors is likely to be low because the majority of the survey participants will be project managers who are not likely to answer the survey in a way that reflects negatively on themselves or the field of project management as a whole.

Hypothesis 4**:** Critical risk factors identified by experienced project managers will differ from critical risks identified by project managers with little experience. Although this is a simplistic hypothesis, its proof can yield valuable information related to the experience level of a project manager and its relationship to the likelihood of project success. It is axiomatic that experience generally affords a project manager the ability to more quickly and easily recognize and handle risks, especially those he/she has previously encountered. Data in this area can be useful in determining the type of project manager to assign to a particular project.

This research study follows the general design of prior research on traditional project risk (Barki et al. 1993; Boehm 1991; Keil et al. 1998; Wallace 1999). First, a literature review of the seminal work was conducted to create an initial research study risk factor list. Identifying risk factors from literature was similar to research performed by Boehm and Barki et al (Barki et al. 1993; Boehm 1991). Second, a survey instrument was created and approved by the university Internal Review Board (IRB). Third, the approved survey was tested in face-to-face interviews with industry project managers who were asked to identify critical risk factors on specific virtual and traditional projects they had managed through open-ended questions. This resulted in the identification of new risk factors that were added to the research study risk factor list. Having risk factors validated by industry practitioners was similar to research performed by Wallace and Keil et al. (Keil et al. 1998; Wallace 1999). In step four, an electronic focus group session was conducted to validate and enrich the existing research study risk factor list. The result of the focus group was a large volume of rich data which was collected, sorted and categorized several times. The categories were taken from the groupings found in the seminal literature on traditional software project risk. A charting technique was then used to combine and categorize risk factor results from each of the four seminal studies and the focus group results. The resulting eight categories which were used to group the 55 risk factors are:

1. Resources
2. Technology
3. Environment
4. Requirements
5. Planning & Control
6. End-User
7. Quality
8. Communication

The grouping was essential to the process of comparing and contrasting the identified risks. The new risk factors were added to create a concise, comprehensive research study risk factor list grouped in categories which would be used in the survey. The research study risk factor list before the factors were grouped into categories is displayed in Table 1. Step five was to modify the survey instrument to include the research study risk factor list instead of the open-ended questions used in the face-to-face interviews. Once the list was included, survey participants were asked to refer to an actual project they managed or where they played a lead role. They were then to rank each risk factor on a three-point Likert scale with "1" equal to "Did not occur" or "No Impact", "2" equal to "Minor Impact" and "3" equal to "Major Impact". Step six involved the testing of the revised survey in a pilot distribution. The resulting pilot study data was reviewed in detail to validate the structure of the survey instrument. Minor changes were made to the survey based on the pilot results and statistics were performed to verify content and construct validity of the survey instrument. Step seven which is currently in process; is a mass distribution of the survey which is being conducted with a purchased mailing list of approximately 4,000 names from a project management magazine. Other sources such as contacts, an IS conference, and project management associations will be used to obtain a varied pool of participants. The target audience is industry practitioners; IT project leaders/managers, and IT analysts. The final steps will be data collection and data analysis from the mass distribution of the survey. Some preliminary results from the survey distribution will be discussed at the conference.

1. Team members are not accountable for bad or poor decisions
2. Lack of commitment from management
3. Lack of or inadequate communication
4. Technical connectivity issues hinder communication
5. Too many meetings
6. Conflict among team members
7. Project team members resist change
8. No contingency planning
9. Cost overruns
10. Excessive wait for funding approval, no funding or loss of funding

11. Unrealistic Estimate/Budget expectations
12. Project critical to the organization
13. Cultural or language differences
14. Poor decision making process
15. Lack of balance or diversity on the project team
16. Integration of project components is complex
17. Lack of knowledge needed for successful integration of project components
18. Catering to desires and wants of a few stakeholders
19. Company politics and/or lack of integrity
20. Geopolitical issues
21. Hidden agendas impact the project
22. Project manager replaced during project
23. Inadequate project management and/or inexperienced project manager
24. Unclear project objectives
25. Poor quality deliverables
26. Poorly written, unclear or vague project requirements
27. Developed application or product doesn't satisfy requirements
28. Too many scope changes/scope creep
29. Project scope too limited or vague
30. Project scope was scaled back from original scope
31. Forced to work within dictated constraints
32. Idle people resources, for example due to early staffing or project windup
33. Lack of appropriately skilled resources
34. Insufficient knowledge transfer
35. Loss of key resource(s) that impact the project
36. Resource inexperience with company and its' processes
37. Personnel turnover
38. Loading up project with excess resources to resolve issues
39. No sponsors or wrong sponsors
40. Misidentification of stakeholders
41. Lack of stakeholder or end-user involvement in project
42. Lack of project team cohesion
43. Inadequate technical resources, i.e. hardware, processing availability
44. Technology hardware new to the organization
45. Technology software new to the organization
46. Unidentified technical constraints
47. Creation of meaningless intermediate deliverables to give the impression deadlines are being met
48. Unrealistic time estimate
49. Lack of needed training
50. Developed application or product unacceptable to end-user

51. Inexperienced end users
52. Lack of end user buy-in
53. Poor vendor performance
54. Poor vendor relationship
55. Lack of coordination among vendors

Table 1: Research Study Risk Factor List

CURRENT STATUS OF THE PROJECT

Currently, the data collection phase of the project is being conducted with an expected completion date in November 2007. The next step will be analysis of the data including statistics. Since the survey data was collected from project managers on both virtual and traditional projects, an attempt will be made to compare the differences in risk factors identified by these two groups.

DESCRIPTION OF WHAT WILL BE PRESENTED AT THE CONFERENCE

During the presentation I will present some preliminary results and related demographics from the survey in the form of charts and graphs.

Preliminary results have identified several risk factors as critical with more than 40% of the participants indicating these items had a major impact on their projects and with a mean score greater than 2. Two was selected as the threshold because a three-point Likert scale was used to rate the risk factors. The risk factors in this category are:

1. Project is critical to the organization – this risk factor may have scored high because in high profile projects often the consequences of failure are much greater. These projects are generally categorized as strategic.
2. Integration of project components is complex – this risk factor may have scored high due to greater use of upgrades and add-ons instead of new development in corporations. Integration of changes into existing systems can require more skill and experience than new development.
3. Too many scope changes/scope creep – this risk factor is an old problem, often documented in literature, which can still haunt a project. It is still difficult to hit a moving target; therefore scope changes can causes delays and unexpected expenditures.
4. Unrealistic time estimate - this risk factor may be due to original estimates that have been reduced by upper management or the customer due to political pressures. This can cause a project to be predestined for failure, since it starts with an approved schedule and budget that is not sufficient to successfully complete the project.

Demographics in the following areas will be shared:

- Type of project, i.e. virtual vs. traditional; strategic vs. informational
- Role of participant
- Years of experience of the project manager
- Team size and number of project site locations
- Project duration and cost

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